

# Accelerating Learning in Oral Language, Reading, Writing and Mathematics

Report prepared for the Ministry of Education  
July 30, 2024

---

Report Authors: Gail Gillon, John Everatt, Brigid McNeill, Sally Clendon,  
Mark LaVenía, Tanya Evans, Jen Smith, Megan Gath, Tufulasi Taleni.

Child Well-being Research Institute  
University of Canterbury

# Accelerating Learning in Oral Language, Reading, Writing and Mathematics

---

**Report prepared for the Ministry of Education**

July 30, 2024

**Report Authors:** Gail Gillon, John Everatt, Brigid McNeill, Sally Clendon, Mark LaVenia, Tanya Evans, Jen Smith, Megan Gath, Tifulasi Taleni.

**Child Well-being Research Institute**  
University of Canterbury

---

## **Suggested Citation:**

Gillon, G., Everatt, J., McNeill, B., Clendon, S., LaVenia, M., Evans, T., Smith, J., Gath, M., & Taleni, T. (2024). *Accelerating learning in oral language, reading, writing, and mathematics*. Child Well-being Research Institute, University of Canterbury. Prepared for the Ministry of Education, New Zealand.

---

## **Disclaimer:**

This report was prepared for the New Zealand Ministry of Education. The views expressed in this report are those of the authors and do not necessarily reflect the official policy or position of the New Zealand Government or the Ministry of Education. The contents are intended for informational purposes only and should not be construed as policy statements.

# Contents

<b>Report Overview</b>	<b>4</b>
<b>Introduction to Researchers</b>	<b>5</b>
<i>Acknowledgements</i>	6
<b>Executive Summary</b>	<b>7</b>
<b>Introduction</b>	<b>12</b>
Sustainable Accelerated Learning	13
Inclusive Education Practices	14
Current Ministry of Education Initiatives 2022–2025	14
Research Frameworks	15
<i>He Awa Whiria</i>	15
<i>Science of Learning Framework</i>	16
<b>Method</b>	<b>17</b>
Standards of Evidence	17
Rapid Review Methodology	19
<i>Process for systematic rapid review</i>	19
<b>Results overview</b>	<b>20</b>
<b>Oral Language</b>	<b>21</b>
Comprehensive or Multicomponent Oral Language Interventions	22
<i>Description of meta-analyses and systematic reviews</i>	22
<i>Strength of evidence</i>	22
Accelerating Vocabulary Learning	23
<i>Description of meta-analyses and systematic reviews</i>	23
<i>Strength of evidence</i>	23
English Language Learners	25
<i>Strength of evidence</i>	25
Oral Language Intervention intensity	25
<i>Strength of evidence</i>	25
<i>Monitoring progress</i>	26
<i>Additional studies outside meta-analyses and systematic reviews</i>	26
<i>He Awa Whiria</i>	27
<i>Section summary</i>	28
<b>Reading and Writing</b>	<b>30</b>
Accelerating Early Reading Development	30
<i>Description of meta-analyses</i>	30
<i>Strength of evidence</i>	31
<i>He Awa Whiria</i>	33
<i>Section summary</i>	35
Accelerating Learning for Children with Dyslexia or Reading Challenges	36
<i>Description of meta-analyses and systematic review</i>	36
<i>Strength of evidence</i>	37
<i>Students in the primary school years</i>	37
<i>Students in intermediate and secondary school years</i>	39
<i>Bilingual/multilingual and second language learners</i>	41
<i>He Awa Whiria</i>	42
<i>Monitoring assessments</i>	43

Section summary .....	44
Accelerating Writing and Spelling Skills .....	44
Introduction .....	44
Description of meta-analyses .....	45
Strength of evidence .....	45
He Awa Whiria .....	46
Section summary .....	47
Accelerating Reading for Children with Complex Communication and/or Learning Needs (CCLN) .....	48
Phonological Awareness, Phonics, Decoding and Word Reading .....	48
Reading Comprehension, Shared Reading, and Narrative Instruction .....	49
Monitoring Assessments .....	53
Bilingual/multilingual and second language learners .....	54
He Awa Whiria: Braiding Knowledge Streams .....	54
Section summary .....	54
<b>Mathematics .....</b>	<b>55</b>
Accelerating Learning in Mathematics .....	56
Description of meta-analyses and systematic reviews .....	56
Description of additional studies outside meta-analyses .....	56
Strength of evidence .....	57
Intervention intensity .....	59
Educator expertise .....	59
Monitoring and assessing student progress .....	59
Emerging areas in mathematics education .....	60
He Awa Whiria: Braiding Knowledge Streams .....	60
Section summary .....	61
Accelerating Mathematics Learning for Children with Complex Communication and/or Learning Needs (CCLN) .....	62
Description of meta-analyses or systematic reviews .....	62
Strength of evidence .....	62
He Awa Whiria .....	64
Section summary .....	64
<b>Discussion .....</b>	<b>65</b>
<b>References .....</b>	<b>69</b>
<b>Appendix Tables for Meta-analyses Systematic Reviews .....</b>	<b>80</b>
Appendix A: Oral Language .....	81
Table 1: Oral Language - Multicomponent .....	81
Table 2: Oral Language - Vocabulary .....	95
Table 3: Oral Language - English Language Learners .....	100
Appendix B: Reading and Writing .....	103
Table 4: Early Reading .....	103
Table 5: Dyslexia – Primary Years .....	122
Table 6: Dyslexia – Secondary Years .....	131
Table 7: Dyslexia – English Language Learners .....	138
Table 8: Writing and Spelling .....	143
Table 9: Children with Complex Needs – Phonological Awareness, Phonics, and Word Reading .....	152
Table 10: Children with Complex Needs – Reading Comprehension, Shared Reading, and Narrative Instruction .....	158
Appendix C: Mathematics .....	168
Table 11: Mathematics .....	168
Table 12: Mathematics – Children with Complex Needs .....	176

# Report Overview

This research report has been commissioned by the Ministry of Education. It responds to the Ministry’s request for a synthesis of empirical evidence aligned to “the science of learning” that focuses on teaching practices and interventions that accelerate learning in oral language, reading, writing and mathematics for school aged children. The report is contextualised within strengths based and culturally responsive research frameworks. Given the three-month time frame to complete this report a rapid review methodology was utilised. The review considered empirical evidence from within New Zealand and internationally. It drew upon indigenous knowledge and scientific evidence and considered outcomes for linguistically and culturally diverse learners. Key findings are highlighted and implications for teaching practice to accelerate learning for children who require targeted learning support are summarised.

## **This report is structured in the following sections:**

1. An introduction to the researchers who have written this report.
2. An executive summary which highlights key findings from the research synthesis undertaken.
3. An introduction section that begins with a narrative of the importance of effective oral language, literacy, and mathematics skills, highlighting current initiatives within the New Zealand education context. It describes culturally relevant inclusive education frameworks from which to gather and consider relevant research findings.
4. A methods section that describes the methodology for selecting and analysing relevant research evidence.
5. A results section that details findings in relation to oral language, reading and writing, and mathematics. Main findings from the research evidence relevant to accelerating students’ learning in these areas are highlighted.
6. A discussion section that draws together major findings and teaching implications.
7. Appendices that provide references and tables detailing findings in each subject area.

# Introduction to Researchers



**Professor Gail Gillon**, PhD (Ngāi Tahu iwi) is the founding director of the **Child Well-Being Research Institute, University of Canterbury**. With leadership expertise in teacher education and speech-language therapy, Professor Gillon is an internationally renowned researcher in children's oral language and early literacy interventions. Prof Gillon, has won several awards for research excellence and is a Fellow of the Royal Society of New Zealand and a Fellow of the American Speech-Language Hearing Association.



**Professor John Everatt** is a Professor of Education in the **School of Teacher Education at the University of Canterbury**. He is a leading international expert in developmental learning difficulties such as dyslexia with extensive knowledge of effective interventions to support children who struggle to acquire skills in reading and writing. He has expertise in understanding dyslexia in English language learners and bilingual or multilingual children and adolescents.



**Professor Brigid McNeill**, Associate Dean of Postgraduate Research **University of Canterbury**, is an international expert in literacy development, particularly in children with Childhood Apraxia of Speech and other types of speech and oral language difficulties. She has in-depth knowledge of structured literacy approaches and oral language interventions to accelerate learning in children with speech and language challenges.



**Professor Sally Clendon** is an Associate Professor in Speech-Language Therapy in the **Institute of Education, Massey University**. She is a leading expert in accelerating literacy for children with complex communication and learning needs, particularly those who use augmentative and alternative communication (AAC). She has extensive knowledge of the New Zealand curriculum including oral language and early literacy learning initiatives.



**Dr Mark LaVenía**, methodologist and data strategist, is a Senior Lecturer in the **Child Well-Being Research Institute at the University of Canterbury**. He is an educational researcher specialising in mathematics interventions and structured approaches to literacy. Dr. LaVenía has extensive experience from projects that implement educational interventions. He is a certified reviewer for the What Works Clearinghouse and experienced in evaluating the strength of educational research evidence.



**Dr Tanya Evans** is a senior lecturer and Head of the Mathematics Education Unit in the **Department of Mathematics**, Faculty of Science at the **University of Auckland**. A Fellow of the New Zealand Mathematical Society, Dr Evans has served as a founding member of the New Zealand Association for Research in Education (NZARE) Special Interest Group on Quantitative Studies in Education.



**Jennifer Smith** M.Ed. (Ngāti Whātua, Ngāpuhi) is an indigenous educational researcher in the **School of Teacher Education, University of Canterbury**. She specialises in culturally responsive pedagogy, primary education, and indigenous Māori education. She has extensive expertise from collaborative research projects with communities and whānau. She has in-depth knowledge of the New Zealand Education context and has specific research interests in accelerating learning for children with hearing difference.



**Dr. Megan Gath**, is a developmental psychologist and senior lecturer in the **Child Well-Being Research Institute** at the **University of Canterbury**. She has a strong background in statistical analysis and critical evaluation and synthesis of research findings. Dr Gath has a particular research interest in parent-child relationship, screen time and home influences on children's accelerated learning.



Leali'ie'e **Dr Tufulasi Taleni** is a Senior Lecturer in the **School of Teacher Education** at the **University of Canterbury**. His area of research is Pasifika education with a deliberate focus on the impact of effective leadership on accelerating learning achievement and engagement of Pasifika students. He has extensive experience in translating research for whānau, community leaders and teachers.

## Acknowledgements

We are very grateful to the following experienced educationalists who have provided feedback on the draft report: **Ingrid Hillgrove**, Resource Teacher for Literacy; **Niamh Burns**, classroom teacher with mathematics expertise; **Awhina Green**, Māori educationalist, Resource Teacher for Māori. **Va'ai Sililoto**, Pasifika educationalist in primary and secondary Math and English teaching; **Trudi Browne**, experienced educator with expertise in oral language interventions, literacy, and supporting learners with complex communication needs.

We acknowledge Sally Trethowan, Charlotte Endres for editorial and project management support and Julia Martin for research assistance support.

# Executive Summary

This report, commissioned by the Ministry of Education, synthesises empirical evidence aligned with the “science of learning” to identify teaching practices and interventions that accelerate learning in oral language, reading, writing, and mathematics. The report authors incorporated inclusive and culturally responsive frameworks and used a rapid review methodology to consider both New Zealand and international evidence. The primary emphasis was on reviewing meta-analyses and systematic reviews of relevant research that provide robust evidence to derive implications for teaching practice.

Common elements that facilitate accelerated learning across each of the topic areas reviewed include the following:

- **Explicit and Systematic Instruction:** Across all areas, explicit and systematic instruction is highlighted as an important teaching approach. This includes teaching strategies such as modelling, scaffolding learners’ attempts, guided practice, and providing learners with immediate corrective feedback. Well-structured lesson plans, or detailed teaching guides, based on the research evidence, are common features of effective interventions.
- **Intensity and Duration:** The intensity and duration of successful interventions varies significantly. Determining the optimal length of interventions is an area for further research. However, small group interventions up to 4 or 5 times per week (with 20-30 minute teaching sessions) for a minimum of between 8 – 11 weeks were found to be effective for most learners. Increasing intensity of teaching and longer interventions are necessary for children with more severe learning difficulties or complex learning needs.
- **Incorporating Technology:** Technology-enhanced assessment and teaching approaches show promise. Teaching that incorporates gamification can be effective, particularly for younger learners.
- **Professional Learning and Development:** Ongoing professional learning and development for educators is crucial to ensure the successful implementation of effective teaching strategies. It is important that this professional development is not in isolation, but that teachers are supported to integrate new learning into their daily teaching practices and have access to quality teaching resources.
- **Multi-Tiered Systems of Support.** Within inclusive teaching frameworks it is crucial that teachers are regularly monitoring children’s response to quality evidenced based Tier 1 (universal) teaching as well as children’s response to Tier 2 (targeted) and Tier 3 (tailored) interventions. Monitoring assessments must have proven reliability and validity. Adaptations to assessment tasks are required as necessary to ensure children with complex communication needs can engage in the assessment tasks.

- **Culturally Responsive Teaching Practices.** Researchers recognise the importance of culturally responsive teaching approaches, particularly in relation to supporting learners' engagement and motivation. Research on culturally responsive teaching practices in New Zealand schools emphasises the importance of integrating Māori knowledge and perspectives across the curriculum. The development of respectful relationships and partnerships, with Pacific families and their communities is important in enhancing achievement for Pacific learners.

## Oral Language:

There is good evidence that oral language interventions are effective in accelerating children's language skills, including for children with lower-level language abilities, children with developmental language disorder, and children who are English language learners.

Oral language interventions have shown immediate positive impacts, particularly in enhancing vocabulary and foundational language skills. However, while short-term gains are well-supported by evidence, there remains a need for further research to explore the long-term effectiveness of these interventions.

Evidence supports the use of a variety of teaching models to accelerate learners' oral language development. Key findings from the research include:

- Small group intervention lessons (e.g. 20 – 30 minutes) offered 4 or 5 times weekly for a minimum of between 11 weeks are effective in accelerating students' oral language.
- Speech-language therapists either supporting class teachers to implement explicit language teaching strategies or leading lessons focused on explicit teaching of oral language are effective intervention models.
- Well-supported teaching assistants, implementing small group interventions following structured lesson plans, can

accelerate learning for young children with lower levels of oral language.

- It is important for teachers to monitor children's oral language growth in response to quality teaching. Promising new work is being undertaken using AI in oral language progress monitoring, particularly with analyses from automated speech transcription of children retelling a story.

Evidence provides good to strong support for the use of a range of specific teaching strategies to accelerate learners' oral language. Key findings from the research include:

- Effective multi-component oral language interventions commonly include activities to advance children's phoneme awareness, phonic knowledge, and include explicit teaching instruction to support children's learning of new vocabulary, oral language comprehension and oral narrative skills.
- Using explicit teaching strategies during shared book reading is more effective than just reading the story to children.
- The use of digital technologies to accelerate children's phonological and vocabulary skills shows promise.
- The use of explicit teaching strategies to advance children's vocabulary knowledge is more effective than implicit vocabulary teaching strategies.
- Increasing teaching intensity through using multiple explicit vocabulary teaching techniques to support learning of new vocabulary is effective. This can be conceptualised as repeatedly teaching the new vocabulary with variety.
- The same teaching approaches that accelerate oral language in monolingual learners are effective for English language learners (i.e., explicit teaching of language components). However, English language learners are likely to need a stronger focus on

commonly used vocabulary and oral language comprehension strategies.

Continued research is necessary to provide robust evidence for the use of specific oral language strategies to accelerate children's oral language learning.

## Reading

There is robust evidence indicating the effectiveness of reading interventions to accelerate learners' reading accuracy, fluency, and comprehension. Effective interventions generally have a moderate to large positive effect on children's word reading skills.

Evidence supports the use of a variety of teaching models to accelerate learners' reading development. Key findings from the research include:

- Class teachers, literacy specialists, literacy researchers, speech-language therapists, or teacher assistants have been involved in implementing reading interventions that demonstrate moderate or large positive effects on children's reading outcomes.
  - Longer and/or more intensive interventions, on average, yield larger effects on students' reading and spelling outcomes. However, the evidence for this relationship is more consistent for those experiencing higher levels of reading difficulty (e.g., children with dyslexia) and children with complex communication needs. Shorter, targeted interventions (e.g., 20 hours over 10 weeks) are effective for many children who require targeted teaching support.
  - Targeted small group (Tier 2) interventions can be as effective as one-to-one support including for children with dyslexia/learning challenges. Factors such as the level of reading difficulty experienced by the child, type of instruction, intervention intensity, experience of the teacher/tutor, will impact effectiveness.
  - Quality professional development that strengthens educators' linguistic knowledge and skills is crucial for implementing effective reading interventions.
- Evidence provides robust support for a range of specific teaching strategies to accelerate learners' reading. Key findings from the research include:
- Explicit and systematic instruction in phonics, phoneme awareness, word decoding and spelling skills is effective in accelerating students' reading. Instruction that also includes the explicit teaching of vocabulary and comprehension strategies is most likely to improve reading and spelling skills across the primary school years.
  - Adapted phonological interventions that include explicit teaching of letter-sounds, phoneme blending, phoneme segmentation and word decoding skills are effective for individuals who use augmentative and alternative communication systems.
  - Learners' interest in the reading material, expected to be related to motivation, influence learning outcomes across most school contexts.
  - Explicit teaching of phonological and morphological awareness skills that directly link these skills to word decoding and spelling are effective for older children and adolescents with dyslexia and those that require tailored (Tier 3) teaching supports.
  - Interventions that advance foundational word decoding and encoding skills through text reading (where access to meaning of the text is the goal) are effective for older learners.
  - Explicit text structure instruction improves expository reading comprehension for adolescent students with dyslexia.
  - The same explicit and structured teaching methods that support struggling monolingual readers are effective for struggling bilingual/multilingual learners

across school year levels. However, English language learners benefit from increased consideration to their background cultural knowledge, a greater emphasis on vocabulary learning and from explicit instruction in language comprehension strategies.

- Supporting parents to use specific reading strategies when listening to their child read has been shown to effectively accelerate young children's reading progress.

## Writing

The same types of explicit and systematic teaching strategies in phonic, phoneme awareness, oral language comprehension and vocabulary instruction that accelerate children's reading also support children's writing development. In addition, key findings from the research evidence focused on spelling or writing include the following:

- Effective interventions that accelerate children's writing quality include a focus on writing strategy, dictation, goal setting, and process writing strategies.
- Effective strategies to teach handwriting include handwriting focused on timed transcription skills, multicomponent handwriting programmes, and providing quality feedback on learners' handwriting attempts.
- Handwriting interventions in early school years can improve writing fluency, ensuring students write smoothly and easily.
- Providing performance feedback is an effective way to improve writing fluency, even in languages where the relationship between letters and sounds is inconsistent or ambiguous (non-transparent orthographies).
- Explicit, linguistically based spelling instruction that requires active reflection on and production of orthographic patterns leads to moderate to large improvements in children's spelling abilities.

In general, the evidence suggests that teachers should use a combination of writing acquisition and writing fluency interventions, including self-regulated strategy development (SRSD), graphic organisers, timed practice, performance feedback, goal setting, and graphing, to improve the writing skills of students with and without disabilities.

## Mathematics

There is good evidence from meta-analyses and systematic reviews in mathematics to direct teaching practices to accelerate children's learning. More in-depth research, however, is required particularly in relation to accelerating learning for students with complex learning needs. In addition to evidence from the meta-analyses, recent primary research studies published since 2020 have contributed valuable contemporary insights into effective instructional strategies. There is strong evidence to support the use of systematic and explicit teaching instruction, the use of material and visual representations, and targeted practice within small groups to accelerate children's learning in mathematics.

Evidence supports the use of a variety of teaching models to accelerate learners' mathematics learning. Key findings from the research include:

- Small group instruction and peer-assisted learning teaching models are effective.
- The use of collaborative teaching and coaching models are useful to support students' accelerated learning.
- Frequent and sustained intervention sessions are critical to accelerate mathematics learning across all schooling levels, with more intensity needed as student progress to advanced mathematic topics.

Evidence provides support for a range of specific teaching strategies to accelerate students' learning in mathematics. Key findings from the research include:

- Clear, structured lessons that progressively build on mathematical concepts are effective.
- Teachers' use of precise mathematical language in classroom discussions is an effective strategy. Visual organisers for specific vocabulary can improve students' communication of mathematical ideas.
- Using physical objects, visual aids, and number lines to help students understand abstract concepts, particularly in primary years, is an effective strategy. The use of graphic organisers and manipulatives are also promising practices for children with more complex learning needs.
- Focused instruction on word problems and integrating algebraic reasoning enhances students' real-world application of mathematics.
- Timed activities and structured practice help build automatic retrieval of basic arithmetic facts, which is essential for complex problem-solving.
- Use of structured prompting techniques (e.g., least-to-most prompting strategies) and quality feedback is effective for learners, particularly for those with cognitive disabilities.
- Breaking down complex mathematical tasks into smaller steps and teaching in real-life contexts are effective strategies for children with learning challenges.

## New Zealand Context

There is a need for further controlled research trials to provide robust evidence in relation to effective teaching strategies in oral language, reading, writing and mathematics for students in the New Zealand education context.

The most robust evidence from peer reviewed published research trials in relation to oral language and early literacy development in 5- 6-year-old children can be drawn from implementation of the

*Better Start Literacy Approach*. Evidence indicates that the implementation of this approach is more effective in accelerating children's phonic, phoneme awareness, word reading, spelling, vocabulary and listening comprehension skills from both universal teaching (Tier 1) and targeted support (Tier 2) teaching compared to other oral language and early reading approaches the teachers were implementing.

Incorporating Māori and Pacific cultural knowledge into oral language, reading, writing, and mathematics teaching is likely associated with increased engagement and learning for Māori and Pacific students. Continued research, however, detailing the benefits of culturally relevant and responsive teaching methods for accelerating students' learning is required.

## Overall summary

This report provides a comprehensive overview of the research evidence related to effective teaching practices and interventions for accelerating students' learning in oral language, reading, writing, and mathematics. While acknowledging limitations in the current research findings, there is robust evidence from meta-analyses that indicate both effective models for teaching as well as specific teaching strategies that can have positive significant effects on accelerating students' learning. The evidence supports the use of explicit and systematic teaching strategies, more targeted and tailored teaching support for diverse learners, and the critical role of educator expertise and professional learning and development. The large-scale implementation of evidenced based teaching strategies across oral language, reading, writing, and mathematics is an important goal towards ensuring equitable education achievement outcomes within New Zealand.

# Introduction

Oral language, reading, writing and mathematics skills are fundamental to children and young people being able to navigate and contribute to a complex society. Strong oral language skills facilitate effective communication, foster cultural connectedness, and the transmission of knowledge through generations. Oral language skills are critical to the development of interpersonal relationships, and collaborations. Proficiency in oral language provides the necessary foundation for reading, writing, and mathematics success. Reading enables access to both historical written knowledge as well as new knowledge. Reading proficiency broadens individual perspectives and promotes empathy by immersing children and young people in diverse narratives and ideas. Reading proficiency is critical to the development of comprehensive literacy skills which increasingly are contributing to individuals' health and wellbeing in our world of digital information. Writing supports the expression of thoughts, emotions, and creativity, fostering skills needed for personal wellbeing and professional success. Meanwhile, mathematics promotes the critical thinking, reasoning, and problem-solving abilities essential for innovation and progress.

Collectively, oral language, reading, writing, and mathematics skills enable children and young people to fully participate and engage within and across cultures and communities. They help facilitate students' success across the education curriculum areas, and lead to improve education, economic and health outcomes over time. It is critical, therefore, that we understand effective teaching practices that support the advancement of these fundamental skills. Importantly, as we strive towards our aspirations for equitable quality education, there is a need to understand the types of teaching strategies that accelerate learning for those children who struggle to acquire proficiency in oral language, reading, writing and mathematics. This report focuses on the research evidence to inform effective teaching practices and interventions to accelerate children's learning in oral language, reading, writing and mathematics.

The New Zealand Government is committed to enhancing education success for all learners. In 1993, Aotearoa New Zealand ratified the 1989 **United Nations Convention on the Rights of the Child (UNCRC)**. This included two rights that have relevance to education. Article 29 provides children with the right to develop their personality, talents and mental and physical abilities to their fullest potential, and Article 30 provides children with the right to learn and use their own language, culture and religion. New Zealand is committed to the **United Nations' 17 Sustainable Development Goals (SDGs)** as part of the 2030 Agenda for Sustainable Development. Two of these goals are particularly pertinent to education. Goal 4 is focused on ensuring inclusive and equitable quality education and the promotion of lifelong learning opportunities for all. Goal 10 is focused on reducing inequality within and among countries.

Several reports have highlighted education inequities in New Zealand – particularly for Māori Learners and Learners who identify as Pacific Peoples ethnicities. The Ministry of Education seeks to reduce these inequities and has introduced a range of initiatives including ***Ka Hikitia – Ka Hāpaitia | The Māori Education Strategy*** focused on supporting Māori learners and their whānau, hapū and iwi to achieve excellent and equitable outcomes and ***The Action Plan for Pasifika Education 2020–2030*** (Ministry of Education, 2023) focused on ensuring diverse Pacific learners and their families achieve their education aspirations. Research underscores the importance of culturally sustaining competence,

strong teacher-student relationships, and the active involvement of families in the educational success of both Māori and Pacific learners. These factors are crucial in fostering an environment where learners are engaged, motivated, and better equipped to achieve accelerated learning outcomes (Si'ilata, Samu, & Siteine, 2017). These factors, along with quality school leadership and valuing of students' culture, language and identity are crucial. They help foster an environment where Māori and Pacific students are engaged and motivated to achieve accelerated learning outcomes (Alansari et al. 2022; Si'ilata, Samu & Siteine, 2017; Si'ilata et al., 2023; Taleni, 2023).

## Sustainable Accelerated Learning

---

In this report we focus on “sustainable accelerated learning” to align with global sustainable education development goals.

**The term sustainable learning has been defined as**

***“Increasing the quality of learning whilst conserving the resources required to produce and deliver it.”***

(Glassey & Bälter, 2021, p.1)

This is an important concept when considering the evidence base for effective interventions to accelerate students' learning. Some interventions may be effective in improving a child's oral language, reading, writing or mathematic skills, but require such intensity or individualised teaching support that the intervention would not be sustainable or scalable at a national level within a resource limited model of funding.

Sustainable approaches require co-ordinated approaches that maximise opportunities for students' learning and avoid overlapping services (Glassey & Bälter, 2021). This is also important to consider within the New Zealand context where we currently have a range of positions within the education system that focus on supporting teachers and whānau to accelerate children's learning (e.g., speech-language therapists, resource teachers for literacy, learning support co-ordinators, resource teachers for learning and behaviour). A co-ordinated response would ensure these specialists are implementing or promoting accelerated learning strategies that are aligned and that their expertise is utilised in ways that provide additive value to the children's learning or in supporting the children's class teacher and whānau.

The concept of 'accelerated learning' in relation to children's oral language, reading, writing, and

mathematics refers to advancing the learning of children who are struggling with content at their current year level. Accelerated learning is achieved through specific teaching strategies, learning conditions, or scaffolded supports that enable learners to acquire skills more rapidly than they would under 'usual teaching conditions.'

This approach differs from traditional remediation, which often involves withdrawing students from year-level content to focus on filling gaps from previous years. In contrast, accelerated learning emphasises consistently providing students with year-level materials, tasks, and assignments, supplemented by appropriate scaffolds to make this work accessible (TNTP, 2020). This method relies heavily on continuous monitoring of student progress against benchmarks and progress indicators, ensuring that the learning process remains aligned with year-level expectations.

In practice, this means that accelerated learning involves not only advancing through the curriculum at a quicker pace but doing so in a way that aligns with key educational benchmarks. Progress monitoring is essential in this context, as it ensures that interventions are effective and that students are advancing toward these benchmarks in a meaningful way. With the right dosage and intensity of support, teachers can make informed decisions about when a student is ready to move out of intervention support and return to a more standard instructional track.

The research literature supports the use of effect sizes to quantify the impact of additional teaching support (or specific interventions) implemented. Effect sizes provide a standardised measure to evaluate how much an intervention accelerates learning relative to typical

progress (Hill et al., 2008; Kraft, 2020). For instance, an effect size of 0.20 to 0.30, while seemingly modest, can represent significant progress for students who are behind, indicating that they are on track to meeting year-level expectations.

With reference to the research literature and the science of learning, the evidence for accelerating students' learning is derived from controlled research trials. Such trials typically involve the demonstration that a specific learning condition (intervention condition) significantly improves students' learning over and

above their usual learning condition or an alternative intervention condition. Significant accelerated learning outcomes mean the improvement observed from the intervention condition has a low probability (less than 5%) of occurring by chance, suggesting that the observed difference between the conditions is likely real and not due to random variation or measurement error.

A range of frameworks to contextualise accelerated learning in oral language, reading, writing and mathematics may be used. Two inclusive education frameworks are discussed below.

## Inclusive Education Practices

---

Te Tūāpapa is one of the key frameworks embedded within He Pikorua (Ministry of Education, 2024); the practice model for all practitioners who work in learning support within the Ministry of Education. Te Tūāpapa positions learning supports within day-to-day teaching and learning, across three layers of support: Te Matua (universal), Te Kāhui (targeted), and Te Arotahi (tailored) with learning support staff, teachers, and whānau working together to support the growth and wellbeing of all children. Te Matua involves strengthening inclusive environments, cultures, and practices including teacher practice, curriculum design, and everyday routines and systems. Te Kāhui involves more targeted supports to enhance children's participation, learning, and wellbeing. Te Arotahi involves more tailored supports to meet children's unique needs and contexts.

Multi-Tiered Systems of Support (MTSS) are advocated within the international scientific literature to ensure all children are successful in their learning. Within MTSS support to enhance children's learning is set within the

wider context of children's family, culture and other behavioural, emotional or physical needs. Critical to MTSS is the implementation of valid and reliable monitoring assessments. These assessments are used to monitor children's progress in response to quality, evidenced based teaching. In relation to oral language, reading, writing and mathematics MTSS typically involves Tier 1 teaching, which is evidenced based universal teaching for all children. Tier 2 teaching is targeted support, usually small group, to accelerate learning for children identified as requiring additional teaching supports. Tier 3 involves further individualised support for children with greater learning challenges.

While targeted Tier 2 and Tier 3 teaching may be introduced to enhance children's learning, accelerated learning may be expected across all tiers/ layers of support implemented. The alignment of teaching strategies across tiers of teaching may optimise children's learning potential.

## Current Ministry of Education Initiatives 2022–2025

---

In 2022, the release of the *Literacy & Communication and Mathematics Strategy and the Literacy & Communication and Mathematics Action Plans* signalled a specific emphasis on equity and excellence in teaching and learning in literacy, communication, and mathematics. In 2021, as part of an Early Literacy Initiative, The Ministry of Education approved the large-scale implementation of Professional Learning and Development for teachers and literacy specialists to implement the Better Start Literacy Approach. This approach developed by researchers at the University of Canterbury is an example of an evidenced-

based structured literacy teaching approach to accelerate children's oral language, reading, and spelling in Years 0 – 3 (Gillon, et al., 2024, 2023, 2020, 2019). BSLA is now being implemented in junior school classes in approximately half of all state funded primary schools (English medium) across the country (over 900 schools).

In 2024, the Minister of Education signalled six key education priorities for the current government including:

- a focus on a clearer curriculum,

- evidence-based instruction,
- smarter assessment and reporting,
- strengthening initial teacher education,
- effective learning support, and
- effective use of data.

Initial steps include requiring teachers to implement an hour per day of instruction in reading, writing, and mathematics. The Minister also announced a significant shift in literacy teaching practices and early literacy interventions. The Reading Recovery model for early literacy intervention and the balanced and

whole language approaches that have dominated New Zealand literacy instruction will no longer be supported from 2025. Rather, there is a requirement for all state funded primary schools to implement **structured literacy teaching approaches**. Professional Learning and Development for teachers to upskill in structured literacy teaching is being implemented nationally with a number of approved PLD providers to support teachers. These initiatives are set within the context of a refreshed New Zealand Curriculum (NZC). Continued consultation on the refreshed curriculum is in progress. Schools and kura have until the beginning of 2027 to start using the fully refreshed national curriculum.

## Research Frameworks

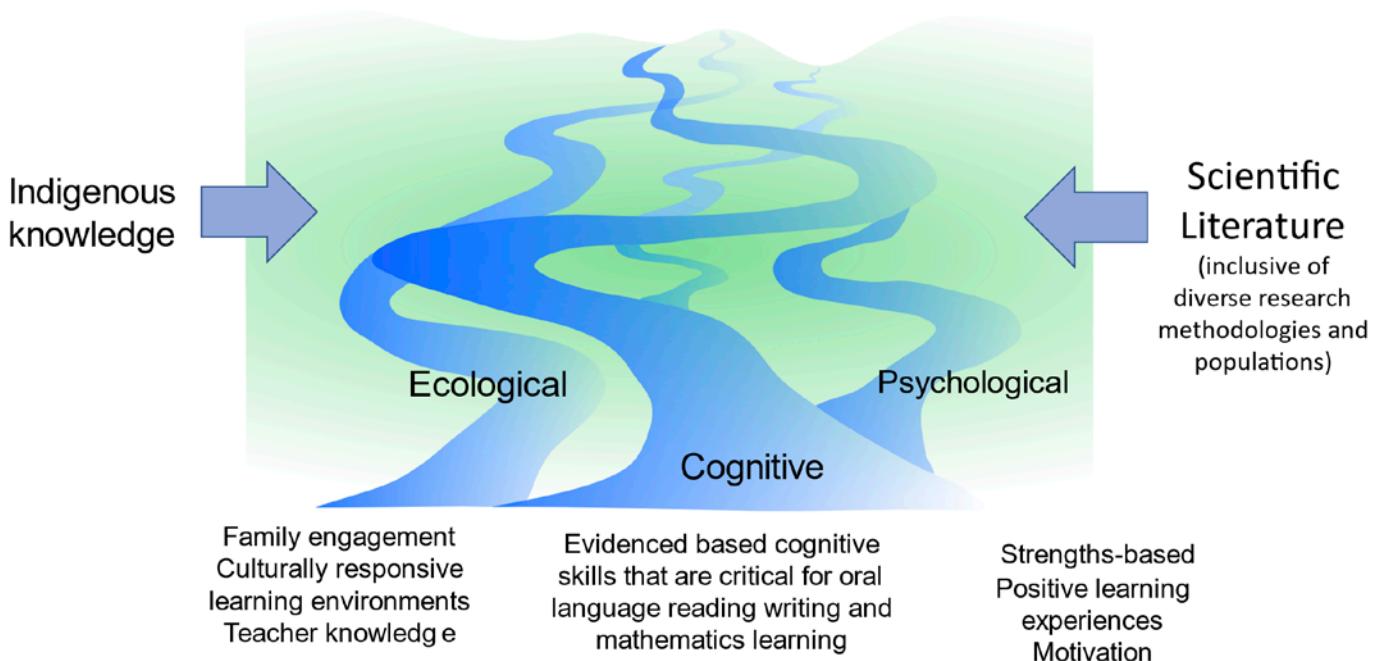
Two research frameworks have informed the development of this report. The first is He Awa Whiria and the second is the Science of Learning framework. Each are briefly summarised in this section.

### He Awa Whiria

Culturally grounded approaches to research, teaching, and learning are vital to understanding and instituting

change in New Zealand’s schools. He Awa Whiria, an Indigenous framework, was designed to frame the potential of braiding together multiple streams of knowledge related to students’ accelerated learning. The framework itself emerged from the ongoing research efforts and collaboration between Indigenous Māori and non-Māori researchers to produce research that embraces differing knowledges to find solutions that are fit for purpose and meaningful in New Zealand’s

*He Awa Whiria or Braided Rivers*  
(Macfarlane et al, 2024; Gillon et al., 2024)



**Figure 1 He Awa Whiria or Braided Rivers framework**

Copyright UC Child Well-being Research Institute

unique cultural context (Macfarlane et al., 2024). He Awa Whiria framework for research gives mana to both Māori knowledge, indigenous science as well as other science (that Macfarlane refers to as “western science”). Each knowledge stream has its own integrity and can stand alone – just as streams flow separately at times within a braided river – but the braiding of knowledge streams may offer new insights and opportunities, just as the water flows stronger as streams braid together. The He Awa Whiria framework has a history of supporting the Ministries’ approaches to responding to the myriad of complexities in the New Zealand education sector (Trewartha, 2020; Trewartha et al., 2024; Superu, 2018; Cram et al., 2018; Oranga Tamariki, 2020, Williamson, 2020).

*Gillon and Macfarlane (2017)* and *Gillon et al., (2024)* added to the He Awa Whiria framework to enhance our understanding of knowledge streams that influence children’s literacy development. This framework shapes the current report (See Figure 1). The cognitive stream categorises and refines the cognitive interventions related to oral language, reading, writing and mathematics. The ecological stream considers the influences of our unique Aotearoa educational context, teacher knowledge skills and pedagogy, and the influence of home engagement for indigenous and English language learners. The psychological stream takes into account children’s interest motivation and self-efficacy in reading, writing and mathematics.

### Science of Learning Framework

The **Science of Learning** is a term used by various groups of researchers and practitioners as a way of discussing and describing how we learn (see Darling-Hammond et al., 2022). Although those who use the term often do so to inform teaching practice, it is important to understand that the term “science of learning” does not represent one viewpoint. Rather, the term encompasses a range of research and theories, including cognitive psychology, neuroscience, and educational psychology (Benassi et al., 2014; Kim & Sankey, 2022). It emphasises the importance of understanding how students learn and develop, and how this knowledge can inform teaching practices (Tan et al., 2012) and educational policy (e.g. Truong, 2019). However, commonalities across these differing perspectives suggest that within a Science of Learning framework, practice or a theory would include the following.

1. Prioritisation of research evidence to support detailed description of children’s learning. This research

evidence, and the theory derived from the evidence, then informs teaching practice.

2. Consideration of the cognitive processes involved in learning. For example, this may include evidence on how individuals acquire, store, and retrieve information, the cognitive skills necessary to solve problems or the foundational skills that support the ability to recognise words in print, to understand oral and written language, or to grasp and apply mathematical concepts.
3. Understanding the neural underpinnings of learning processes. This involves examining how different areas of the brain contribute to various cognitive functions, such as memory, attention, and problem-solving. Research in this area explores how experiences, teaching methods, and environmental factors influence brain development and functioning over time. For instance, studies have shown that effective teaching strategies can enhance neural activity in specific brain regions, supporting the development of skills such as reading and mathematics. Additionally, this research helps educators understand how neurological differences, including those resulting from adversity or trauma, may impact learning and guide the development of targeted interventions.

Theorists within the Science of Learning often also refer to issues that align to psychological and ecological influences on learning such as a child’s motivation, behavioural patterns/reinforcement, as well as a child’s emotion and social influences, and how these impact on learning. Therefore, although this general framework of the science of learning can include a large number of differing theories, for the purposes of this review, these general themes would focus on

- i. cognitive/biological/neurological aspects of learning,
- ii. environmental/ecological/educational aspects of learning, and
- iii. psychological/emotional/motivational aspects of learning

These three areas of the science of learning are consistent with our He Awa Whiria framework of considering the different streams of knowledge that influence children’s learning.

# Method

**In this review, we focus on robust, high-quality evidence to make conclusions about intervention effectiveness. This section describes our method for determining the standard of the evidence reviewed and our method for reviewing the extensive literature base in the areas of oral language, reading, writing and mathematics.**

## Standards of Evidence

---

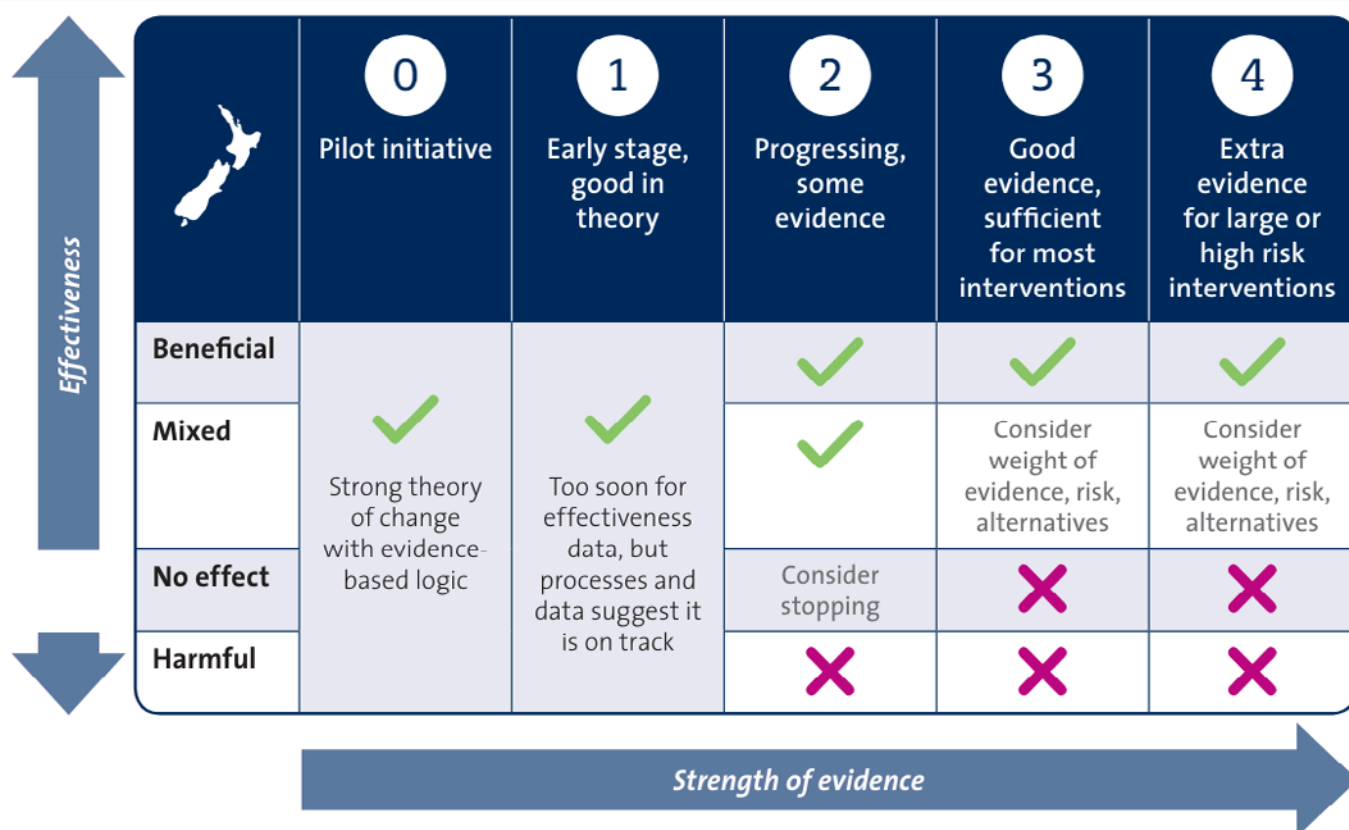
Standards of evidence have been developed by the New Zealand Social Policy and Evaluation Research Unit (Superu, 2017), which consider both the strength of the evidence and the demonstrated effectiveness in evaluating interventions (see Figure 2). Importantly, within this framework, research studies conducted overseas must be held to a higher standard of evidence than evidence from studies within the New Zealand so that transferability to our New Zealand education context and issues of scale are properly assessed. We have adopted these standards of evidence for this report given they have been developed for our New Zealand policy and decision-making processes and are in current use.

In terms of deciding which pieces of evidence are robust, this framework suggests an assessment of reliability, robustness, transparency, validity and rigour. This includes how the study/evaluation has been conducted, the technical quality of designs and methods, the normative, ethical and institutional context.

Within the context of this review, we primarily focus on evidence at levels 3 and 4 (strongest levels of evidence). In a few sections, we discuss research evidence in 1 and 2 particularly when the evidence provides insights of effectiveness of teaching practices or interventions for Māori and Pacific Peoples learners in our New Zealand education system.

A few of the key indicators of research evidence meeting level 3 or higher are:

- Change is measured using pre- and post-analysis of outcomes.
- Attribution of impacts to the intervention has been investigated using a comparison (control) group or other appropriate comparison data, ideally with participants being randomly assigned to groups and with long-term follow-up data collected.
- Studies have used valid and reliable methods and measurement tools that are appropriate for participants and relevant to what the intervention is trying to achieve.
- Data has been analysed appropriately and conclusions are supported by the findings.
- There is evidence that supports the causal mechanism, indicating how the intervention leads to outcomes.



**Figure 2: Strength of evidence scale (Superu, 2017).**

Social Policy and Evaluation Research Unit (Superu, 2017). *An evidence rating scale for New Zealand: Understanding the effectiveness of interventions in the social sector*. Superu: Wellington, New Zealand. Available at: [https://thehub.swa.govt.nz/assets/documents/Evidence\\_Rating\\_Scale.pdf](https://thehub.swa.govt.nz/assets/documents/Evidence_Rating_Scale.pdf)

## Rapid Review Methodology

---

Given the short time frame for completing this report (10 weeks) a rapid review methodology was selected.

### Process for systematic rapid review

The current review used the protocols in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) as methods for conducting searches and as a guide for the selection of evidence presented in the review (Page et al., 2021; Rethlefsen et al., 2021). The protocols in PRISMA cover a range of different types of reviews, but the current methods used were based on frameworks for rapid timeline reviews and taking into account procedures for scoping reviews (Tricco et al., 2018).

Rapid reviews provide abbreviated versions of the full versions of the PRISMA systematic reviews with certain concessions made in the process to accommodate faster production and decision making. Rapid reviews are usually conducted for a specific purpose of decision making and are typically take six months or less to complete. Rapid reviews differ from systematic reviews in a number of ways, such as the number of abbreviated methods employed to search for documents and review the data (Stevens et al., 2018).

One procedure for streamlining the review process which we used for this report involves using currently available meta-analyses and systematic reviews; consistent with the analysis of secondary evidence sources. These reviews are published in respected scientific journals (or other high-profile review sources, such as Best Evidence reviews or What Works Clearinghouse), and focus on meta-analyses and systematic reviews that are based on studies using rigorous research designs. This process has the advantage of gaining important insights from robust analyses involving multiple studies related to a specific area of accelerating children's learning in oral language, reading, writing or mathematics. Its limitation however is understanding specific details from individual studies that may support the effectiveness of a particular type of intervention. To overcome this limitation, we have included tables in the Appendix that detail more specific information from the studies included in the meta-analyses.

The procedures we followed included:

1. Searches for recent meta-analyses and systematic reviews that meet the criteria for the current review.
2. Previous meta-analyses and systematic reviews were selected as secondary sources given that they show academic rigour in their presentation of the primary data.
3. These secondary evidence sources were then used as the baseline evidence that we tested by checking primary sources (based on the reviewers' expert knowledge of the field, which would include an understanding of many of the works reviewed in the systemic review and some checking of other sources that may be less well-known).
4. We considered additional primary sources published after the meta-analyses and systematic reviews to ensure that the conclusions of the new research are consistent with the past meta-analyses and systematic reviews. We focused attention of findings in education contexts similar to New Zealand (as per the report brief).
5. We considered further published scientific research studies and reports focused on implementation of initiatives in NZ.

This approach limits the number of studies summarised by the reviewers (hence, providing a rapid review process), while retaining academic rigour by careful selection of the meta-analyses and systematic reviews sourced, and checking of the evidence provided in these meta-analyses and systematic reviews. By employing this method, we have systematically and rapidly compiled high-level summaries of recent studies, comparing them with the existing secondary evidence. This approach helps streamline the analysis, provide the basis on which decision making can be developed, and has the potential to identify significant trends and gaps in the research.

# Results overview

This section describes main findings from our literature analysis. It is divided into three main sub sections:

1. **Oral language**
2. **Reading and writing**
3. **Mathematics**

Within each section we begin with an introduction to the topic area followed by description and key recommendations from robust research meta-analyses or systematic reviews related to effective interventions. We relate these findings to specific research informed teaching strategies. Next, we supplement the findings from meta-analyses with any recent relevant published studies internationally and in New Zealand.

We include evidence that relates to effective interventions for culturally and linguistically diverse learners, particularly as this relates to the New Zealand context as well as for Māori and Pacific Peoples learners. We also include evidence related to children who have complex learning needs.

The appendices provide tables detailing aspects of the meta-analyses or systematic reviews included in this report. References for the key findings highlighted from these reviews in each area of oral language, reading, writing and mathematics are provided in these tables. A reference to support a statement made that is not included in these tables is provided in the text.

The tables in the appendices have been generated using AI (Elicit Research Assistant). This process involves the research team first finding, reviewing and analysing relevant meta-analyses and research articles using the University Library's scientific data bases such as Scopus. The researchers then loaded PDFs of these relevant articles into Elicit. Elicit Research Assistant generated tables automatically from these uploaded PDFs highlighting relevant information related to the meta-analyses. The researchers then reviewed and edited the tables generated into Word format for the appendices.

Throughout the meta-analyses' findings and summaries in the Appendices, the phrase **explicit and systematic instruction** is often highlighted. Buckingham (2020) provides a useful definition of the term "explicit instruction"

*"Explicit instruction is a teacher-directed pedagogy that includes modelling, guided practice, and independent application with immediate corrective feedback"*  
(Buckingham, 2020 p.106)

Systematic instruction refers to the teaching of specific skills that is organised in a planned sequence. Often systematic instruction will include structured lesson plans that are sequenced to build on previously taught skills in deliberate ways.

# Oral Language

Oral language proficiency is critical for educational achievement.

Children's oral language skills have a direct influence on their development of reading, writing, mathematics and social skills. Children with oral language difficulties are more likely to experience difficulties in socio-emotional (Snowling et al., 2006), behavioural (Winstanley et al., 2018) and academic learning (Young et al., 2002). Indeed, some reports indicate that children with speech and oral language challenges are 4 to 5 times more likely to have later reading problems than their peers if underlying processing challenges are not resolved early (Catts et al., 2002). It is also clear that in many educational systems young children with oral language challenges often don't catch up to their peers in education achievement over time (McLeod et al., 2019). This creates inequities for their later life outcomes. To reduce such inequities targeted evidenced based interventions to accelerate these children's learning are essential.

Effective multi-component oral language interventions commonly include activities to advance children's phoneme awareness, phonic knowledge, and include explicit teaching instruction to support children's learning of new vocabulary, oral language comprehension and oral narrative skills.

Oral language is a multi-faceted concept that is typically considered to be made up of the following components.

- Phonology (processing and using sounds in a language including speech production)
- Morphology (understanding the internal structure of words e.g., using prefixes and suffixes in language)
- Syntax (ability to construct and understand sentences)
- Vocabulary/semantics (understanding word meanings)
- Pragmatics (using language for social communication)
- Narrative/discourse (understanding the way stories or information is conveyed)

Given the wide scope of oral language interventions and time constraints for this report, this section discusses findings from meta-analyses of multi-language component interventions and those that focus on vocabulary interventions. Enhancing children's oral language skills (including language comprehension) and vocabulary are critical for skilled reading (as indicated via the Simple View of Reading theoretical model, Hoover & Tunmer 2019). Phoneme and morphological awareness interventions are addressed in detail in the Reading and Writing sections of this report.

It is acknowledged that some children will use sign language or augmentative and alternative communication systems to engage in learning. The scope for this report, however, focuses on effectiveness of oral language interventions or teaching practices to accelerate children's oral language learning. The effectiveness of interventions for children with complex communication challenges is addressed in subsequent sections of the report.

# Comprehensive or Multicomponent Oral Language Interventions

## Description of meta-analyses and systematic reviews

Thirteen meta-analyses and systematic reviews from 1994 to 2004 were identified and reviewed. Collectively these reviews covered over 360 individual studies, focused on interventions for differing populations of children with oral language challenges such as those with speech-language disorders and those identified as neuro diverse. The students in the studies reviewed ranged in age from preschool through to adolescents. References and study details are provided in Appendix A – Table 1

## Strength of evidence

The standard of evidence from these meta-analyses of oral language interventions that targeted multiple components of oral language are mostly considered to be level 2 and 3 of the NZ evidence scale (showing either promising trends or sufficient to transfer to interventions). Several researchers noted the need to strengthen the research evidence base for oral language interventions. Notably, however, some more recent meta-analyses that focus on targeted small group interventions in oral language and early reading skills showing stronger evidence at level 4. These analyses provide robust evidence to inform policy and practice.

## Teaching implications from main research findings

In general, well designed multi component oral language interventions can significantly improve language skills in children with neurodevelopmental disorders and/ or children with lower levels of oral language skills. Some meta-analyses show evidence of moderate intervention effects observed at post-test and smaller effects at follow-up. Early intervention is critical and strongly supported from the research evidence.

Researchers involved in the meta-analyses, as well as other leading researchers (e.g., Moats, 2023) advocate for the importance of quality professional learning and development for teachers. In addition, there is a need for enhancements to Initial Teacher Education programmes to ensure graduating teachers have the appropriate linguistic knowledge for quality oral language assessment and teaching practices.

Main findings from the meta-analyses can be grouped within themes for teaching implications and include:

- **Oral language focus:** Effective multi-component oral language interventions commonly include

activities to advance children’s phoneme awareness, phonic knowledge, and include explicit instruction to support children’s learning of new vocabulary, oral language comprehension and oral narrative skills.

- **Structured and explicit teaching strategies.** Effective interventions use consistent teaching strategies, structured lesson plans, or manualised curricula. Explicit teaching instruction, modelling, effective prompting and scaffolding techniques are common teaching strategies within Tier 2 interventions that accelerate children’s oral language.

**Effective multicomponent oral language interventions often involve speech-language therapists in the implementation approach.**

- **Specific Oral Language Teaching Strategies.** Explicit teaching in oral narrative skills (e.g., teaching story structure elements), oral language comprehension strategies (e.g., using elaborative questioning techniques), and use of interactive story book reading techniques with vocabulary and comprehension activities can significantly enhance children’s oral language skills. For younger children including play based “pretend” oral language activities (e.g., creating a story and acting it out) with quality interactions between an adult and children can significantly enhance children’s expressive language
- **Use of Technologies** There is variable evidence from meta-analyses for the use of technologies in multicomponent interventions to accelerate children’s oral language. The use of e-books can enhance specifically taught vocabulary knowledge, but single viewing of television programmes does not enhance children’s oral language skills. Metaanalyses indicated no significant effect of Fast ForWord (a computer software oral language intervention) on any outcome measure compared to control groups for children with language challenges.

However, integrating technologies into multicomponent interventions for English Language Learners may be advantageous. Recent individual studies show promising results from the use of digital technologies in improving children’s phonological and vocabulary skills (Drosos et al., 2021; Liu et al., 2024). This is an area in need of ongoing research.

- **Educators involved:** Effective multicomponent oral language interventions often involve speech-language therapists in the implementation approach. Class teachers and teaching assistants

can effectively implement oral language interventions following quality professional learning and development.

- **Intervention intensity:** Positive effects from multicomponent language interventions have been found for interventions that are 8 weeks or longer with 20–30-minute teaching sessions up to 5 times weekly. However, there is wide variability in the intensity levels reported within studies. Evidence for an optimal level of oral language intervention intensity requires further research.

## Accelerating Vocabulary Learning

---

Vocabulary is an important component to target within oral language interventions. Growth in vocabulary knowledge is not only important for children’s speaking and listening development, but also has direct impact on children’s growing word decoding and reading comprehension skills. Research has shown that a child’s vocabulary knowledge (depth and breadth) in the early school years is predictive of their reading comprehension knowledge. For example, in one longitudinal study, children’s vocabulary knowledge assessed in year 1 predicted more than 30% of their year 11 reading comprehension (Cunningham & Stanovich, 1997).

### Description of meta-analyses and systematic reviews

Six meta-analyses and systematic reviews focused on vocabulary interventions from 2009 to 2023 were identified and reviewed. Collectively these reviews covered 270 individual studies, focused on interventions for a range of children with vocabulary difficulties aged from preschool through to adolescents. References and study details are provided in Appendix A – Table 2

**Research has shown that a child’s vocabulary knowledge (depth and breadth) in the early school years is predictive of their reading comprehension knowledge.**

### Strength of evidence

The standard of evidence from these meta-analyses of vocabulary interventions are mostly considered to be level 2 and 3 of the NZ evidence scale (showing either promising trends or sufficient to transfer to interventions). Several researchers noted the need to strengthen the research evidence base for vocabulary interventions, particularly for more distal outcomes of the intervention. For example, Cervetti et al. (2023) noted that although individual words can be successfully taught, the impact of the intervention on children’s vocabulary breadth overall is more limited.

### Teaching implications from main research findings

In general, the evidence suggests that vocabulary instruction is effective in accelerating children’s learning when it includes explicit and direct instruction using proven vocabulary teaching techniques. Main findings can be grouped within themes for teaching implications and include:

- **Structured and explicit teaching strategies.** Effective vocabulary interventions use consistent teaching strategies, structured lesson plans, or manualised curricula. There is strong evidence that explicit, rather than implicit, teaching strategies are more effective. For example, Marulis and Neuman (2010) reported an effect size of 1.11 for explicit vocabulary strategies across studies compared to an implicit only effect size of 0.62 across studies.
- **Specific Teaching Strategies.** There is stronger evidence for children’s growth in taught words during the intervention and researcher-

implemented assessment measures than more generalised vocabulary measures. Progress monitoring assessments (rather than standardised language assessments) are more useful to track change over time in children's oral language. A variety of explicit vocabulary teaching strategies is needed to accelerate children's vocabulary knowledge. These include explicit teaching of word meanings via vocabulary elaboration (giving a definition of the word in the moment) and repetition strategies, word solving strategies where children are taught to use their morphological knowledge and other cues to learn the meanings of new words, discussion and use of new vocabulary within meaningful contexts, and comparing and contrasting techniques of the new vocabulary such as identifying words that have similar meanings and words that have opposite meanings and teaching the origin of the word.

- **Staff involved:** Effective vocabulary interventions can be implemented by teachers, speech-language therapists and well supported/trained teaching assistants and whānau.
- **Vocabulary Selection:** Hadley and Mendez (2021) highlighted the following principles to guide the choice of which vocabulary items to target during intervention.
  - **Principle 1:** Words selected should include a variety of parts of speech (e.g., verbs, nouns, adjectives etc.). Words that are likely to be learned through conversational language should not be prioritised. There should be limited emphasis on concrete nouns.
  - **Principle 2:** Teach words that are conceptually related to each other at the same time (e.g., morphologically related).
  - **Principle 3:** Teach words that the child does not yet know, but they are not too difficult. Children should have some conceptual understanding of the words' meaning before learning the specific vocabulary.
  - **Principle 4:** Teach words that are useful (e.g., related to a topic in the classroom, the book that is being shared, words that can be used across multiple contexts).
  - **Principle 5:** Consider your context and your learners when selecting words to teach.

#### Other word selection considerations include

- Basic concept words for children that need them (e.g., colours, shapes, prepositions such as in front, over, time/sequence words (e.g., new, next etc.) as they are critical for classroom instruction
- Tier 2 words (Beck & McKeown, 2007); these are likely to occur in texts (rather than conversational language) and can be explained by a simpler word (e.g., benevolent – kind).
- Words needed for classroom / curriculum

**Vocabulary Teaching Intensity.** Teaching intensity is important for vocabulary teaching (and oral language intervention in general)

1. New vocabulary is best taught by increasing teaching intensity through using multiple explicit vocabulary teaching techniques. This can be conceptualised as repeatedly teaching the new vocabulary with variety.
2. The number of exposures needed to learn a new word will depend upon a variety of factors including the salience of the word or the situation in which the word is learned, its relationship to known words, the pronunciation of the word, or whether the word is concrete or abstract. Density of exposure to novel vocabulary is associated with vocabulary acquisition (Hoff, 2003; Pan et al., 2005).
3. Although words can be learned with as little as one exposure, the average young learner requires around 35 exposures to acquire the full meaning of a word. Children who have robust vocabularies may require only 20 exposures and children with language disorder may require up to 55 exposures (Blachowicz and Fisher, 1996, in Montgomery, 2012). Snow (2010) suggests 15–20 exposures.

**Although words can be learned with as little as one exposure, the average young learner requires around 35 exposures to acquire the full meaning of a word.**

## English Language Learners

---

Three meta-analyses and systematic reviews focused on oral language interventions for English language learners. Collectively these reviews covered 82 individual studies, focused on interventions to support English language learners' oral language development aged from preschool through to adolescence. References and study details are provided in Appendix A – Table 3

### Strength of evidence

The standard of evidence from these meta-analyses are mostly considered to be level 2 and 3 of the NZ evidence scale (showing either promising trends or sufficient to transfer to interventions). A number of researchers noted the need to strengthen the research evidence base regarding the longer-term impacts of oral language interventions for English language learners. Given the diversity of the English language learner population, specific cultural and linguistic circumstances require further study. For example, a relatively large number of studies in the English language learning literature have focused on Hispanic children.

### Teaching Implications from main research findings

Main findings can be grouped within themes for teaching implications and include:

1. The teaching approaches supported for English language learners are aligned with those strategies supported for children with English as a first language (i.e., explicit teaching of language components). However, English language learners are likely to need different content (e.g., more of a focus on conversational vocabulary and commonly used vocabulary, more specific focus on morphology and oral language comprehension).
2. Intensity of oral language teaching and level of exposure to English language is critical for English language learners. Any intervention time provided specifically for English language learners should be in addition to the class oral language/literacy instructional time (rather than in place of that time). Oral language interaction with class peers within the classroom and in the playground should also be specifically encouraged.
3. Oral language intervention for English language learners has a small effect on their English reading ability. Targeted oral language intervention should be provided alongside other evidence-based strategies to support reading development in English (e.g., word decoding skills).

## Oral Language Intervention intensity

---

There is wide variability in the intensity of effective oral language interventions. Two meta-analyses or systematic reviews (Frizelle, Tolonen, Tulip, Murphy, Saldana, Mckean, & Camarata, 2021; Frizelle, Tolonen, Tulip, Murphy, Saldana, Mckean, & Storkel, 2021) focused specifically on oral language intervention intensity (often termed 'dosage' in the intervention literature). Collectively these reviews covered 40 individual studies, focused on oral language intervention intensity for children with oral language difficulties aged from 3 to 12 years.

### Strength of evidence

The standard of evidence from these meta-analyses of the impact of oral language intervention intensity are mostly considered to be level 2 of the NZ evidence scale (showing promising trends). A number of researchers noted the need to strengthen the research evidence base to have more robust guidelines for teaching intensity. For example, intervention dosage has generally been

studied in individualised or very small group intervention settings with an SLT leading the lesson which may not translate to the general classroom setting.

### Teaching implications from main research findings include:

- Higher teaching intensity within a lesson (e.g., multiple exposures to the teaching target) means that a smaller number of lessons is required to teach the concept.
- When teaching aspects of morphology (i.e., use and understanding of prefixes and suffixes in oral language), there is evidence to support intervention delivery of short and frequent (2 or 3 short sessions per week) or one longer lesson weekly.
- Teaching intensity is enhanced when explicit instruction is combined with variability of

input. For example, just repeating the same elaboration of a target vocabulary item multiple times is less effective than the use of multiple different explicit teaching strategies and multiple exposures to the word in isolation and different sentence structures.

A further meta-analysis that focused on Tier 2 oral language and early reading interventions for preschool to year 2 children (Goldfield et al., 2021) also highlighted levels of teaching intensity. The researchers concluded that common characteristics of effective Tier 2 interventions to accelerate oral language and/or reading included small groups of 3–5 students, 4–5 sessions per week with a minimum 11-week duration.

### Monitoring progress

Essential to accelerated learning with MTSS and within Te Tūāpapa is monitoring of children's progress in oral language using valid and reliable assessments. Effective monitoring approaches have been identified. The English Learner Oral Narrative Scale (ELONS) assesses personal narrative skills in English learners (Cavazos & Ortiz, 2020). Technology-guided data-driven decision making has shown positive effects on language growth in young children (Buzhardt et al., 2020). Progress monitoring methods such as curriculum-based measurements can be used effectively including for students with extensive support needs in inclusive settings (Wakeman et al., 2021).

Effective progress monitoring assessments for children's oral language skills include analyses of children's oral narrative skills such as including story structure elements within their story retell or quantitative measures of the number of different words and types of words and sentences used in their retells (Westerveld et al., 2008). The Monitoring Indicators of Scholarly Language (MISL) shows promise for tracking narrative proficiency (Gillam et al., 2017).

Valid and reliable oral language monitoring assessments commonly focus on narrative, vocabulary, and syntax skills, typically conducted in one-on-one adult-directed contexts (Malec et al., 2017). These can be time consuming for teachers. Promising new work is being undertaken using AI for analysing children's oral language through their retelling of a story. The most advanced model currently available internationally for 5- and 6-year-old child is the oral narrative story retell assessment within the Better Start Literacy Approach (BSLA) being implemented in New Zealand (Gillon et al., 2023). Word error rates from automated speech transcription of 5-year-old speech within the BSLA assessment are the lowest reported internationally

(around 15%) making it very useful for teachers to use within regular teaching practice (Scott et al., 2022).

### Additional studies outside meta-analyses and systematic reviews

#### Nuffield Early Language Intervention (NELI)

One of the most well researched oral language intervention programmes is The Nuffield Early Language Intervention (NELI) programme. A leading research team at Oxford University has led the development of this intervention and has extensively researched its effectiveness. Using randomised controlled research design (Level 4 of evidence within the NZ Evidence framework) the NELI has proven to be effective in improving oral language skills in preschool and young school aged children (West et al., 2021, 2024). In a clustered randomised control trial involving 65 classes in the UK, children receiving NELI Preschool made significant larger gains in their oral language skills than children in the control group with small effect sizes  $d = .26$ .

The NELI includes the key elements of successful oral language interventions described in the previous section. That is; explicit teaching of vocabulary, oral narrative and early phoneme awareness skills, involves interactive story book activities and developing children's story retelling skills. It uses structured lesson plans to advance children's skills with quality teaching resources and professional learning and development for teaching assistants and class teacher. Teaching assistants deliver the teaching with small groups of children and with some additional individual teaching sessions. Notably, the NELI includes phoneme awareness activities that were developed and proven effective through Professor Gillon's controlled trials in New Zealand (Gillon, 2002, 2005).

In collaboration with developers of NELI from Oxford University, a clustered randomised control trial of a New Zealand adapted version of NELI is currently underway in New Zealand involving 65 schools (Gillon et al., in progress).

#### Large scale investigation of teacher PLD in the Australian context (Goldfield, Snow et al., 2022 Australia)

It may be challenging to take some interventions to larger scale. For example, despite finding positive effects from a pilot study, Goldfield et al. (2022) found no intervention effect from professional learning and development (PLD) to advance teacher knowledge in oral language

interventions when they scaled up from 12 schools to 72 schools within the State of Victoria in Australia.

This was a robust clustered randomised control study involving 1,360 students; 687 interventions, 673 control in 75 schools. The intervention group of Year 1 teachers received 6 days of PLD in oral language and early literacy. This was an adapted version of the Oral Language Supports Early Literacy (OLSEL) PLD that proved effective in pilot trials (Snow et al., 2014). The researchers found no differences between intervention and control groups in oral language, reading, and mental health at years 1 and 3 nor in year 3 reading outcomes. The researchers raised issues such as teaching fidelity, appropriate supports for intervention and PLD content amongst aspects to consider in the lack of translation from improved teacher knowledge to learning outcomes in children. This study highlights the importance of ensuring successful pilot studies can be effectively scaled up prior to Government investment in a national roll out of a teacher professional learning and development approach, particularly for approaches that have been developed in other countries.

### **New Zealand published research with control comparison**

**The Better Start Literacy Approach (Gillon et al., 2024)** is the only New Zealand developed structured literacy approach that has published controlled research trials indicating its effectiveness within New Zealand schools. BSLA includes teacher professional learning and development to accelerate children's oral language skills and early reading and spelling skills. It is set within a MTSS framework with evidence currently available for the effectiveness of both Tier 1 and Tier 2 teaching. Research findings demonstrate the effectiveness of the approach in accelerating oral narrative, listening comprehension, phonic, phoneme awareness word decoding and spelling skills in 5 and 6 year old children. (Gillon et al., 2019, 2020, 2023, 2024). Recent data indicated the effectiveness of this approach at large scale with over 900 schools engaged with BSLA. In a recent report to the Ministry of Education (Report No 7) data using an internal comparison group indicated that children going into Year 2 who had received BSLA teaching in Year 1 performed significantly better on all oral language and literacy measures used compared to children who had received other types of literacy instruction in Year 1. Quality Teacher PLD through the BSLA micro credential is associated with accelerated learning in children's oral language skills. (Further details are discussed in the early reading section of this report). The Gillon et al. (2019)

**Promising new work is being undertaken using AI for analysing children's oral language through their retelling of a story. The most advanced model currently available internationally for 5- and 6-year-old children is the oral narrative story retell assessment within the Better Start Literacy Approach (BSLA) being implemented in New Zealand**

study reporting data from BSLA was included in the Gibbs et al. (2024) meta-analysis of oral language interventions.

**Unpublished Report:** The Oral Language and Literacy Initiative (OLLI)

**OLLI** The Oral Language and Literacy Initiative (OLLI) is an MTSS approach to developing young children's oral language and literacy skills. It has been implemented in New Zealand early childhood centres and with Year 0/1 at school. The approach was evaluated over a three-year period (2018–2021) by Synergia. While kaiako were positive about the approach and reported positive changes in themselves and their students, an analysis of assessment data from 1,392 children indicated there was no impact of OLLI on children's oral language and literacy development. The data therefore does not support investment in the large-scale implementation of the approach.

### **He Awa Whiria**

Despite much discussion of the importance of whānau involvement in MTSS (e.g., Gertzel-Short, 2018; Weingarten et al., 2020), little empirical research has attempted to systemically evaluate the effectiveness of including whānau engagement within MTSS interventions (i.e., Tier 2 and Tier 3). However, the existing evidence suggests promising results from including whānau in these interventions, but further robust research is required.

Individual research studies have demonstrated that parent-implemented interventions can lead to significant improvements in children's language skills, including their vocabulary, sentence structure, and narrative

**In relation to accelerating children’s oral language development within New Zealand schools, evidence from the Better Start Literacy Approach (Gillon et al., 2024), suggests that structured teaching that integrates culturally responsive teaching pedagogy is associated with enhanced oral language skills in Māori and Pacific Peoples’ learners as well as for English Language Learners.**

abilities (Roberts et al., 2019; Burgoyne et al., 2018; Rajesh & Venkatesh, 2019). These programmes are particularly beneficial for children with or at risk of language impairments (Roberts et al., 2019; Kruythoff-Broekman et al., 2019). The effectiveness of these interventions is attributed to increased parental use of language support strategies and improved parent-child interactions (Roberts et al., 2019; Reese et al., 2010). However, long-term effects may vary, highlighting the need for ongoing monitoring of children’s language development (Kruythoff-Broekman et al., 2019).

There is an urgent need for further culturally responsive intervention research (Guiberson & Vingin, 2023). Available research findings suggests that culturally responsive approaches can effectively accelerate children’s oral language skills. Integrating culturally responsive pedagogy with evidence-based practices is crucial for supporting linguistically diverse learners (Linan-Thompson et al., 2018; Méndez et al., 2015).. Culturally adapted frameworks, such as the ‘Braided Rivers Approach,’ can enhance phonological awareness in children with speech-language impairment while respecting their cultural identity (Gillon & Macfarlane, 2017). For parents with less education, talk and play activities focusing on oral language and responsive communication strategies are most effective, especially when adapted to daily life activities (van der Pluijm et al., 2019).

Developing oral language skills through alignment to family language, cultural and spiritual activities that children participate in may be useful for young Pacific children. The use of dual language texts that support children to draw upon their own background cultural knowledge may also advance Pacific children’s oral language and early literacy skills (Si ‘ilata et al., 2023).

Research on culturally responsive teaching practices in New Zealand schools emphasises the importance

of integrating Māori knowledge and perspectives into mainstream curricula (Sexton, 2024; Macfarlane & Macfarlane, 2012). Effective strategies include collaborative learning, supportive processes, and weaving cultural dimensions into teaching (Macfarlane & Macfarlane, 2012). Studies highlight the need for sustained professional development, self-awareness, and reflection among teachers (Smyth, 2013) and in teacher education programmes (Howe et al., 2021). In relation to accelerating children’s oral language development within New Zealand schools, evidence from the Better Start Literacy Approach (Gillon et al., 2024), suggests that structured teaching that integrates culturally responsive teaching pedagogy is associated with enhanced oral language skills in Māori and Pacific Peoples’ learners as well as for English Language Learners. However, more detailed research is necessary to determine specific benefits related to culturally responsive oral language and literacy teaching practices.

**Section summary**

There is good evidence that oral language interventions are effective in accelerating the language skills of children with lower level language skills, children with developmental language disorder, and children who are English language learners. There is stronger evidence for the impact of language intervention on accelerating expressive rather than receptive language. There is agreement within the literature that early intervention to support language development is critical, given it lays a critical foundation for social, academic and literacy development. Explicit teaching strategies are the cornerstone of effective oral language interventions.

While immediate impacts of oral language interventions are well-documented, there is a critical need for more research on their long-term effects. Most studies focus on short-term gains in children’s knowledge, but understanding the sustained impact over time is essential for evaluating the true efficacy of these interventions. Structured teaching approaches have demonstrated significant immediate impacts on taught vocabulary, showing a clear intervention effect. However, effects on more distal outcomes, such as oral narrative skills, have been less pronounced. For instance, early controlled trials demonstrated a clear intervention effect on taught vocabulary but not on oral narrative measures. This suggests that a duration of 10 weeks, for example, may not be sufficient to detect changes in more complex language skills.

The most effective models of oral language intervention combine the use of structured lesson plans and quality

professional learning and development for teachers. There is evidence to support the use of the following models of accelerating oral language learning:

- Small group intervention lessons offered 4 or 5 times weekly within class for at least 8 weeks.
- Well trained teaching assistants implementing small group interventions following structured lesson plans.
- Speech language therapists training and supporting class teachers to implement explicit language comprehension strategies and to lead lessons focused on explicit teaching of oral language.
- Class teachers implementing structured lesson plans with literacy specialist or speech-language therapists' support.
- Using explicit oral language teaching strategies when reading and sharing stories with children.

Quality resources are important. Effective interventions included structured lesson plans with culturally appropriate materials (e.g., the BSLA model, NELi model, Read it Again) with professional learning development for those implementing the sessions. Approaches that focus only on building teacher knowledge (without appropriate

supports and resources for teaching implementation) are not as effective at accelerating children's oral language (e.g., Synergia, 2021).

Monitoring assessments rather than normative or standardised language assessments should be used to track the growth of learners' oral language development. Although broad-spectrum normative measures may provide good information about the child's level of oral language ability, they are not sensitive enough to measure impact of an oral language intervention or to identify next steps for learning. The written language development of children who require additional oral language teaching should also be closely monitored.

Multifaceted oral language interventions to accelerate children's oral language skills should include phoneme awareness, phonics, explicit vocabulary instruction, oral narrative and oral language comprehension activities (amongst other skills as suited to learner needs). Structured teaching approaches of at least 8 weeks using structured lesson plans are helpful. Involving speech-language therapists both directly in implementing lessons and in training others is advantageous. There is a need for further quality research that provides evidence at levels 3 and 4 within the NZ Evidence framework as to the effectiveness of oral language interventions within our New Zealand education context.

**Approaches that focus only on building teacher knowledge (without appropriate supports and resources for teaching implementation) are not as effective at accelerating children's oral language**

# Reading and Writing

## Accelerating Early Reading Development

---

Success in early reading development leads to later reading success and stronger academic achievement. The cumulative benefits of reading achievement to children's education, health, economic and general wellbeing are well documented (Cunningham & Stanovich, 1997; Reynolds et al. 2007). Early intervention and preventative approaches to supporting all children develop the foundational skills that support reading success early in their schooling are strongly supported. Such approaches are both cost effective and lead to multiple advantages for children's learning across the curriculum. This section of the report focuses on a synthesis of the evidence for instructional practices that support accelerated learning in reading for children in their early school years.

**This section of the report presents findings from meta-analyses examining types of teaching strategies and instructional components aimed at accelerating children's phonic, phoneme awareness and word decoding skills.**

One of the mostly widely used theoretical models of skilled reading is called The Simple View of Reading (Gough & Tunmer, 1986). This model holds that children's cognitive skills that support their ability to recognise words in print and to comprehend oral language are both necessary for successful reading comprehension. A recent meta-analysis confirmed this pathway to reading comprehension (Hjetland et al., 2020). The vocabulary, listening comprehension, emerging phonic and phoneme awareness skills of 5-year-old children are powerful predictors of their later reading comprehension ability. It is therefore critical that we understand how to effectively

teach these foundational skills in children's first year at school to ensure all children are set up for reading and writing success.

This section of the report presents findings from meta-analyses examining types of teaching strategies and instructional components aimed at accelerating children's phonic, phoneme awareness and word decoding skills. It also includes findings from meta-analyses that have focused on comprehensive early reading interventions that include teaching skills for word recognition as well as skills for reading comprehension. Evidence for effective vocabulary and language comprehension teaching strategies have been presented in the previous oral language section. Findings specifically related to interventions for children with dyslexia and older learners are presented in the next section.

### Description of meta-analyses

Twenty-five meta-analyses from 1999 to 2024 were identified and reviewed. Collectively these reviews covered over 1,009 individual studies indicating the depth of research in early reading interventions. Studies were mostly focused on English speakers, but also included speakers of other European languages as well as Chinese. The studies included children in their first years

at schools and some studies included English language learners. References and study details are provided in Appendix B – Table 4.

### Strength of evidence

The standard of evidence from meta-analyses of phonic, phoneme awareness, word decoding and reading interventions that include children in the early school years is mostly considered to be level 3 and 4 of the NZ Strength of Evidence Scale (showing good or strong evidence to transfer to large scale interventions and policy). Researchers caution, however, that in many of the studies immediate post intervention results are reported. There is less data available related to longer term outcomes from early reading interventions. Teaching fidelity of the intervention approaches to accelerate early reading is often not reported. Researchers conclude that there is a need for further randomised controlled trials in early reading interventions that more carefully describe both the universal (Tier 1) reading instruction the children are receiving as well as the targeted (Tier 2) teaching supports implemented.

### Teaching implications from main research findings

Overall, the findings from meta-analyses reviewed indicate that evidenced based early reading interventions in school years 1–3 have a moderate to large positive effect on accelerating reading for children identified as requiring additional teaching support. (Effect sizes ranges from hedges  $g = 0.3$  to greater than 1.0). Effect sizes are usually larger on focused reading measures such as nonword reading measures and smaller on standardised reading connected text measures or reading comprehension measures. Among these interventions, systematic synthetic phonics—a structured approach that explicitly teaches the synthesis of sounds (phonemes) to form words—has been particularly effective. This method supports students in decoding written words by identifying the individual phonemes in words and blending these phonemes together to form the word. Efficiency in word decoding is crucial for both reading accuracy and reading fluency.

**Overall, the findings from meta-analyses reviewed indicate that evidenced based early reading interventions in school years 1–3 have a moderate to large positive effect on accelerating reading for children identified as requiring additional teaching support.**

Main findings from the meta-analyses can be grouped within themes for teaching implications and include the following:

### Phonological Awareness (children’s awareness of the speech sounds within a word).

- Phonological awareness (PA) interventions focused on phoneme level skills (e.g., identifying individual speech sounds within words, segmenting words into sounds, or blending sounds to form words) consistently show moderate to large positive effects on children’s reading and spelling skills.
- PA instruction benefits young readers receiving universal or class teaching as well as those learners who require more targeted or tailored teaching support.
- Developing children’s phonological skills at the phoneme level have a stronger effect on reading outcomes than developing children’s awareness of rhyming words.
- Technology-enhanced PA programs can be effective, particularly for younger learners. Higher effect sizes are found from gamification based PA interventions for 5 year-old children of 8 hours or longer total engagement.
- The positive effects of PA instruction on reading and spelling is strongest in the early school years, but remain significant for older children.
- Combining PA with letter sound (phonic) knowledge is more effective than PA training alone.
- Including a spelling component with phoneme awareness and word decoding results in larger effect sizes on reading outcomes than interventions without a spelling component.
- Phoneme awareness intervention is a critical component to include in early reading interventions but is insufficient on its own.

### Phonic interventions

- The systematic teaching of phonics (i.e., understanding the relationship between letter/s and the speech sound/s they represent) is a critical component of reading instruction and reading interventions for all learners.
- A phonic scope and sequence to guide teaching is recommended, but there is no evidence that

one phonic scope and sequence is more effective than another.

- Systematic phonics teaching should be alongside or integrated with other skill areas such as teaching phoneme awareness, vocabulary, word decoding and spelling skills.
- Linking explicitly taught letter-sound mappings to texts such as when reading decodable texts or engaged in shared book reading activity is helpful.

### **Comprehensive early literacy intervention programmes**

- Interventions that accelerate children's reading use systematic and explicit teaching instruction in both word recognition skills (phoneme awareness, letter-sound knowledge, word decoding, reading fluency and spelling) as well as meaning focused skills (vocabulary, oral language, and comprehension activities).
- Including both word reading and spelling tasks in early reading interventions may be particularly important.
- A stronger focus in early reading interventions (e.g., Years 1 and 2) on word reading and spelling skills with a shift in focus to reading comprehension skills once children are confident in word recognition skills (e.g., from year 3 onwards) is recommended.
- Targeted (Tier 2) interventions are more effective when explicit and direct instruction techniques are used.
- Interventions described as "multisensory" had a small positive impact on reading (hedges  $g = 0.2$ ) but showed no advantage over interventions that didn't have a multi-sensory component (which had effect sizes of hedges  $g = 0.34$ ) (see p.38 for further discussion).
- Intervention effects on word reading outcomes and phoneme awareness measures are typically larger than for reading comprehension and text reading outcomes.
- Reading interventions that include explicit and systematic instruction in phonics, phoneme awareness, decoding and comprehension may lead to functional activation of brain activity for struggling readers. However, this is preliminary evidence only and an area in need of further research.

### **Educators involved in interventions.**

- Class teachers, literacy specialists, literacy researchers, speech-language therapists, teacher assistants have all be involved in early reading interventions that have moderate or large positive effects on children's reading outcomes.
- Quality professional learning and development for educators involved in reading interventions is an important factor to consider and strongly advocated by many researchers.
- Enhanced teachers' linguistic knowledge, skills and teaching practices influences children's reading outcomes.

### **Teaching Intensity**

- Intervention intensity (referred to in the studies as "dosage") influences reading outcomes. In general, more intensive interventions produce more effective outcomes. For example, Hall and colleagues found that for every additional hour of intervention the effect size on reading outcomes increased by .002.
- Hall et al., (2022) found on average that effective interventions were around 55 hours, but there was wide variability in studies within their meta-analyses (ranging from 9 hours to 160 hours of intervention mostly delivered in small groups). More intensive interventions were generally more effective.
- Goldfield et al. (2021) found in their meta-analyses that common characteristics of effective interventions included small group intervention with 3–5 students in a group, delivered 4–5 sessions per week, with a minimum 11-week duration,
- There does not appear to be an advantage from individual interventions compared to small group interventions in the early school years.

### **English language learners**

- Phoneme awareness instruction has a large positive effective on listening comprehension in English for children who are learning English as their second and foreign language.
- Phoneme awareness teaching may be particularly helpful for younger English language learners and those with lower levels skills.

- There may be a potential advantage to including phoneme blending skills in PA interventions for English language learners.
- While dialogic reading interventions (e.g., those that involve interactive teaching strategies when sharing a story book with children) may be effective for improving oral language skills in English language learners more explicit teaching in phonics, phoneme awareness, word decoding and reading comprehension is necessary to improve reading and writing skills in English.

### He Awa Whiria

Sénéchal and Young's (2008) meta-analysis provides strong evidence for engaging children's family through specific training in reading strategies (for children in kindergarten to Year 3).

- Specific parent reading training approaches involving families from diverse backgrounds had an overall moderate effect size of 0.65.
- Large effect sizes were found when parents were trained in using specific reading strategies with their child and when listening to their children read.
- Parents simply reading to their children did not influence children's reading outcomes.

Culturally responsive literacy teaching practices have shown promise in improving outcomes for diverse learners. These practices build on students' cultural and linguistic backgrounds, making learning more relevant and effective (Piazza et al., 2015; Toppel, 2015). Research indicates that culturally responsive teaching can enhance teacher perceptions of English language learners (Williamson, 2022). However, more evidence is needed to determine if these practices consistently increase student engagement, motivation, and achievement (Cheesman & De Pry, 2010). Teachers feel confident in being able to form personal relationships with students but are less sure in areas that require specific cultural knowledge (Cruz et al., 2020). Incorporating culturally specific materials and allowing students to use their home language can support meaning-making (Dukes et al. 2021). Critically examining texts through a culturally responsive lens can create more inclusive teaching practices (Kesler, 2011). The specific benefits of culturally responsive reading and writing instruction and strategies that best support these approaches is an area in need of further research.

### Monitoring assessments

Within inclusive teaching frameworks it is crucial that teachers are regularly monitoring children's response to quality evidenced based teaching. Monitoring assessments must have proved reliability and validity. In the early years at school monitoring of children's cognitive skills that support both word recognition (such as phonic and phoneme awareness skills, word decoding skills) as well as skills that underpin reading comprehension (such as vocabulary, oral narrative and listening comprehension) is critical. (Also refer to the monitoring assessments in children with dyslexia section of this report).

Online foundational literacy monitoring assessments and use of artificial intelligence (AI) and digital technologies show promise. AI systems can efficiently and accurately evaluate a wide range of reading abilities (Gordon & Breazeal, 2015; Mich et al., 2020) and can offer ideas for teaching following assessments (Hauwaert et al., 2020). Automated assessment presentations have the advantage of consistent task presentation to all children (i.e. avoid bias of teacher variability in the presentation of the task), can reduce marking errors as well as reducing teaching workload through automated analysis of children's responses. AI-based assessments have shown particular promise for students with special educational needs, increasing engagement and providing alternative ways to complete tasks (Calotă & Paduraru, 2021).

The online monitoring phonic, phoneme awareness, non word reading, nonword spelling, and oral narrative assessments implemented within the Better Start Literacy Approach in New Zealand have proven reliability through data collection of over 40,000 5- 6 year old children (See MoE Report 7, Scott et al., 2023, Gillon, et al. 2023). These assessments have been specifically designed for the New Zealand education context. A PA assessment in Samoan language (Aukuso, 2021) also shows promise for use in New Zealand.

**Within inclusive teaching frameworks it is crucial that teachers are regularly monitoring children's response to quality evidenced based universal (Tier 1) teaching and children's response to targeted (Tier 2) and tailored (Tier 3) teaching support.**

Some teachers in New Zealand may implement DIBELS for the purpose of monitoring children's early literacy growth. DIBELS (The Dynamic Indicators of Basic Early Literacy Skills) is widely used across the USA in the junior school years (Hoffman et al., 2009). Research shows mixed evidence for its effectiveness. Strong reliability and validity were found for the Oral Reading Fluency subtest (Goffreda & DiPerna, 2010) while other subtests showed more variable results. DIBELS may be useful to screen early literacy skills in children who are deaf or hard of hearing (Burke et al., 2023). However, concerns have been raised about DIBELS' limitations for emerging bilingual learners (Butvilofsky et al., 2020). Some researchers have also raised concerns around its effectiveness in evaluating literacy programmes (Kamii & Manning, 2005), its usefulness to inform teaching decisions and the time required for multiple individual assessments (Hoffman et al., 2009).

Preschool Early Literacy Indicators (PELI®) developed by the same lead researchers involved in DIBELS has also been trialled in New Zealand. Cameron et al. (2022) suggested a NZ adapted version of these indicators may be useful at school entry. However, research investigating its usefulness for class teachers in monitoring early literacy progress in children's first year at school in New Zealand has not yet been undertaken.

### **Evidence from within the New Zealand context**

In this section, we summarise the small number of accelerative early phonic, phoneme awareness reading interventions that have been trialled within New Zealand. There are no meta-analyses available examining interventions in the New Zealand context. We have therefore examined peer-reviewed academic journal articles available through scientific journal search engines. These studies provide evidence at level 2 and 3 of the New Zealand Strength of Evidence framework.

### **Phoneme awareness**

Research conducted in New Zealand demonstrates the effectiveness of phonological awareness interventions for children, particularly those who require targeted teaching support. Studies show that structured interventions can significantly improve phoneme awareness, letter knowledge, and early reading skills in preschool and early primary school children in New Zealand schools (Rachmani, 2020; Gillon et al., 2024, 2019, 2007; Gillon, 2000, 2002). These benefits are observed across diverse populations, including children from low socioeconomic backgrounds (Gillon et al., 2019) and those with spoken language impairments (Gillon, 2000, 2002). Teacher-implemented interventions

have also proven effective in accelerating literacy skills (Gillon et al, 2019). Research suggests the integration of phoneme awareness, letter knowledge, and vocabulary development in early childhood settings may be useful with a relationship observed from preschool children's ability to spell their own name, letter knowledge, and initial phoneme awareness (Arrow & McLachlan, 2014; McLachlan & Arrow, 2010). Evidence suggests that phoneme awareness interventions can be beneficial for children in New Zealand schools who have Down syndrome (van Bysterveldt et al, 2010), childhood apraxia of speech (McNeill et al, 2009) and children who are blind and use Braille as their reading medium (Gillon & Young, 2002).

Key components of effective phonological awareness interventions implemented in New Zealand include:

- Intervention activities focused at the phoneme level (e.g., phoneme identify, blending and segmenting, rather than rhyme or syllable awareness).
- Explicit teaching instruction used in the intervention activities.
- Integration of letter-sound knowledge phoneme awareness word decoding and spelling in the intervention such as phoneme manipulation tasks using letter blocks.
- Between 12 and 20 hours of intervention (e.g., 2 hours per week for 10 weeks).
- Speech-language therapists, specialist literacy teachers, or class teachers involved in implementation who have received specific training in the approach.
- Quality professional learning and development for educators involved in implementation.
- Quality teaching resources including structured lesson plans or teaching guides.

Overall, the evidence strongly supports the implementation of phonological awareness interventions to enhance reading and spelling outcomes for children in New Zealand schools if the above key components are in place.

### **Comprehensive early literacy interventions**

There have been few quasi-experimental controlled trials in comprehensive early reading teaching or interventions conducted in New Zealand that have been published in peer reviewed journals. The only recent examples are

controlled research trials related to **The Better Start Literacy Approach** (BSLA). Empirical evidence is available for the effectiveness of both BSLA Tier 1 (universal teaching) and Tier 2 (targeted small group) teaching within BSLA.

Data collected from over 15,000 5-year-old children provides strong evidence that Tier 1 BSLA teaching is associated with accelerated growth in children's phonic, phoneme awareness, word decoding and spelling skills compared to other literacy teaching approaches. BSLA Tier 2 teaching results in greater acceleration of these foundation skills in 5–6-year-old learners who require additional support compared matched controls who did not receive Tier 2 intervention. Māori, Pacific Peoples' learners and English language learners show accelerated early reading and spelling growth in response to BSLA Tier 1 and Tier 2 teaching.

### **Teacher Professional Learning and Development in literacy**

Professional development (PD) initiatives in New Zealand have shown significant positive impacts on student achievement, particularly in literacy. The Literacy Professional Development Project demonstrated improved reading and writing outcomes, especially for low-performing students (McDowall, 2007). Effective PD is characterised by evidence-based inquiry, collaborative learning communities, and a focus on pedagogical content knowledge (Timperley et al., 2009; Alton-Lee, 2011). Successful implementations involve school leaders promoting and participating in teacher learning (Alton-Lee, 2011), establishing a professional learning culture (Ferrier-Kerr & Earl, 2015), and using literacy data to inform evidence-based teaching (Whitehead, 2010). Sustainability of PD benefits is enhanced by building a critical mass community of practice and focusing on broader learning concepts rather than just literacy (Whitehead, 2010).

### ***Massey Early Literacy Initiative (unpublished in scientific literature- sourced online and from MoE report).***

An early literacy initiative involving professional learning and development for new entrant and Year 1 teachers in the lower north island (Massey University Early Literacy Project; Chapman et al., 2017) was undertaken to develop teachers' knowledge of evidenced based early literacy teaching strategies (focus on phonic, phoneme awareness, word decoding and encoding strategies). A controlled comparison research design was implemented. However, the data failed to demonstrate positive intervention effects on children's reading achievement or improvement in teacher knowledge. The researchers attributed these findings to unexpected challenges

teachers faced in implementing different teaching strategies. The researchers refined the PLD to support a second cohort of teachers using more explicit and structured examples and a phonic scope and sequence to support teachers embedding specific word decoding instruction into their literacy practices activities. This more structured PLD was associated with improved teacher knowledge and enhanced reading outcomes for the children. Particularly promising was the evidence indicating the accelerated learning for children in areas of higher socio-economic deprivation.

### ***Better Start Literacy Approach***

Online large-scale professional learning and development for over 4000 junior school teachers through the Better Start Literacy Approach is proving very promising. Online learning was supplemented with in-class coaching and mentoring. This PLD is associated with accelerated early literacy learning for children in classes of teachers who participated in BSLA (Gillon et al, 2023, 2024). Teaching fidelity was high during the first 10 weeks of BSLA teaching (Gillon, 2024) when this was monitored, but longer-term teaching fidelity requires investigation. Teacher feedback through anonymous teacher feedback evaluations and surveys has been very positive (Scott et al., 2024).

### **Section summary**

There is robust evidence indicating the effectiveness of early reading interventions to accelerate foundational skills necessary for reading. Interventions generally have moderate to large positive effect on children's word reading skills. Effective interventions include explicit teaching strategies in phonic, phoneme awareness, word decoding, and spelling. Integrating vocabulary and listening comprehension activities and building foundations for reading comprehension is important. Children with typical language development, children at greater risk for reading problems, children from culturally and linguistically diverse backgrounds, and children with speech and language disorders all benefit from these types of systematic and explicit early reading interventions. Continued ongoing controlled research trials are needed, particularly within the New Zealand Education context.

# Accelerating Learning for Children with Dyslexia or Reading Challenges

**In this section we focus on evidence from meta-analyses and systematic reviews that include intervention studies involving children identified as having dyslexia, learning disability or relatively severe reading difficulties in the absence of other known causes for reading problems such as intellectual disability.**

Dyslexia is classified as a neuro development disorder that manifests as difficulty in learning to read and to write. Children with dyslexia have persistent difficulty with word reading, reading fluency and spelling and may have co-occurring other difficulties (Snowling et al., 2020). Underlying difficulties in processing phonological information are commonly associated with dyslexia (Gillon, 2018), but how these difficulties differ from children who have more general reading problems is unclear (Snowling et al., 2020). In this section we focus on evidence from meta-analyses and systematic reviews that include intervention studies involving children identified as having dyslexia, learning disability or relatively severe reading difficulties in the absence of other known causes for reading problems such as intellectual disability. (See Everatt & Denston, 2020, and Nicholson & Dymock, 2023, for discussions of dyslexia and related reading difficulties.) Combining the evidence derived from these groups of children avoids the need to ‘identify’ dyslexia or a learning disability. What the findings focus on, therefore, is the manifestation of reading difficulties, and associated problems with spelling/writing. Children with more complex needs (such as intellectual disability) are discussed in a separate section of this report.

The specific point at which a study has defined dyslexia or severe reading difficulties varies. For example, some researchers select the bottom 20% of readers within a cohort, others the bottom 15%. We combine these studies in this sub-section of the current review. One

caveat here is that the current sub-section does not include those meta-analyses that have focused only on those within the very low end of the reading distribution: for example, studies that have selected readers only from the bottom one or two percent of reading ability. Such studies primarily focus on individuals with complex learning needs. Again, we have considered the evidence for effective interventions for these learners later in the review.

Note on Language: The term “dyslexia” and the associated language of “difficulty” are based on the existing research terminology, which often focuses on the challenges faced by individuals. While these terms can be seen as deficit-based, they reflect the specific focus of the research on understanding and addressing these challenges. Our aim in this report is to accurately convey the findings of this research while acknowledging the importance of using language that respects and empowers all learners.

## Description of meta-analyses and systematic review

A total of 22 meta-analyses or systematic reviews from 2012 to 2023 were identified and reviewed. Collectively these reviews reviewed 1,010 individual studies, with several thousand sourced as part of the search procedures. The studies focused on interventions for children with reading or learning challenges from 5–18 years. A proportion of studies were inclusive of children who are culturally and linguistically diverse – indeed, many did not differentiate such groups, indicating that the conclusions below will be applicable to a general population of learners.

The majority of studies included also incorporated measures that are recognised as valid/reliable within the field. These measures were standardised for the population under study or included a combination of standardised and specific purpose measures. In intervention research, research-developed measures may be more aligned with the skills explicitly taught. Therefore, for the purposes of generalisation to children with dyslexia (poor reading) in other education contexts, we want to see the intervention effect occurring in standardised tests in addition to researcher developed measures (see Graham et al., 2023, and Hall et al., 2022 for discussion of these issues). Additional information on

identified meta-analyses or systematic reviews can be found in Appendix B – Tables 5 and 6.

### Strength of evidence

Most reviews provide evidence at level 3 and 4 (strong and robust evidence) of the NZ evidence scale. Limitations to the current evidence are discussed below.

### Students in the primary school years

#### Teaching implications from main research findings

##### Intervention focus

- Explicit and systematic instruction in phonics, phoneme awareness, and decoding skills, which also integrate meaning-focused aspects of reading and writing, is the most effective approach for improving foundational reading and spelling skills throughout the primary school years. Such interventions lead to accelerated learning for the majority of children who may be struggling with literacy acquisition. Therefore, these features should be a primary focus of all intervention methods targeted at accelerating learning among those with difficulties at the start of learning to read/write.
- For younger learners, effective intervention methods focus on ‘code-based’ skills that included teaching phoneme awareness, letter-sound correspondence, phonics (decoding and/or spelling) and word recognition. Effective interventions also incorporated support in the development of meaning; this can include vocabulary (understanding the meaning of words) and/or comprehension strategies
- With increasing age in the primary years, effective interventions incorporated more meaning-focused skills (i.e., vocabulary, listening and reading comprehension skills) in addition to phonological and morphological strategies that support decoding skills. Therefore, start with decoding/phonics-based teaching, but include meaning in learning. Then increase the latter over subsequent years, but still maintain the need to develop decoding skills for those who are struggling.
- Effects of phonics/decoding plus meaning interventions tend to be greater on word reading or spelling outcomes than on reading

comprehension Given that as learners move up the primary years (years 3 and up), the importance of reading comprehension grows, then more specific reading comprehension interventions may be needed– discussed in more detail in the following sub-section on older poor readers. However, proficiency in word recognition is a precursor to reading text, so developing word decoding skills is still vital in order to develop foundational skills within the primary years. Comprehension strategies can then build on these foundational skills.

##### Intervention Intensity

- Longer and/or more intensive interventions, on average, yield larger effects on students’ reading and spelling outcomes. However, the evidence for this relationship is more consistent for those experiencing higher levels of reading difficulty. This is consistent with the need for multiple intervention phases for those with dyslexia and more severe learning problems.
- Shorter, targeted interventions are effective for those with less severe learning or reading difficulties. Small group interventions targeting specific foundational skills for a fixed period can be effective for the majority of those with reading difficulties Therefore, shorter and intensive interventions (Tier 2) will work with most struggling learners, but longer and more intensive interventions will be needed for those with higher levels of reading difficulty. The simplest answer to who needs Tier 3 (tailored support) is those with more severe difficulties or more complex needs. For the teacher, this can be decided through a phase approach to support. Assessment of complex needs should be determined by trained assessors.
- One-tutor with one-learner interventions show larger intervention effects for those children with more significant word reading difficulties, but the effect is relatively small compared to the impact of other factors, such as type of literacy instruction at the class level.
- Targeted group (Tier 2) interventions can be as effective as one-to one support including for children with dyslexia/learning disabilities. Factors such as the level of reading difficulty experienced by the child, type of instruction,

intervention intensity, experience of the teacher/tutor, will impact effectiveness. Additional one-on-one support (Tier 3) should be available for those who are not showing improvements with evidenced-based Tier 2 support.

- Features of group interventions can increase their effectiveness. Cooperative learning can be a positive feature of well-structured group work and has been found to increase learning gains for older learners in later primary, intermediate and secondary contexts

### Specific intervention strategies

- The evidence for the effectiveness of multisensory learning, defined as instructional approaches that engage multiple senses (e.g., visual, auditory, and tactile) simultaneously to reinforce learning, is weak to non-existent in the literature focusing on classroom-based learning. These approaches are often championed under the belief that engaging more senses will lead to better retention and understanding, particularly for students with learning difficulties such as dyslexia. However, comprehensive analyses indicate that, as long as a phonics/decoding-based intervention approach is employed with an emphasis on meaning, adding a multisensory component does not significantly enhance learning outcomes. This is an important finding from robust analyses since multisensory learning methods are proposed as being effective by some practitioners (including in second language learning contexts, for example). There may be a case for its use with a specific individual with more severe levels of dyslexia or learning needs who requires multiple repetition of material to ensure retention. However, its use within a more general classroom context, or within small group interventions to provide the basis for accelerated learning, is not supported by the current evidence.
- Interest in the reading material, expected to be related to motivation, has been shown to influence learning across most school contexts. Hence, the same underlying foundations skills for reading and spelling can be targeted and show positive effects with most struggling learners, but the specific materials should be engaging for the learner. For example, a greater use of comprehension, or a focus on text decoding

rather than single word decoding or single word spelling, within an intervention has been shown to be advantageous with older primary school students.

- Technology-based adaptive instruction has not been shown to have major impacts on struggling readers' reading achievement. Again, it is the focus on the foundational skills (phonics plus meaning), or the use of motivational materials, that has the major impact on learning rather than the technology itself.
- Inference generation instruction has been shown to have a significant effect on reading comprehension outcomes with primary school children as well as older learners. Modelling of this comprehension strategy should be included in teaching methods for most learners.
- Integrating reading and writing interventions has been found to be beneficial for students with reading difficulties. However there are only a few studies that have formally assessed the impact of adding additional writing support to an effective reading intervention. Studies conducted that include the explicit teaching of spelling skills with reading interventions lead to better reading outcomes for primary school learners. Spelling activities have been found to support children's understanding of the variability in pronunciation when reading aloud and the development of orthographic patterns.
- Phoneme awareness or morphological awareness training in isolation (e.g., segmenting and blending sounds in words without linking to word decoding) has only have limited intervention effectiveness (Hall et al., 2022). Rather the phoneme awareness skill or morphological strategy needs to be explicitly linked to reading and spelling/writing.

### Educators implementing intervention

1. Quality professional learning and development that enhances teachers' linguistic knowledge, skills and use of this knowledge in their teaching of reading and writing is vital for effective intervention implementation (Moats, 2010, 2020, 2023). However, once this is in place large differences across types of educators have not been found when assessing the effectiveness of accelerating struggling learners' foundational literacy skills. For example, differences

in effectiveness have been found to be marginal (or inconsistent across studies) when comparing support provided by classroom teachers versus trained reading tutors or research assistants. Exceptions will occur. For example, some individuals with dyslexia or learning disabilities can often have co-occurring challenges that may require more specialist support (e.g., from a speech and language therapist or psychologist). This would be determined after an assessment of these challenges.

## Students in intermediate and secondary school years

### Teaching implications from main research findings

There are a more limited number of systematic reviews or meta-analyses that have focused on accelerating reading and/or writing skills for older learners with dyslexia/severe reading difficulties, and that have included studies with strong and robust evidence (e.g., Baye et al., 2019; Hall-Mills & Marante, 2022). Often, when we consider reading interventions in the secondary years, the focus is more on comprehension than efficiency in word decoding; or more on written text than word spelling (though see both Hall-Mills & Marante, 2022, and Galuschka et al., 2020, for a consideration of both). However, problems with word-level reading and spelling skills can persist through to adulthood. It is therefore necessary to consider evidence to support older learners with dyslexia/severe reading difficulties in word recognition and spelling as well as reading comprehension and writing abilities. Where necessary, reference to other key reviews/studies are included in order to supplement conclusions from the limited number of meta-analyses or systematic analyses in this area. Findings with teaching implications from these research reviews are presented below.

### Intervention focus

- Explicit and structured teaching of phonological and morphological awareness skills that explicitly link these skills to word decoding and spelling are effective for older children and adolescents with dyslexia/severe reading difficulties (see Gillon, 2018 for a review).
- Interventions that advance foundational word decoding and encoding skills (once acquired) through text reading (where access to meaning of the text is the goal) are effective (see Everatt & Denston, 2020).

- Explicit text structure instruction improves expository reading comprehension for adolescent students with dyslexia/learning disabilities.
- Interventions that focus on direct vocabulary and reading comprehension strategies are effective at improving reading skills among adolescents
- Explicit teaching of reading comprehension strategies is more effective than reading practice aimed at implicit learning of these skills
- Teaching of key vocabulary (their meaning, and possibly phonological and morphological word structure) that are used in target texts will support reading comprehension
- Strategies for overcoming disengagement from learning are useful when such disengagement in an individual has occurred (see discussions in Everatt & Denston, 2020). Motivation-related strategies focusing on learners' interest and background knowledge, as well as aimed at developing self-regulation, have been identified as useful in these cases.

### Specific Teaching Strategies

1. In addition to the importance of supporting word decoding strategies, including decoding within text writing practice will provide spelling practice which will support the development of word-levels skills
2. Provide systematic teaching of reading comprehension strategies that involve asking questions and answering questions about the text though verbal as well as written forms. Explicit use/modelling of skills/strategies during text reading context will be needed to ensure a skill will be used in text reading/production. These can comprise clarification of material, summarising passages, outlining ideas, making predictions about content or overall themes, and sometimes using visual diagrams/figures (such as graphic organisers or mind-maps) to develop a 'model' of the text.
3. Metacognitive strategies such as summarising, questioning and identifying key terms or main ideas in a text are effective. Teaching flexibility in the use of these different strategies, potentially based on the type of material to be learnt, has also been identified as useful. This will support the development of self-regulatory processes leading to increased self-efficacy and motivation to learn.

4. Practice in text reading fluency through collaborative reading with a teacher or use of repeated reading strategies have been found to be effective in a number of studies. However, the evidence for improvements in reading fluency based simply on speed of reading is mixed since slower reading speeds can be indicative of a reading strategy used to support understanding. Hence, collaborative reading or repeated reading are useful to improve fluency, but slow text reading speeds should be considered alongside comprehension levels when determining poor reading skills.
5. Once a strategy has been acquired, practicing the skills is always useful. Collaborative/paired (student-and-teacher, student-to-student) reading strategies will provide opportunities for students to practice reading skills. Better outcomes are more likely if these collaborative/paired relationships are positive and motivational (Teacher-student interactive reading strategies can also highlight areas of difficulty in terms of word knowledge (written vocabulary weaknesses) or foundational skills (poor decoding of long/unfamiliar words)).
6. In terms of vocabulary learning, the majority of the evidence in the literature argues that learning specific vocabulary within a text given to an individual to read will improve the reading of that text. There is less evidence that the teaching of a vocabulary used in a specific text will then lead to better reading comprehension generally. That is; simply increasing vocabulary size may not in itself lead to great improvements in reading comprehension. There are two exceptions that need to be considered: those learning to read in a second language (see sub-section below) and those with specific, vocabulary-related, reading comprehension deficits. A range of methods for vocabulary development are available which have been shown to accelerate oral language learning, which may then support the development of reading comprehension.
7. Reading comprehension also requires readers to integrate the meaning of the text with what they already know and again these strategies are best taught using material that is at least partially familiar to the learner (which would include cultural knowledge).

### **Intervention Intensity**

1. Phonological processing interventions that integrate word decoding and spelling and last for approximately 20 hours (e.g., 2 hours per week for 10 weeks) have proven effective in accelerating word reading, spelling and reading comprehension in older children with dyslexia/severe reading difficulties (see Gillon, 2018).
2. The same is true for methods that support reading comprehension skills. Longer interventions are not necessarily more effective than shorter length interventions that last for around two months or less. However, it is surprising how many studies of older learners often do not state intervention length— an area where further evidence would be useful, for example, to determine if longer interventions would be useful with more severe or complex needs.

### **Educator implementing intervention**

1. Teacher-led, often small group, direct instruction has been found to support the development of a range of reading and writing skills among secondary school learners with severe reading difficulties/dyslexia.
2. Tutoring programs provided by teachers or paraprofessionals have a positive effect on learning, with one-to-one tutoring typically being more effective than small-group tutoring. This type of support shows greater effects than cooperative learning programmes and whole-school programmes with secondary students who have shown a history of severe reading difficulties.
3. Teacher professional learning and development is critical. Teachers implementing interventions for children with dyslexia/severe reading difficulties need strong linguistic knowledge and theoretical understanding of how learners acquire efficiency in reading and writing. This is likely to be the primary reason for teacher-implemented or trained-tutor interventions to show greater effects than alternatives (Baye et al., 2019). As with studies of primary school children, an understanding of the foundations of literacy and language is a key component of successful teaching of reading and writing, particularly for those who are experiencing difficulties (Gillon, 2018; Moats, 2020).
4. It is important for the educator planning the intervention to know and understand the background of the learner. A structured literacy focus would argue that intervention content should build on learners existing knowledge; both in terms of literacy levels and curriculum material attained.

## Bilingual/multilingual and second language learners

There is less empirical research specifically on those with dyslexia, or severe reading difficulties, among bilingual/multilingual and second language learners (see Solari et al., 2022). One reason is the difficulties of identifying dyslexia, or related reading difficulty, independent of language proficiency (see discussions in Everatt & Denston, 2020). Those with poor second language skills may be struggling with a standardised measure of word reading due to language experience rather than an underlying problem that can lead to poor word decoding skills. This can lead to a tendency to wait for language skills to develop further before conducting dyslexia assessments. There has also been a tendency among researchers focusing on bilingualism to avoid terms such as dyslexia due to a perceived link with disability; based on a desire to avoid suggesting that bilinguals are disabled, for example. The conclusions below are derived from empirical evidence of studies of children with severe reading difficulties/dyslexia, but supports this with studies that have looked at a range of learners in order to identify consistency in, and generalisation of, conclusions. See Appendix B – Table 7 for references and study details.

A growing number of learners come from backgrounds where more than one language is used for communication (due to increased mobility of populations, for example). There is also increasing awareness that speaking more than one language brings advantages in the modern world. Therefore, supporting the development of reading and writing among those who are using more than one language is likely to be an important feature of modern teaching methods. Given that the focus of the current review is on the teaching and learning of English reading and writing, this review will not focus on English language students learning another language.

There has been a debate in the literature about whether those with reading difficulties should learn a second language, or whether they are better to focus only on learning English to concentrate on overcoming the literacy difficulties in English. At present, the literature suggests that poor reading skills in English should not be seen as a barrier to learning a foreign language, though it is recognised that some poor readers will struggle with language learning more than others (see review by von Hagen et al., 2021). This is likely due to the underlying reason why a student is struggling with learning to read – if the reason relates to general problems with oral

language, then second/foreign language learning may also be a struggle – if the problems are more focused on decoding, then learning a spoken language should not be so much of a challenge.

If we consider the evidence for effective teaching of those struggling with English reading and writing who use more than one language, then many of the teaching strategies discussed previously will be relevant to such bilingual/multilingual learners (see reviews by Artzi et al., 2022; Cheung, & Slavin, 2012; Graham et al., 2023; Hur et al., 2020; Solari et al., 2022). Note that the research is varied in terms of ‘type’ of bilingual learner (simultaneous, where two languages are learnt at the same time, or sequential, where one language is learnt after another has been acquired) and the level of proficiency in the languages used by the multilingual learner (see discussions of this point in Hur et al., 2020). However, much of the research suggests that if a second language is learnt at a young age, then differences between bilingual and monolingual learners in terms of reading and writing acquisition are negligible, and learning processes developed by successful monolingual and bilingual learners are very similar or identical.

Research evidence suggests that the same explicit and structured teaching methods (discussed above) that support struggling monolingual learners should also be effective for struggling bilingual/multilingual learners, and across school year levels (e.g., Graham et al., 2022). There are two caveats to this general conclusion.

1. Based on the view of the Science of Learning we need to build on learners’ current knowledge. More consideration to the bilingual/multilingual learner’s background (cultural knowledge) would be useful in supporting their written language development (see discussions in Denston et al., 2024, for a recent New Zealand example).
2. The level of language proficiency may influence the specific intervention methods used. A greater focus on vocabulary learning at the same time as supporting word decoding and spelling will support English language learners with less English learning experience. More explicit support in language comprehension strategies should also be considered so as to accelerate the development of language as well as reading fluency and spelling.

### Teaching implications from main research findings

1. The systematic and explicit teaching of foundational reading and writing skills in the areas of phonics,

phoneme awareness, morphological awareness, word decoding and spelling, vocabulary and reading comprehension skills will support accelerated learning for bilingual/multilingual learners as much as monolingual English learners, including those at risk of reading difficulties.

2. A focus on decoding/phonics-based teaching will support the development of word-level reading and spelling
3. Teaching of critical vocabulary is vital, and opportunities to expand vocabulary would be useful for the learner who is still developing proficiency in English. This may use non-language material (pictures and figures) and/or first language explanations where possible. Where it is possible, first (or home) language use has been shown to be beneficial in many studies where second language proficiency is low (and if there is a risk of reading difficulties).
4. Strategies that have been found to be useful involve definitions of key vocabulary in the first/home language and priming a lesson with an overview in the first/home language – making connections between languages is beneficial. Even if first/home language strategies are not possible, priming background knowledge so that new material can be learnt via this foundation is important. Relevant cultural examples of key vocabulary will provide a basis for developing understanding and lead to accelerated learning.
5. Modelling reading/writing strategies and providing opportunities to use the skills learnt (collaborative or paired reading) will support skills development (Peer pairing should be strategic: e.g.. another child from the same cultural background has been found to help a struggling learner with practice and to support understanding of key vocabulary).
6. Teacher professional learning and development is a continuous process that evolves as teachers gain new insights and strategies, and it is critical to supporting accelerated learning. One of the main elements identified in studies of successful (accelerated) learning is the need for appropriate teacher education and professional development, particularly to support learners from different language backgrounds. This leads to teachers who recognise what works and have the confidence to use methods appropriate for all struggling learners, including specific second language strategies. Additionally, effective professional development emphasises the importance of engaging

with and supporting families, whānau, and the home environment, acknowledging their vital role in the educational success of students.

### He Awa Whiria

The Science of Learning suggests that a focus on cognitive processes, based on underlying neurology, should be the foundation of theory that informs teaching interventions for children with dyslexia. The key findings related to cognitive process from the meta-analyses and systematic reviews in the above section are consistent with this requirement. However, a recognition of ecological and psychological influences on the effectiveness of interventions for children with dyslexia or poor reading are important to consider (see reviews by Cho et al., 2023, and Kelly et al., 2023).

Motivation has been investigated in several studies that have focused on those with dyslexia or more several levels of reading difficulty (see review by Cho et al., 2023; Louick et al., 2023). The evidence for the use of motivational supports/strategies suggests that such methods can be paired with the type of explicit and structure approaches to interventions that focus on the development of word-level decoding and meaning processes. Although, potentially small in the primary years, the combination of effective reading/spelling teaching with methods that increase motivation does lead to greater improvements in measures of reading than either intervention on their own (Cho et al., 2023). Evidence from studies in the primary school years indicate that positive motivation can have greater effects on word-level outcomes than reading comprehension outcomes – though, we might expect this to change with older learners. Given that the majority of ways to increase motivation in primary years focus on word-based games or paired reading, then smaller effects on reading comprehension may not be surprising. When more metacognitive strategies are taught as part of a motivation-focused intervention, then more effects on comprehension outcomes may be evident.

Strategies researchers have considered in interventions to support motivation include:

- game-based activities (eg computer games that focuses on word learning).
- collaborative learning activities (paired reading, for example).
- allowing learners to choose reading materials (focusing on interest) or to set their learning

goals and provide rewards for achievement (stickers or additional activities).

- strategies to support learners own motivational development through monitoring their own reading and spelling goals (what do they want to get out of an activity).
- Strategies can also focus on self-efficacy or self-esteem, such as believing that they can achieve a reading goal or that it is their own effort that has led to success rather than some external factor (see Everatt & Denston, 2020).
- Developing strategies to overcome negative self-perceptions children with dyslexia may have developed as a consequence of negative education experiences associated with failure in learning to read.

Therefore, learner motivation, along with cultural knowledge as a basis for knowledge development, have been found to be potentially useful in methods that have targeted primary school children who are struggling with reading and writing. These factors may increase in their importance as children increase in age through the primary years and into secondary school.

### Monitoring assessments

There is much current debate around assessments for diagnosing dyslexia. Recent empirical evidence suggests that the identification of dyslexia is more suitably based on identification of specific word reading and spelling problems and children's response to evidence-based Tier 1 or classroom reading instruction within MTSS (Miciak & Fletcher, 2020).

Three teaching aspects are therefore crucial to this identification of dyslexia and appropriate teaching support.

1. Classroom reading and writing instruction at Tier 1 (universal teaching) is based on strong scientific evidence for effective reading and writing instruction (as outlined above).
2. Teachers closely monitoring children's response to quality evidenced based literacy instruction and identifying children who struggle with word decoding, reading fluency and spelling.
3. Readers who struggle with word decoding and spelling are identified early and receive quality Tier 2 teaching

(targeted support) that focuses on accelerating word reading fluency and spelling.

Good monitoring assessments are crucial to this model of identification and teaching support for children with dyslexia. In the early years at schools these monitoring assessments should focus on phonic, phoneme awareness, word decoding and word encoding skills. In addition, children's vocabulary knowledge and listening comprehension should also be closely monitored to identify children who are at risk for reading comprehension difficulties.

For older learners, monitoring assessment measures will need to be more complex. They would involve: less frequent vocabulary and/or more complex spoken language understanding tasks. More complex phonological processing and morphological awareness tasks, Word reading and sentence reading fluency tasks.

Spelling tasks and simple sentence writing can be used to support interpretation of areas of weakness. As the learner gets older, task should focus more on reading text. This can help with identifying continued word reading difficulties but can also be used to determine weaknesses in reading comprehension. Contrasting text comprehension with speech comprehension can also help identify the specific area of difficulty: distinguishing between more general language problems or problems specific to text decoding.

In considering large scale and sustainable approaches to accelerating learning for children with reading problems, monitoring assessments that can be implemented online, or in ways that reduce teacher workload are useful to consider. Online presentation of task has the advantage of ensuring each child receives the same quality of task presentation (reducing variability that teacher implemented tasks introduce). Recent advances in digital technologies provide promising options for consistent and regular monitoring of children's response to evidenced based reading and writing instruction.

A range of appropriate tasks to monitor children's response to quality reading and writing instruction are readily available. Within New Zealand, junior schoolteachers in almost half of all primary schools who are implementing the Better Start Literacy Approach (BSLA) are using valid and reliable online monitoring assessments tasks. These tasks are used within BSLA to monitor children's response to Tier 1 teaching, identify children who require more targeted support through Tier 2 teaching and further monitor children's responses

**Overwhelming, the evidence supports the use of explicit and structured teaching methods to ensure these learners have strong foundational skills in areas that support efficiency in word decoding, spelling, reading fluency, vocabulary learning, and reading comprehension.**

to quality teaching at Tier 1, 2, and 3 during the junior school years. This method is consistent with current research evidence and is proving effective. Gillon et al. (2024) found that 5- and 6-year-old children identified after 10 weeks of BSLA teaching as struggling in word decoding and encoding skills who then received BSLA Tier 2 targeted support caught up to their peers (on average) at the 30 week monitoring assessment. Extending these types of monitoring measures for use with older learners would be a valuable contribution to identifying points when intervention should be considered.

The 'Three steps in screening for dyslexia' provide also provides a useful guide on what is available to teachers; and Nicholson & Dymock (2015) discuss such methods well in the New Zealand dyslexia handbook. However, whether these should be exclusive steps is more debateable. For example, Sleeman et al. (2022) argue for monitoring procedures across areas so that children can be identified who required support in word reading, those that require support in reading comprehension, and those that need support with both word reading and comprehension. This is consistent with the Simple View of Reading (see the more recent interpretation of this model in Hoover & Tunmer, 2018; Tunmer & Hoover, 2019). This is also consistent with the data presented in this sub-section above that moving from word-level support to reading comprehension support is often

needed as the child grows older. Monitoring assessments for both language comprehension and word reading will also provide the basis for identifying areas of difficulty among those who are learning English as a second or additional language.

### Section summary

The evidence from robust meta-analyses and systematic reviews provides clear evidence as to effective interventions for children with dyslexia or poor readers across the age groups. Overwhelming, the evidence supports the use of explicit and structured teaching methods to ensure these learners have strong foundational skills in areas that support efficiency in word decoding, spelling, reading fluency, vocabulary learning, and reading comprehension. Although multisensory interventions for children with dyslexia may be popular, the current evidence does not support their wide-spread use. Understanding and knowing the learner's cultural and educational background as well as the integration of intervention strategies that address ecological and psychological influences on children's reading and writing development are important. Educator professional learning and development is vital to ensure interventions are appropriately planned and implemented.

## Accelerating Writing and Spelling Skills

### Introduction

Writing and spelling skills are crucial to students' overall literacy development and success in school. Writing is important for integrating knowledge, thinking critically, and provides students with a means to communicate

what they know (McMaster et al., 2018). Further, a lack of writing proficiency can have a serious impact on later success in school, employment, and life. The seminal work by Hayes and Flower (1980) provides a theoretical model of skilled writing that includes three key writing

processes: planning, translating, and reviewing/ revising. Within children, understanding and assessing writing development is based around two key components of translating:

- Text generation (selecting words and producing sentences and paragraphs to express ideas), and
- Transcription (translating words, sentences, and paragraphs into print, requiring handwriting/ typing and spelling; Berninger, 2009).

Each component is important to the overall quantity and quality of students' writing, and when students struggle with one component, such as handwriting or spelling, they have limited cognitive resources to devote to other components, such as word selection and sentence construction (Berninger, 2009; McMaster et al., 2018). Thus, writing interventions must target skills within each component (a multicomponent intervention) to improve writing development.

Dysgraphia refers to persistent difficulties with learning to write, particularly focusing on handwriting (legibility and fluency) and spelling, which are considered aspects of transcription. While dysgraphia can also impact writing composition, such as cohesion and coherence, these issues may arise indirectly from the challenges in transcription leading to lower levels of writing practice. Although dysgraphia is not as widely discussed in educational research as dyslexia, students with this condition often face significant challenges in the writing process. It is important to note that the research on writing and spelling interventions reviewed in this report applies broadly to students experiencing writing difficulties, including but not limited to those with dysgraphia. The findings discussed in this section are relevant to a diverse group of learners who face challenges in writing, whether identified with a specific learning disability or not.

Ecological influences on writing development include the complex interaction of language, cognitive, and motor processes that demand cognitive resources from the writer, the lack of automation in lower-level processes like handwriting for young children, the tendency for developing writers to focus more on lower-order processes, and the interdependence and potential interruption between the various writing processes. Further, cultural, social, institutional, political, and historical factors operating at both the classroom/local level and the broader societal level shape the purposes, practices, and resources for writing instruction, and can

contribute to differences in the effectiveness of writing interventions (Graham et al., 2021).

### Description of meta-analyses

Five meta-analyses and four research syntheses/ systematic reviews were identified as examining the effectiveness of writing interventions and various components within these interventions. Collectively, these reviews covered 294 individual studies. The studies ranged in their participant samples from new entrant students up to the end of secondary school. References and study details are provided in Appendix B – Table 8.

Most of these meta-analyses and reviews only included studies that had either a control group or at least two groups of students receiving different writing interventions; however, some included studies with single-subject designs. A single-subject design is when the outcome variable is measured repeatedly prior to and after the intervention to determine whether changes in the outcome variable correspond to intervention onset.

### Strength of evidence

The strength of research evidence in this area is predominantly at level 3 (good evidence suitable to support interventions) with some evidence at level 2 (promising, some evidence). Some of the limitations of evidence in this area include a substantial proportion of research using quasi-experimental or single-subject designs. Further, there is often only a small number of studies for each instructional technique, limiting the ability to draw strong conclusions (García-Sánchez et al., 2022) and the procedures for measuring writing quality are often not consistent across all studies (Graham et al., 2021). There are also some concerns about publication bias within this area (Datchuk et al., 2021; Graham et al., 2021).

### Teaching implications from main research findings

#### Intervention Focus

- Explicit and systematic code-based literacy interventions, especially those involving generating spellings of words and segmenting phonemes, are more effective at improving spelling outcomes compared to control conditions or less explicit interventions. Similarly, treatments focused on enhancing writing processes are only effective when explicit instruction is provided.

- Literacy programs balancing reading and writing instruction can enhance both reading and writing performance.
- Using an “occupation-as-means” approach, where the occupation (handwriting or spelling) is the medium of the intervention, is more effective than “occupation-as-ends” approaches that targets underlying component skills.
- Four specific writing interventions – strategy instruction, dictation, goal setting, and process writing – were found to have statistically significant positive effects on writing quality.
- Three specific handwriting interventions were particularly effective: handwriting focused on timed transcription skills, multicomponent handwriting treatments, and performance feedback

### Specific Teaching Strategies

- Handwriting interventions in early years can improve and prevent writing fluency difficulties for all students.
- Performance feedback effectively improves writing fluency, even in languages with non-transparent orthographies, where letters and sounds do not consistently correspond.
- Spelling interventions focused on orthographic patterns beyond just the alphabetic principle can improve spelling performance in students with reading disabilities.
- Explicit, linguistically based spelling instruction that requires active reflection on and production of orthographic patterns leads to moderate to large improvements in spelling.
- Three specific handwriting interventions are particularly effective in improving writing fluency:
  1. handwriting focused on timed transcription skills,
  2. multicomponent handwriting treatments, and
  3. performance feedback.
- Instruction incorporating self-regulated strategy development (SRSD) shows great promise for benefiting young children, as it teaches

critical writing strategies and supports their independent use.

- To improve the writing fluency of students, practitioners should consider using both acquisition interventions like SRSD and graphic organisers, as well as fluency interventions with timed practice, performance feedback, and goal setting. Writing fluency focuses on developing smoothness and ease in writing, which is an essential part of broader writing development but doesn’t fully address the deeper aspects of writing knowledge and structure.
- Research has identified two main types of effective writing interventions for older students with disabilities: systematic study strategies and technological assistance.
- Procedures for scaffolding or supporting students, like peer assistance, pre-writing, process writing, and strategy instruction, are effective for improving writing quality.

### Conditions that Facilitate Accelerated Learning

While research has examined the extent to which the impact of spelling instruction and intervention varies based on implementation characteristics, meta-analytic results indicate that neither interventionist role (i.e., type of educator) nor group size are significant moderators of effectiveness (Petersen-Brown & Kromminga, 2024).

### He Awa Whiria

Graham (2007) highlights the challenges in implementing research-based writing interventions in real-world classroom settings, where conditions may differ from controlled research settings, and the need to carefully analyse organisational structure and format when implementing these evidence-based practices in order to identify facilitating and impeding factors. Ecological and psychological influences on spelling and writing development include the home environment, cultural and language environment, motivation and attitudes.

**Home Environment.** Parents who read to their children, provide books, and engage in literacy activities create a rich literacy environment that supports spelling and writing development (Niklas et al., 2023). Family socioeconomic status impacts resources available to support literacy development, such as access to books, educational materials, and extracurricular activities. Exposure to a rich and varied vocabulary in both spoken

and written forms can enhance spelling and writing development.

**Cultural and Language Environment.** Communities that value and promote literacy often have higher levels of literacy among their members. Cultural practices, such as storytelling and shared reading, can also support literacy development, including spelling and writing development. Further, learning multiple languages can influence spelling and writing skills. While it can provide cognitive benefits and enhance metalinguistic awareness, it can also present challenges in managing different spelling rules and conventions (Zhang et al., 2022).

**Individual Factors.** Individual differences in memory, attention, phonological awareness, and language processing can impact spelling and writing development (Kim & Schatschneider, 2017); however, motivation and attitudes are also important. A positive attitude towards reading and writing and intrinsic motivation to engage in literacy activities can drive the development of these skills (Graham et al., 2007).

Understanding these ecological influences helps educators, parents, and policymakers create supportive environments that foster effective spelling and writing development.

## Section summary

Research in this area has identified a variety of instructional procedures that can improve students' writing and spelling. Explicit and systematic code-based literacy interventions, especially those involving generating spellings of words and segmenting phonemes, are more effective at improving spelling outcomes compared to control conditions or less explicit interventions.

Handwriting interventions for early primary students can improve and prevent writing fluency difficulties. Effective methods include handwriting/transcription instruction, multicomponent programs, and performance feedback. In adolescents, evidence-based instructional procedures include explicitly teaching writing processes and strategies, structuring the writing process, and using word processing. Practitioners should use a combination of acquisition and fluency interventions, such as self-regulated strategy development (SRS), graphic organisers, timed practice, performance feedback, goal setting, and graphing, to improve the writing fluency of students with and without disabilities.

**Explicit and systematic code-based literacy interventions, especially those involving generating spellings of words and segmenting phonemes, are more effective at improving spelling outcomes compared to control conditions or less explicit interventions. Similarly, treatments focused on enhancing writing processes are only effective when explicit instruction is provided.**

# Accelerating Reading for Children with Complex Communication and/or Learning Needs (CCLN)

Literacy skills are critical for children with CCLN as they can significantly enhance a range of important outcomes in the areas of school, employment, and independent living (Johnston et al., 2018). They can also impact social participation, quality of life, and self-esteem (Dessemontet et al., 2019). Furthermore, for children with complex communication needs, literacy skills enable precise and autonomous communication (Clendon & Gillon, 2018). The ability to spell conventionally equips these children with the flexibility to use spelling alongside the picture symbols in their AAC systems to communicate more precisely (Clendon & Erickson, 2009).

**This section reviews the evidence for effective interventions for children with CCLN to accelerate their foundational literacy skills in areas recommended for all learners.**

Historically, literacy instruction for children with CCLN was largely focused on sight word teaching. Researchers and educators had lower expectations for these children's reading development. The focus was on developing functional literacy skills to enhance independence (Dessemontet et al., 2019). It is now well recognised, that children with CCLN need access to the same high-quality literacy instruction provided to their neurotypical peers (Erickson et al., 2020; Murphy et al., 2023). Many children with CCLN have significant language learning needs so it's critical that literacy instruction is comprehensive and emphasises the skills needed for effective and efficient word identification and spelling, but also the skills needed to extract and create meaning in text (Clendon & Erickson, 2023).

This section reviews the evidence for effective interventions for children with CCLN to accelerate their foundational literacy skills in areas recommended for all learners.

## Phonological Awareness, Phonics, Decoding and Word Reading

### Description of Meta-analyses or systematic reviews

Six reviews (meta-analyses or systematic reviews) were identified that either: (1) had a specific focus on phonological awareness, phonics, decoding and/or word reading instruction for children with CCLN or, (2) included a sub-section with a specific focus on phonological awareness, phonics, decoding, and/or word reading instruction as part of a broader review. Two of the reviews focused on individuals with intellectual disability (ID), two on individuals who use augmentative and alternative communication (AAC), one on individuals on the autism spectrum, and one on individuals with cerebral palsy (CP) See Appendix B – Table 9 for study details.

### Strength of Evidence

The strength of research evidence in this area is predominantly at level 2 (promising, some evidence) and level 3 (good evidence suitable to support interventions). Several limitations to the evidence in this area are apparent including the following:

- In general, there is a limited number of well-designed studies in the effectiveness of interventions for this population.
- Dessemontet et al. (2019) commented on the limited number of studies involving students with more severe ID and the limited number of studies that involve small group format for interventions (as opposed to 1-1 intervention).
- Nearly all of the research studies included in the reviews were conducted in special school or self-contained classroom settings, with few examples of studies conducted in mainstream school settings.
- Few studies have investigated the transfer of improved phonological awareness, phonics, and word reading skills to untaught or novel words or connected text.

## Intervention Focus

- Systematic and explicit literacy instruction using evidence-based principles can be effective for children (5–18 years) with CP, but more research is needed.
- Explicit teaching of phonological awareness and phonics can be effective for children (and adults) with ID.
- Medium effect sizes on improvements in phonological awareness, word reading, and decoding may be expected for children and adolescents (4–21 years) with ID. Effect sizes for these variables ranged from 0.40 to 0.55, indicating meaningful positive impacts of the interventions.
- Adapted phonological interventions that include explicit teaching of letter-sounds, phoneme blending, phoneme segmentation and word decoding skills are effective for individuals who use AAC, with large and very large effect sizes (average Tau-U = .81). These interventions are useful across ages (preschool to adult), and diagnoses (including autism, cerebral palsy, Down syndrome, intellectual disability).
- Systematic and explicit approaches to foundational literacy skills are the most promising for children with AAC.
- Multi-component literacy instruction targeting phonological awareness, phonics, fluency, vocabulary, and reading comprehension was the most promising, leading to gains across various reading skills in diverse samples of children on the autism spectrum. Many of these studies were of variable quality, however, so future research is needed.
- Although researchers cautioned against the use of a “sight word” only approach (i.e., learning to visually recognise at the whole word without using phoneme awareness skills to decode), a combination of phonics and sight word approaches may have positive benefits.

## Specific Teaching Strategies

- A synthetic approach to phonics and word decoding is useful (students are taught to

pronounce the sounds associated with letters and to blend the sounds to form words).

- Specific scaffolding and promoting strategies are useful in supporting phonological, awareness, phonics, and word reading for children with ID and children who use AAC such as pre-response prompting (e.g., modelling, and time delay) and post-response feedback.
- Adapting instruction so that verbal responses are not required or expected was identified as key for children who use AAC.
- Access to AAC and/or assistive technology (e.g., software programmes, alternate access methods) was noted as critical for children with CP and children who use AAC.
- Targeting a single skill or a small number (2–4) of skills during intervention may be more effective than targeting more skills concurrently.

## Intervention Intensity

- Interventions with high intensity - one-to-one teaching four times per week are effective.
- Although limited evidence, review of studies of interventions for children who use AAC delivered in small groups appear to be similarly effective to those delivered one-to-one.
- Long term interventions for children with ID may be necessary and patience and perseverance are important.

## Educator Implementing Intervention

- Educators, well trained by experts in the intervention approaches are able to effectively implement interventions.

## Reading Comprehension, Shared Reading, and Narrative Instruction

### Description of Meta-analyses or systematic reviews

Eleven reviews (meta-analyses or systematic reviews) were identified that either: (1) had a specific focus on reading comprehension, shared reading, and/or narrative instruction for children with CCLN or, (2) included a subsection with a specific focus on one of these areas as part of a broader review. Most of the reviews (n=9) focused on individuals on the autism spectrum. Of the remaining,

three focused on individuals with intellectual disability (ID) and one on individuals with cerebral palsy (CP). See Appendix B – Table 10 for study details.

### Strength of Evidence

The strength of research evidence in this area is predominantly at level 2 (promising, some evidence) and level 3 (good evidence suitable to support interventions). There is currently only a small number of studies focused on narrative intervention for children with CCLN (one systematic review of seven studies of children on the autism spectrum; Tam et al., 2022).

There are several limitations to the evidence related to shared reading and reading comprehension instruction. These include:

- Nearly all of interventions with children on the autism spectrum do not include children with complex communication needs (Alharbi et al., 2023).
- Shared reading interventions often include a combination of strategies which makes the impact of individual strategies difficult to determine (Dessemontet et al., 2024).
- Although reading comprehension interventions for children on the autism spectrum are “broadly effective”, there are “insufficient studies to determine evidence-based reading interventions for improving comprehension” (McClain et al., 2021, p. 118).
- Only a few studies have implemented the same type of reading comprehension program with children with ID; this therefore restricts the synthesis of evidence for specific types of programs (Joseph et al., 2023).
- Studies focused on reading comprehension instruction for children on the autism spectrum show considerable within-study and between study variability (McClain et al., 2021).
- Few studies have included generalisation measures (Boyle et al., 2019; Shelton et al., 2019).
- Few studies have included high school aged children (Shelton et al., 2019).
- In a review of reading comprehension instruction for children with ID, only one study

was conducted in a large group setting. The remaining studies involved small groups or were carried out one-to-one. In addition, nearly all of the studies included children with mild to moderate ID (Joseph et al., 2023).

### Intervention Focus

#### Shared Reading

- Nearly all of the shared reading interventions used with children on the autism spectrum are adapted versions of dialogic reading.
- Two reviews have explored the impact of shared reading interventions for children on the autism spectrum. One review (Alharbi et al., 2023) noted moderate to large effects on children’s verbal communicative responses, but limited impact on verbal initiations. The second review (Boyle et al., 2019) observed large effects on children’s listening comprehension. In contrast, small effects were evident for expressive communication and moderate effects for non-communicative participation. Interventions that measured both communicative and non-communicative acts demonstrated large effects (Boyle et al., 2019). Boyle et al. (2019) concluded that shared reading is as an emerging intervention for children on the autism spectrum.
- The positive effects of shared reading for children on the autism spectrum are seen across the age span of 2–14 years.
- Large effect sizes are evident for shared reading interventions on the listening comprehension skills of children with ID.
- One third of the studies involving children with ID targeted inferential questions as well as literal questions. This “reflects a growing educational ambition for these students, particularly a growing concern for their general knowledge and reasoning” (Dessemontet et al., 2024, p. 13).
- Children with ID are able to generalise their comprehension skills to untrained texts or demonstrate a reduced need for help (less prompting) with trained texts.

#### Reading Comprehension

- Studies involving children with ID and children on the autism spectrum have employed a range of programs targeting reading comprehension. Some have used published or commercially available Direct Instruction programs featuring systematic instruction and scripted curricular. Others have implemented strategy instructional programs (e.g., Reciprocal Teaching).
- Only one study (Ip & Lian, 2005, reviewed in Murphy et al., 2023) has examined reading comprehension instruction for children with cerebral palsy. This study implemented an existing program adapted for children with ID that focused on comprehension strategies (e.g., deleting redundant information, locating the topic sentence, identifying the main ideas). The program was found to positively impact 4 of the 5 participants with weak-to-medium effect sizes.
- Studies of reading comprehension instruction for children with ID have included a range of outcome measures. Large effects are typically observed on retell measures. In contrast, mixed effects are observed on measures requiring responses to comprehension questions with more consistent effects seen for open-ended versus multiple choice questions. Moderate to large effects are observed in measures requiring a physical response (e.g., pointing to a picture).
- Younger children on the autism spectrum show larger gains in reading comprehension than older children, although older children have a greater immediacy of effect.

### **Narrative**

- To date, only a small number of studies have examined the effectiveness of narrative intervention for children on the autism spectrum. Medium effects are evident for narrative macrostructure (four studies) and microstructure (one study). Large intervention effects are evident for comprehension of questions related to story elements (two studies) and labelling of story elements (one study). Mixed intervention effects are evident for perspective taking with one study reporting a small effect, and a second study indicating a medium effect. Across studies, there is minimal to no evidence of skill maintenance.

## **Specific Teaching Strategies**

### **Shared Reading**

- Shared reading interventions that target listening comprehension for children on the autism spectrum typically include aided techniques (e.g., AAC displays) or informal supports (e.g., pointing to pictures in the book) alongside speech to support participation.
- Shared reading interventions for children with ID often include shortened and simplified texts suggesting this might be “an important instructional component for success” (Dessemontet et al., 2024, p. 12).
- Shared reading interventions that target listening comprehension with children with ID frequently include a system of least-to-most prompts to support children to answer questions, instruction regarding wh-words, and/or explicit instruction regarding text comprehension strategies. The first two strategies have sufficient research to be considered evidence-based.
- Technology is also incorporated in several studies with children with ID either to read the text aloud, as a response mode, or as a support for interactive instruction.
- Only three shared reading interventions for children on the autism spectrum have measured expressive communication outcomes and all reported small effects. The researchers offered three possible explanations for this finding: (a) interventions may need to be of higher intensity to impact expressive communication, especially for children with significant language needs, (b) interventions may need to be restructured to enable more opportunities for children to initiate communication, and (c) children’s participation may be restricted by inadequate access to AAC .
- Shared reading interventions are similarly effective for children with ID that have complex communication needs versus those who are able to communicate with spoken language.
- Adaptations employed for children with ID with complex communication needs typically include providing symbols or pictures (in paper or electronic form) for children to select

from to indicate their response. Interestingly, interventions for children who are able to use spoken language, also frequently incorporate a multichoice non-verbal response mode so these adaptations may be supportive for a broad range of children.

- Other adaptations for children with complex communication needs include providing opportunities to interact with objects related to the text, find pictures in the text, and/or complete the storyline with voice output devices.

### **Reading Comprehension**

- Interventions including at least one evidence-based comprehension strategy (i.e., predicting, summarising, paraphrasing, rereading, self-questioning, or identifying of main ideas) generally produce large effects for children with ID.
- Common features of effective reading comprehension interventions for children with mild ID include explicit strategy instruction and peer-mediated instruction.
- There is preliminary evidence for the use of visually cued instruction (e.g., graphic organisers), comprehension strategy instruction, collaborative (peer-mediated) instruction, and computer-assisted instruction for supporting the reading comprehension skills of children on the autism spectrum.
- Reading comprehension interventions for children on the autism spectrum that include opportunities for children to integrate background knowledge with text-based understanding have stronger effects than those that only address text-based understanding. These interventions provide children with “experience in constructing text meaning and integrating it into their world experience” (Zhang et al., 2023, p. 155).
- Instructional methods such as modelling, guided practice, independent practice, and feedback are important in teaching reading comprehension

strategies to children with ID and children on the autism spectrum.

- Implementation of graphic organisers can have strong effects on the reading comprehension of children on the autism spectrum.
- Interventions involving graphic organisers and visual supports are associated with immediate improvements in reading comprehension for children with ID.
- Interventions that included visual strategies and prompts, graphic organisers, questioning and cuing strategies, perspective taking, and/or a focus on the child’s personal interests positively impact reading comprehension for children with ID.
- Mixed results are evident for instruction integrating electronic devices to support reading comprehension for children with ID.
- Particular adaptations may be necessary to support children with ID. Examples include having children read small chunks of text at a time when completing a graphic organiser versus filling everything in at the end.
- Some reading comprehension interventions are effective with some students and not with others reinforcing the unique needs of children on the autism spectrum. “We cannot assume these interventions will work for everyone” (McClain et al., 2021, p. 117).

### **Intervention Intensity**

#### **Shared Reading**

- Shared reading interventions for children on the autism spectrum have been conducted over 4 to 12 weeks with 1 to 5 sessions per week. Of the nine studies included in Alharbi et al.’s (2023) review, all but one intervention had positive effects including the intervention with the lowest intensity.
- Even a small number of shared reading sessions can benefit children on the autism spectrum.

## Reading Comprehension

- There is currently insufficient research to make definitive conclusions regarding instructional intensity for reading comprehension instruction for children with ID.
- Interventions using small group or one-to-one delivery of reading comprehension instruction for children with ID vary from demonstrating no effect to large effects; most with large effects. The one study using large group instruction (Isikdogan & Kargin, 2010, in Joseph et al., 2023) showed large effects.
- Children on the autism spectrum with co-occurring language impairments may not show significant improvement in response to reading comprehension interventions or they may exhibit more moderate gains. These children may require a higher dosage and/or additional interventions.
- Older children may also require more intensive support to make gains in reading comprehension.

## Educator Implementing Intervention

### Shared Reading

- Shared reading has positive effects when implemented by researchers, parents, and teachers. In particular, large effects are observed for children's listening comprehension, and for measures that are a combination of communicative and non-communicative acts when interventions are carried out by parents and teachers.
- Dessemontet et al. (2024) noted a strong need for more studies with teachers as implementers of shared reading interventions.

### Comprehension

- The number of reading comprehension studies with children on the autism spectrum carried out by teachers (as opposed to researchers) is low. Two studies have used the same intervention (ABRACADABRA, a computer-assisted literacy program) in two different contexts: (1) one-to-one in the participants' homes and (2) teachers at school. The intervention at home positively impacted both reading comprehension and

fluency, whereas the intervention at school only impacted fluency.

## Monitoring Assessments

- For children with CCLN, monitoring assessments are critical for noticing strengths and needs, identifying next steps for learning, introducing appropriate scaffolding, and prioritising supports (Clendon et al., 2021; Clendon & Erickson, 2023). Teachers need knowledge and tools that enable them to notice even the very earliest language, literacy, and mathematics skills and understandings, and to be able to document progress.
- Some children with CCLN are able to engage with standard monitoring assessments if (a) the assessment does not depend on a spoken language response, (b) the child has the physical abilities to respond using the standard response mode (e.g., pointing to make their selection), and (c) the child will attend and engage with the assessment process. Importantly, monitoring assessments need to be targeted and efficient to optimise participation and engagement. Clendon et al. (2021) shared a checklist of key considerations when preparing to carry out an assessment, for example preparing the materials in advance, considering lighting/noise/visual distractions, including visual supports, and keeping instructions simple and concrete. The checklist was written with a focus on children on the autism spectrum, but many of the considerations are relevant to a broader range of children with CCLN.
- Other standard monitoring assessments will need adaptation to ensure they are accessible to children with CCLN. Some of the Better Start Literacy Assessments have been adapted so they don't require a spoken response (Clendon et al., 2022). For instance, the adapted non-word reading assessment asks children to identify the target non-word from a choice of four. In contrast, the standard administration asks the child to read the target non-word aloud. Instructions are also provided for how to adapt the response mode for children with physical needs who are unable to point to make their response. These children can use partner assisted

scanning to respond whereby the communication partner scans through each choice so that they can indicate (e.g., by vocalising) the choice they want. These adaptations are similar to those described in previous literature (e.g., Erickson et al., 2008; Clendon & Gillon, 2018; Clendon et al., 2021).

- Some children with CCLN will have very emerging skills so it's important that teachers have knowledge of the earliest developmental progressions in language, literacy, and mathematics. These children may be unable to engage (at least initially) with a one-off snapshot type monitoring assessment. Teachers need to be able to notice and monitor their skills and understandings throughout the week within authentic classroom routines, for instance, noticing shifts in their engagement, language skills, and literacy understandings in the context of shared reading opportunities. Talking to families around what to notice and how to support next steps for learning in the home context is also important.

### **Bilingual/multilingual and second language learners**

There is a significant need for additional research focused on children with CCLN who are bilingual/multilingual and second language learners. Riviera et al. (2021) reviewed intervention research involving learners with ID who are also emergent bilinguals. Five studies were identified. All focused on Latino children with a primary language of Spanish. All of the studies had a literacy focus but only one focused on word reading and this involved sight word teaching. The researchers noted the incorporation of culturally responsive techniques in these studies including the use of culturally relevant literature, the use of the student's primary language, and the use of instructors who were of similar cultural backgrounds to the learners.

### **He Awa Whiria: Braiding Knowledge Streams**

Murphy et al. (2023) noted the importance of parents and educators having high expectations for children's literacy development. They cited recent research by O'Donnell et

al. (2022) which showed that the expectations of parents of young people with disabilities predicted school functioning and that lower expectations were more prevalent when young people had learning difficulties and speech problems in particular.

Other researchers (e.g., Rivera et al., 2020) have discussed the importance of culturally responsive planning, instruction, and reflection for children with significant disabilities. Their suggestions are not specific to literacy instruction, but include the following key considerations: (1) use of culturally responsive materials, (2) use of primary language and technology, (3) inclusion of families, (4) opportunities for children to be active learners, (5) systematic and embedded instruction, (6) multiple access points, (7) use of positive behaviour supports, (8) respect for the learner, and (9) reflection on culturally responsive practices.

### **Section summary**

The evidence from systematic literacy reviews and meta-analyses focused on interventions to accelerate literacy skills in children with CCLN is promising. The evidence suggests that explicit and systematic instruction (with adaptations and scaffolding as appropriate to individual learner needs) has a positive impact on children's learning. Educators who receive quality professional learning and development (PLD) or training can effectively implement phonological awareness, phonics, decoding, and/or word reading interventions. However, more studies are needed that examine the outcomes when educators implement shared reading, comprehension, and narrative interventions. Continued research is important to elucidate the effectiveness of specific teaching strategies for children with CCLN including how best to facilitate maintenance and transfer of taught skills. Additional studies are needed focused on narrative intervention given its importance for reading comprehension and writing. It is also critical to consider the environmental and psychological factors that might be influencing these children's success. The expectations of educators and parents can influence outcomes, and efforts to shift these could have long-term benefits.

# Mathematics

Mathematics proficiency is essential for educational achievement and long-term success. Students' ability to understand and apply mathematical concepts is critical not only for academic performance but also for practical life skills and future career opportunities. The focus of this report section is to synthesise research findings on effective interventions for accelerating learning in mathematics, especially for students who struggle with this subject.

Mathematics proficiency encompasses various interconnected skills and knowledge areas that are foundational to student success and provide essential context for understanding the research on mathematics interventions in this report. These areas include:

**Numerical Operations:** Proficiency in basic arithmetic operations, including addition, subtraction, multiplication, and division, which are essential for building more advanced mathematical skills.

**Algebraic Thinking:** Understanding and working with variables, expressions, and equations, which are crucial for solving problems and understanding relationships between quantities.

**Geometry, Measurement, and Spatial Reasoning:** Recognising shapes, understanding spatial relationships, and applying measurement concepts to assess size, length, area, and volume, which are vital for both theoretical and practical problem-solving.

**Data Analysis and Probability:** Interpreting data, understanding probability, and making informed predictions, which are increasingly important in a data-driven world.

**Mathematical Language and Communication:** Proficiency in reading, writing, and discussing mathematical concepts, which is essential for deep understanding and effective problem-solving.

**Problem-Solving and Critical Thinking:** Applying mathematical knowledge to address complex challenges and make informed decisions, which are core aspects of mathematics education.

These key areas provide a clear framework for the mathematics interventions discussed in this report, ensuring that readers have a comprehensive understanding of the foundational skills and knowledge essential for effective mathematics education..

To ensure that all students achieve proficiency in mathematics, especially those who struggle, targeted and evidence-based interventions are essential. Effective interventions can help bridge gaps in understanding, build foundational skills, and support students in developing the critical thinking and problem-solving abilities necessary for success in both academic and real-world contexts. This review will examine the most effective strategies for accelerating mathematics learning, focusing on interventions that have demonstrated significant positive impacts on student outcomes.

## Accelerating Learning in Mathematics

---

Dyscalculia is a neurodevelopmental disorder characterised by persistent difficulty in learning mathematics, particularly in understanding numbers and performing arithmetic operations. Children with dyscalculia often struggle with number sense, mathematical reasoning, and problem-solving. These challenges may coexist with other difficulties, such as working memory or spatial reasoning issues.

However, the population of students who experience significant challenges in mathematics extends beyond those formally diagnosed with dyscalculia. Many students face mathematics difficulties (MD) without an official diagnosis, including those who score below certain proficiency thresholds on academic assessments or who struggle with maths despite not being identified with a specific learning disability. This broad group, often termed as students with MD, in the international literature, includes both those with individual education plans focusing on mathematics and those at risk of developing more severe maths difficulties due to persistent low performance.

Research on interventions to accelerate mathematics learning typically addresses this wider population. The studies include students with identified disabilities, such as dyscalculia, as well as those without a formal diagnosis but still require targeted support to improve their mathematical skills. By considering a broad definition of MD, the evidence in this section provides insights into effective mathematics teaching strategies for learners regardless of whether they have been formally identified with a specific learning disability.

The specific criteria for defining dyscalculia or severe mathematics difficulties vary across studies. For instance, some researchers select participants from the bottom 15% or 20% of math achievers within a cohort. We combine these studies in this subsection of the review. However, it is important to note that this subsection does not include meta-analyses focused solely on those within the very lowest end of the mathematics ability spectrum, such as students in the bottom 1% or 2%. Those studies primarily focus on individuals with complex learning needs, who are discussed in a separate section of this report.

### Description of meta-analyses and systematic reviews

Four systematic reviews and meta-analyses from 2020 to 2023 were identified and reviewed. Collectively, these systematic reviews and meta-analyses included

163 individual studies of mathematics intervention effectiveness, with publication years ranging from 1984 to 2020. Studies included in their analyses focused on interventions for differing populations of children experiencing mathematics difficulty, and comprised age ranges from primary to secondary years, and settings within the United States, as well as Australia, Canada, China, Germany, the Netherlands, Turkey, and the UK. The four key secondary analyses are briefly described below. References and study details are provided in Appendix C – Table 11.

**Dietrichson et al. (2020):** This systematic review, published in *Campbell Systematic Reviews*, examines targeted school-based interventions for improving mathematics for students with or at risk of academic difficulties in years 7–12. The review emphasises structured and explicit instruction, mathematical language, and the use of varied representations and timed practice.

**Fuchs et al. (2021):** This What Works Clearinghouse practice guide focuses on assisting students struggling with mathematics in the primary years. It provides evidence-based recommendations on systematic instruction, use of representations, and other strategies to enhance mathematical understanding and skills.

**Myers et al. (2023):** This meta-analysis, published in the *Journal of Research on Educational Effectiveness*, investigates mathematical interventions aimed at increasing word problem-solving performance among upper primary and secondary students with mathematics difficulties. It confirms the importance of systematic instruction, clear mathematical language, material representations, and timed activities.

**Powell et al. (2021):** This systematic review, published in *Learning Disabilities Research & Practice*, focuses on mathematics interventions for upper-primary students experiencing mathematics difficulty. It highlights the effectiveness of systematic instruction, vocabulary development, material and visual representations, and deliberate word problem instruction.

### Description of additional studies outside meta-analyses

Recent primary research studies published since 2020 have contributed to our understanding of mathematics intervention effectiveness. These studies provide contemporary insights into various instructional strategies and their impacts on student learning.

**Bouck et al. (2022):** This study examined the effectiveness of explicit instruction delivered online to struggling primary students during the COVID-19 pandemic. The findings indicated significant improvements in problem-solving accuracy and skill maintenance over time.

**Duhon et al. (2022):** This study explored the effects of varying doses of an explicit timing intervention on math fluency. The findings identified the minimum effective dose and the point of diminishing returns, providing valuable insights into the optimal intensity of interventions.

**Flores and Hinton (2022):** This research investigated the effects of the concrete-representational-abstract integrated sequence, which is similar to the concrete-pictorial-abstract framework, on students' number sense and understanding of addition. Significant improvements were observed in students' conceptual understanding and automaticity in addition.

**Powell et al. (2022):** This study evaluated the long-term effects of word-problem interventions incorporating algebraic reasoning for students with mathematics difficulties. The findings showed significant improvements in word-problem performance, with lasting effects observed when algebraic reasoning is included.

### Strength of evidence

The standard of evidence from these meta-analyses and systematic reviews of mathematics interventions is robust, with most studies considered to be at levels 3 and 4 of the NZ evidence scale. This indicates either promising trends or sufficient rigour to justify transfer to practical interventions. Additionally, recent primary research studies published since 2020 have contributed valuable contemporary insights into various instructional strategies, complementing and extending findings from the meta-analyses and systematic reviews.

While the current evidence base is substantial, there remains a need to further strengthen research on interventions for diverse student populations and long-term sustainability. These analyses show particularly strong evidence at level 4 for systematic and explicit instruction, the use of material and visual representations, and targeted practice for small groups.

In the context of sustainable accelerated learning, these interventions align with the goals of increasing the quality of learning while conserving resources, ensuring scalability and sustainability within a resource-limited model of funding. The evidence supports coordinated

approaches that maximise opportunities for children's learning and avoid overlapping services.

### Teaching implications from main research findings

Integrating the findings from both the secondary analyses and recent primary research studies, several effective teaching strategies for mathematics interventions can be identified. These strategies focus on promoting accelerated learning and supporting students who are experiencing difficulties in mathematics. Year level suitability of learning content is essential across all year levels, from primary to secondary, ensuring that students build a strong foundation and progressively advance their mathematical understanding.

#### Specific Teaching Strategies:

- Structured lessons with clear objectives, step-by-step instructions, and regular reviews are essential across all year levels, from primary to secondary, to help students progressively build a solid understanding of mathematical concepts. These practices are critical in ensuring that foundational skills are reinforced and extended as students advance through their education.
- Explicit instruction, which involves segmenting complex skills, modeling content, structured prompting techniques (e.g., least-to most prompting strategies), providing opportunities to respond with appropriate feedback, and creating purposeful practice opportunities, is highly effective across all year levels. This approach is particularly beneficial in primary education for establishing a strong foundation and in secondary education for achieving proficiency in complex mathematical concepts.
- Explicit mathematics instruction can be effectively delivered online, especially for students in upper primary and secondary levels. The flexibility of online platforms allows for personalised and targeted interventions that can support students struggling with specific mathematical areas. This approach is especially useful in situations where in-person instruction is not feasible, such as during periods of remote learning.
- The teaching of precise mathematical language, including clear definitions, is essential for all year levels. Encouraging the use of mathematical language in classroom discussions enhances students' ability to communicate mathematical ideas effectively. Effective interventions have utilised mathematical vocabulary support such

as vocabulary walls, cards, and graphic organisers. This approach is suitable across all year levels, with increasing complexity as students progress from primary to secondary.

- The concrete-pictorial-abstract (CPA) framework, which involves using physical objects followed by visual representations with the aim of transitioning to abstract concepts, is highly effective in helping students develop number sense and a solid understanding of mathematical concepts such as addition. Utilising physical objects like blocks, counters, and visual aids such as diagrams and charts enables students to visualise and understand abstract concepts, accelerating their learning. This approach is particularly beneficial in the primary years and continues to support understanding as students advance to more abstract mathematics in secondary years.
- Number lines are a powerful tool for facilitating the learning of various mathematical concepts and procedures, including whole numbers, fractions, and negative numbers. They help students develop a unified understanding of numbers and enhance their ability to visualise and solve problems. Number lines are especially effective in primary years for teaching basic concepts and continue to be useful in secondary years for more advanced topics, such as operations, magnitude, elapsed time, graphing coordinates, and data analysis.
- Providing deliberate instruction on solving word problems helps students apply mathematical concepts to real-world scenarios. Effective strategies involve teaching students to recognise and categorise problems based on their underlying structures and use real-world contexts and scenarios to make problems more relatable and understandable. Integrating algebraic reasoning further improves word-problem performance. These strategies are suitable for all year levels, with increasing complexity and context relevance as students advance, making them particularly beneficial in upper primary and secondary years.

**Structured lessons with clear objectives, step-by-step instructions, and regular reviews help students progressively build a solid understanding of mathematical concepts.**

- Using mnemonics to help students remember steps for solving problems can support accelerated learning. Examples include acronyms like SOLVE (Study, Organise, Line up, Verify, Examine) and DISC (Discover, Identify, Solve, Check). These mnemonics guide students through problem-solving processes and have been shown to improve mathematical problem-solving skills. These examples serve similar purposes as tools familiar to educators that help students structure their problem-solving processes, leading to more efficient learning and improved outcomes. Mnemonics are effective across all year levels, with increasing complexity as students progress.
- Graphic organisers are effective tools across various mathematical content areas, helping students visually organise their thoughts and strategies. Studies have shown that graphic organisers assist in problem-solving by helping students identify key information and apply learned strategies. Whether pre-prepared or student-generated, these tools enhance comprehension and facilitate the application of mathematical concepts, which supports accelerated learning by making complex information more accessible and manageable. Graphic organisers are suitable for all year levels, with applications becoming more sophisticated in secondary education as students tackle more complex concepts.
- Teaching aimed at developing fluency and automaticity is particularly effective when combined with timed activities lasting between 1 and 5 minutes. These activities should be introduced after students have had ample practice with a concept, rather than during the initial introduction of new material. Timed activities help build automatic retrieval of basic arithmetic facts, which in turn frees up cognitive resources for more complex problem-solving. This approach is particularly beneficial for students who struggle with self-confidence or have complex learning needs, as it allows them to experience success in manageable increments, reinforcing their sense of competence. The effectiveness of this strategy is especially pronounced in the primary years, where foundational skills are being developed.
- Timed activities that provide real-time feedback, set goals for improvement, and gradually increase item difficulty help ensure that the activities are engaging and supportive rather

than stressful. By offering immediate feedback and clearly defined goals, students can track their progress and feel a sense of accomplishment, which encourages perseverance. Adjusting the difficulty level incrementally ensures that students remain challenged without becoming overwhelmed, promoting sustained engagement and continuous learning. This structured approach to timing and feedback is crucial for maintaining student motivation and fostering growth, particularly in the primary years, where the development of foundational skills is critical.

### Intervention intensity

- Effective interventions require sufficient frequency and duration. Intensive sessions conducted multiple times a week are more effective than less frequent sessions. Longer instructional hours lead to better outcomes. Ensure interventions are sustained over an extended period to allow students to internalise and apply new skills.
- Tier 2 interventions (Small Group targeted instruction) using evidenced based explicit teaching strategies are effective. Ensuring flexible grouping to promote mixed-ability interactions and avoid static ability level groupings, fostering an accelerated learning environment. This method maximises opportunities for accelerated learning by allowing students to learn from each other and providing targeted support based on ongoing progress monitoring, ensuring efficient use of resources and supporting scalability within a resource-limited model.
- Incorporate peer-assisted learning strategies within or concurrent to small groups to enhance engagement and understanding is helpful This method is a natural complement to mixed-ability groups, promoting accelerated learning by enabling students to learn from each other and reinforcing their own understanding through teaching peers.

### Educator expertise

The success of interventions heavily relies on the expertise and training of the educators implementing them. Interventions led by researchers showed higher effectiveness, but well-trained teachers and collaborative approaches (e.g., involving multiple educators or support staff) are also effective.

**The success of interventions heavily relies on the expertise and training of the educators implementing them. Interventions led by researchers showed higher effectiveness, but well-trained teachers and collaborative approaches (e.g., involving multiple educators or support staff) are also effective.**

Ongoing professional learning and development to support educators is crucial to maintain the fidelity and effectiveness of interventions. Coaching of personnel has been shown to be particularly effective, when connected to the implementation of evidenced based specific mathematics programs.

### Monitoring and assessing student progress

Effective monitoring and assessment of student progress are vital for mathematics interventions aimed at accelerating learning (Dietrichson et al., 2020). Evidence-based monitoring activities include formative assessment tasks, such as brief quizzes, exit tickets, observational checklists, think-pair-share, student self-assessments, and peer assessments, which provide immediate feedback on student understanding and insights into students' developmental paths, thought processes, and misconceptions within mathematics (Supovitz, 2012; Wiliam, 2011). Formative assessments are part of an ongoing process where both teachers and students use evidence of learning to adapt teaching and learning to meet immediate needs (Andrade & Heritage, 2017; Black & Wiliam, 2018).

Accelerating student engagement with year-appropriate work is essential for achieving accelerated learning for students experiencing difficulty in mathematics. Key to this strategy is addressing unfinished learning just in time, rather than extensive remediation, which can inadvertently keep struggling students in a cycle of low-quality or below-year level work (TNTP, 2020). Curriculum-based measurement (CBM) provides an effective means to this end through frequent measures of student performance on tasks aligned with the curriculum, providing actionable data that educators can use to adjust instruction dynamically. CBM measures general outcomes rather than proficiency of isolated skills, allowing for continuous tracking of student growth and instructional effectiveness (Stecker, Fuchs,

& Fuchs, 2005). By integrating formative assessment tasks and CBM within a MTSS framework, educators can ensure that students consistently engage with year-level materials and tasks. This approach allows for the provision of necessary scaffolds to make the work accessible and effectively addresses critical learning gaps as they arise. This approach supports accelerated learning by allowing students to progress toward achieving year-level competencies.

### Emerging areas in mathematics education

In addition to the evidence-based practices highlighted in this report, there are emerging areas within mathematics education that deserve attention. Data analysis and probability, in particular, have become increasingly relevant in an era characterised by the proliferation of data and the need for data literacy. While the present review did not yield specific findings on interventions in these areas, due in part to their nascent status in educational research, they represent critical areas for future exploration and integration.

These topics were not prominently featured in our current analysis primarily because our literature search focused on established interventions and Tier 2 supports, where data analysis and probability have traditionally received less emphasis. However, their importance is undeniable as society increasingly relies on data-informed decision-making. As research in these areas develops, incorporating them into comprehensive mathematics education strategies will be vital to equipping students with the skills necessary to navigate and critically evaluate information in a complex world. This proactive stance aligns with the Ministry's goal of preparing students to meet the challenges of a rapidly evolving society.

### He Awa Whiria: Braiding Knowledge Streams

The Science of Learning suggests that cognition theory should inform teaching interventions for students learning mathematics. The recommendations formulated

**However, recent research exploring the relationship between motivational constructs—specifically confidence, interest, and value—and students' mathematics performance has concluded that confidence is the primary predictor of mathematics achievement, overshadowing interest and value (Michaelides et al., 2019).**

from the key findings related to cognitive processes from the systematic reviews and meta-analyses in the above section are consistent with this requirement. However, it is crucial to recognise the environmental and psychological factors that influence the effectiveness of these interventions, especially for students struggling with mathematics.

Students learn more effectively when new information builds on their existing knowledge, particularly in mathematics. Teachers should consider students' knowledge from their whānau, and cultural backgrounds. This cultural knowledge is often shared among multiple learners, making it a valuable foundation upon which teachers can build additional understanding (Hunter & Miller, 2022b; Trinick et al., 2017). Appreciating a child's background and key cultural knowledge can be beneficial for educators, since it provides a context for new information, making it more relatable and easier to understand.

Recent New Zealand-based literature suggests that utilising Māori and Pasifika cultural patterns in mathematics instruction can be effective for transitioning learners from material to pictorial to abstract representations of mathematical concepts (Hunter & Miller, 2022a; Trinick et al., 2017). Additionally, linking mathematics instruction to cultural artefacts may improve motivation to learn. **Pacific students value practical examples, peer collaboration, effort, and family support in mathematics learning** (Hill et al., 2019).

The association between motivation and mathematics achievement has long been the focus of study in mathematics education (Middleton & Spanias, 1999), and a substantial body of research in mathematics education focuses on designing rich, problem-solving tasks that build on learners' interests. However, recent research exploring the relationship between motivational constructs—specifically confidence, interest, and value—and students' mathematics performance has concluded that confidence is the primary predictor of mathematics achievement, overshadowing interest and value (Michaelides et al., 2019). Thus, the assumption that students must be inherently interested in mathematics to excel is not unequivocally supported by research.

Michaelides et al.'s (2019) recently published book, "Motivational Profiles in TIMSS Mathematics", unpacks the intricate relations between interest in mathematics, motivation to learn, and learning outcomes. The researchers found that students who prioritised value and interest in mathematics did worse than those who prioritised competence, which translated into justified confidence. These confident students performed better.

Psychological symptoms of competence include warranted self-efficacy, which refers to the justified confidence in one's ability to perform tasks effectively. This is one of the best predictors of mathematics achievement known to date (Skaalvik et al., 2015). Therefore, developing confidence in mathematics through competence building, while utilising cultural knowledge as a basis for knowledge development is a promising method to support primary school children who are struggling with mathematics. By fostering an environment that integrates cultural relevance and emphasises building competence, educators can enhance both motivation and achievement in mathematics.

### Section summary

The Multi-Tiered Systems of Support (MTSS) framework is a powerful approach for addressing the diverse needs of students struggling with mathematics. It offers a structured and adaptable system of interventions that increase in intensity based on individual student needs. Key strategies within this framework include systematic instruction, diverse representations, targeted problem-solving, fluency-building activities, and flexible support structures. These strategies are effective across all year levels and are particularly well-suited to the New Zealand context due to their emphasis on maximising learning outcomes while efficiently using resources.

### Core Instructional Strategies

**Explicit and Systematic Instruction:** Providing clear, structured lessons that build progressively on mathematical concepts is essential for establishing a strong foundation in mathematics for all students.

**Use of Mathematical Language:** Employing precise mathematical language in instruction, supported by tools such as vocabulary walls and graphic organisers, enhances students' ability to articulate and understand mathematical ideas.

**Representation of Concepts:** Utilising physical materials, visual aids, and number lines helps students bridge the gap between abstract concepts and practical understanding, with particular effectiveness in primary years.

### Enhancing Problem-Solving and Fluency

**Problem-Solving:** Instruction that emphasises word problems and integrates algebraic reasoning supports students in applying mathematics to real-world scenarios, fostering deeper comprehension and problem-solving skills.

**Fluency Development:** Timed activities and structured practice are crucial for building automaticity in basic arithmetic, which frees up cognitive resources for more complex problem-solving tasks.

### Supportive Structures

**Flexible Grouping:** Small group instruction, peer-assisted learning, and ongoing progress monitoring provide targeted support that adapts to students' evolving needs, promoting accelerated learning without rigid ability groupings.

**Intervention Intensity:** Regular, sustained sessions ensure that students receive the consistent support they need, with increased intensity for more advanced topics.

### Cultural Relevance and Educator Expertise

**Cultural Integration:** Incorporating Māori and Pacific cultural knowledge into mathematics instruction not only enhances student engagement but also ensures that learning is relevant and respectful of students' cultural backgrounds.

**Educator Training:** Ongoing professional development and collaborative approaches among educators are key to implementing these strategies effectively and making efficient use of resources.

By adopting these evidence-based strategies within the MTSS framework, and by integrating cultural relevance into instruction, New Zealand can provide an inclusive and effective mathematics education that supports all students, particularly those who face the greatest challenges.

**Incorporating Māori and Pacific cultural knowledge into mathematics instruction enhances engagement and effectiveness. Using culturally relevant teaching methods and linking instruction to cultural artefacts not only makes learning more relatable but also builds students' competence and confidence. This approach ensures that Māori and Pacific students receive education that respects and integrates their cultural backgrounds, thereby supporting their academic success (Hill et al., 2019).**

# Accelerating Mathematics Learning for Children with Complex Communication and/or Learning Needs (CCLN)

Access to comprehensive, high-quality mathematics education is critical for all children. For children with CCLN, mathematics education can influence access to more complex maths skills, which in turn can facilitate academic and employment outcomes as well as important independent living and financial skills (e.g., budgeting) (Bouck & Long, 2018; Liu et al., 2023). Learners with CCLN often face a range of challenges with their mathematics learning. Children with intellectual disability (ID), for example, may experience working memory limitations, and difficulty managing multi-step problems (Bouck & Long, 2018). Many children on the autism spectrum may experience success with mathematics in the earlier years but experience challenges when the content becomes more abstract and requires more advanced executive functioning (Barnett & Cleary, 2015). Language difficulties may also impact mathematics learning, particularly in areas such as problem solving (Barnett & Cleary, 2015). Furthermore, children with CCLN may have difficulty transferring computational skills to real world problems (Kearns et al., 2011). Historically, mathematics instruction for children with CCLN was largely focused on teaching a narrow range of basic mathematics skills (Bowman et al., 2019) and there was significant emphasis on functional or life skills teaching (Bouck & Long, 2018). In more recent years, this has started to broaden. This section reviews the evidence for effective interventions for children with CCLN to accelerate their mathematics skills in areas recommended for all learners.

## Description of meta-analyses or systematic reviews

Fifteen reviews (meta-analyses or systematic reviews) were identified that focused on mathematics instruction. Seven focused on individuals with ID, six on individuals on the autism spectrum, and one on both individuals with ID and individuals on the autism spectrum. One review focused on individuals with Down Syndrome. See Appendix C – Table 12 for study details.

**This section reviews the evidence for effective interventions for children with CCLN to accelerate their mathematics skills in areas recommended for all learners.**

## Strength of evidence

Nearly all of the studies included in the reviews employed single subject designs and these were of varying quality. Bouck & Long (2020) noted in their review that many of the studies (20 out of 26) were of high quality. In contrast, none of the nine studies in Lemons et al.'s (2015) review met quality standards. The following observations were made about the evidence available in this area:

- Nearly all studies were conducted in a secluded area outside of the classroom.
- Nearly all studies included learners who attended special school or self-contained classroom settings, with few examples of studies conducted in mainstream school settings.
- Very few studies utilised comprehensive curricular such as would be seen in mainstream education and group contexts (Gevarter et al., 2016).
- Interventions often included several strategies to support learning (often as part of a package), therefore it was not possible to measure the individual effects of each strategy (Root et al., 2021).
- Bowman et al. (2019) noted in their review that 67% of the studies including a focus on teaching for generalisation either across materials or settings. Generalisation across exemplars, however, was only evaluated in 17% of studies.

## Intervention Focus

- Interventions with learners with ID and learners on the autism spectrum have predominantly focused on early maths skills (e.g., one-to-one matching, number identification).

- Interventions with learners with ID have shifted from an almost exclusive focus on multiplication to a more varied focus on, for example, multiplication, division, addition, subtraction, fractions, algebra, and geometry. Most interventions still focus on number and operation, however, with data analysis/probability the most poorly represented area.
- Interventions have focused almost exclusively on computational or procedural mathematics versus word problems of problem solving. This is slowly shifting with an increased focus on problem solving.

### Specific Teaching Strategies

- Systematic instruction with prompting (e.g., least-to-most prompting) and feedback is effective for learners with cognitive disabilities. Other evidence-based strategies include task-analytic instruction (where a complex task is broken down into smaller steps) and in vivo instruction (where instruction is carried out in authentic contexts). The use of graphic organisers and manipulatives are promising practices.
- There is evidence that prompting is an evidence-based practice for supporting the maintenance of mathematics skills for learners with ID.
- Systematic instruction, explicit instruction, technology-assisted instruction, and the use of graphic organisers and manipulatives are evidence-based practices for learners with moderate to severe ID.
- A number of studies with students with ID used “instructional methods and approaches that sought to make the concepts and operations less abstract and more relevant to students’ daily lives” (Bowman et al., 2019, p. 200). This included the use of material representations (e.g., manipulatives, graphic organisers).
- There is adequate to strong levels of evidence for combining behavioural strategies such as prompting, reinforcement, modelling, and error correction with skill-specific manipulatives (e.g., base-ten blocks), touch points, and mathematics strategy instruction (e.g., counting on) for learners on the autism spectrum. Touch point instruction involves teaching students the dot positions of numbers 1–9 and having students count the dots aloud as they solve the problems.
- Similar practices are identified as evidence-based for teaching mathematical word problem solving to learners on the autism spectrum including: task analysis, least-to-most prompting, graphic organisers, explicit instruction, schema based instruction, and technology-aided instruction.
- Other emerging strategies noted by Bowman et al. (2019) for students with ID include:
  - The concrete-representational-abstract (CRA) approach which gradually fades concrete representations in lieu of more abstract symbolic representations;
  - The use of real world problems in the form of maths stories,
  - Anchored instruction where mathematics is integrated within relevant contexts,
  - Modified schema-based instruction (MSBI) which embeds systematic instruction, a math story, material representations, task analysis to support self-monitoring, and scripted think-alouds to identify the problem type, and
  - Use of technology.
- MSBI has been identified as a promising intervention for teaching students (mainly primary school) with moderate and severe disabilities to solve word problems. A review of 12 studies (11 meeting quality standards) showed strong intervention effects. The researchers determined that MSBI could not currently be identified as an evidence-based practice yet, however, because the studies conducted thus far have all been completed by two overlapping research teams.
- Touch-points (described above) may be a more effective visual representation than number lines for teaching single-digit mathematics problems to autistic learners.
- Virtual manipulatives are an evidence-based practice for secondary students with ID.
- Video-based interventions (e.g., point-of-view video modelling) can be used to successfully teach mathematics to learners on the autism spectrum.
- Tablet-based interventions have a large effect on mathematics learning for learners on the autism spectrum and/or learners with ID.

- There is significant heterogeneity in academic achievement for children on the autism spectrum and the effectiveness of interventions should be evaluated through “data-driven decision-making” at the student level (Hughes & Yakubova, p. 155).
- Learners with language needs may benefit from pre-teaching of content (e.g., vocabulary) and a reduction in the language complexity in the word problems using a structured format.

### **Intervention Intensity**

High cumulative intensity (at least 2 sessions per week) appears to be an important characteristic of effective interventions for primary school aged learners with ID.

Repeated practice is also noted as important for learners on the autism spectrum.

### **Educator Implementing Intervention**

Moderator analyses relating to tablet based interventions for learners on the autism spectrum and/or learners with ID revealed no effect for type of interventionist – researchers, teachers, teaching assistants.

### **He Awa Whiria**

As noted in the Phonological Awareness, Phonics, Decoding and Word Reading section, researchers discussing instruction more broadly for learners with

significant disabilities have highlighted the importance of culturally responsive planning, instruction, and reflection (see Rivera et al., 2020).

Gevarter et al. (2016) noted that very few studies have explored mathematics engagement for learners on the autism spectrum.

### **Section summary**

The evidence from systematic literacy reviews and meta-analyses focused on interventions to accelerate mathematics skills in children with CCLN shows positive shifts towards a focus on a broader range of mathematics skills including word problems and problem solving. The evidence suggests that explicit and systematic instruction combined with appropriate scaffolding and skill-specific manipulatives, graphic supports, and/or technology can have a positive impact on children’s mathematics learning. Continued research is important to examine the effectiveness of specific teaching strategies for children with CCLN including how best to facilitate transfer of taught skills across exemplars and into the context of daily living and real world problem solving. It is also critical to consider these children’s engagement in mathematics learning, and any environmental and psychological factors that might be influencing their success. Furthermore, additional research is needed around effective mathematics instruction in mainstream education settings.

**Systematic instruction with prompting (e.g., least-to-most prompting) and feedback is effective for learners with cognitive disabilities.**

# Discussion

**This report synthesises and describes empirical evidence aligned with the “science of learning” to identify teaching practices and interventions that accelerate students’ learning in oral language, reading, writing, and mathematics. Utilising a rapid review methodology, a detailed analysis of findings from recent meta-analyses, along with other relevant individual studies both internationally and in New Zealand, was undertaken.**

The report authors primarily focused on studies that provided the strongest level of evidence to guide teaching practices and policies. Analysis focused on identifying specific teaching practices and or intervention conditions that may facilitate accelerative learning. The report authors sought out study details such as the specific types of teaching strategies used, models of intervention implementation, the group size of learners receiving the intervention, the intervention intensity, educator characteristics, as well as understanding the characteristics of learners who benefited from the interventions.

The report content focused on describing the key teaching implications from the research findings. Details related to specific intervention, characteristics of study participants, statistical analyses, effect sizes from interventions implemented and main findings from meta analyses are reported in the tables in the appendices.

## Collective findings

Collectively the research evidence highlighted the efficacy of targeted interventions that involve explicit and structured teaching approaches implemented by skilled practitioners. Quality professional learning and development for educators implementing the intervention alongside access

to quality teaching resources and support during implementation phase are essential to effective interventions.

Analyses revealed more robust evidence for the short-term gains of targeted interventions in oral language, reading, writing and mathematics. Long-term effects, while generally positive, show variability. The need for continued research and refinement of intervention strategies is highlighted in study findings. For example, more research on the longitudinal impact of oral language interventions would help to identify when intervention effects can generalise to a range of language skills over time and where effects may be contained to those skills taught explicitly in the intervention.

The consistent finding that explicit and structured teaching approaches are characteristic of effective interventions across teaching domain areas of oral language, reading, writing, and mathematics warrants further discussion. Specific teacher-directed strategies included modelling, prompting, scaffolding techniques’ and immediate quality feedback to guide learner’s attempts towards independent application of the target skill. Targeting specific learning skills in an organised and planned sequence were a feature of accelerated learning interventions. Structured lesson plans sequenced to build on previously taught skills in deliberate ways were typical in effective interventions.

Positive effects from relatively short-term interventions that included explicit and structured teaching approaches have been found in all areas. The interventions need to be relatively intensive (e.g. 4 or 5 times weekly for around 30 minute teaching sessions) and were timetabled over several weeks (such as eight to eleven weeks).

A key aspect for structured teaching approaches within inclusive frameworks such as MTSS and the New Zealand Ministry of Education's Te Tūāpapa framework is the careful monitoring of children's progress in response to teaching. Teachers' implementation of valid and reliable monitoring assessments is critical to the early identification of learners who required more targeted (Tier 2) or tailored (Tier 3) teaching supports. Teachers' use of reliable monitoring assessments will also support the necessary adaptations to teaching strategies to support learners with more severe or complex learning needs,

The development of good monitoring procedures appropriate for use in New Zealand, along with the evidence-based practices discussed in this review, will provide the basis for early support.

Integrating digital technologies in monitoring assessments can improve the fidelity of implementation and reduce teacher workload, allowing teachers to focus more on needs-based analysis and monitoring of student learning. Technology-guided data-informed decision-making has shown positive effects on student outcomes and can support teachers in identifying learning needs and tailoring interventions. Teacher professional learning and development is needed to ensure the effective use of such monitoring assessments that are based on the outcome goals of the New Zealand curriculum.

There is a need for more research to examine the effectiveness of specific teaching strategies for children with more complex needs, including how best to facilitate transfer of taught skills across situations and into daily living. Much of the research in accelerating these children's literacy and mathematics skills focuses on single cases, and there is variable quality in some of the research. Despite

this, systematic and explicit teaching of skills is emphasised, along with prompting and feedback. Intensity of support, and training of educators also show consistency with many of the conclusions derived from larger sample studies. Therefore, good support procedures can be based on the evidence provided in this review, but further research specific to the context of New Zealand schools would also be worthwhile.

## Topic area specific findings

A summary of main findings in each domain investigated follows:

**Oral Language:** Findings from meta-analyses in oral language interventions have shown a positive moderate effect on accelerating children's language development in children with lower levels of oral language skills, children with speech and language disorders, and children with more complex language learning needs. Smaller but positive effects at follow-up are evident for some interventions.

Effective oral language interventions include comprehensive, multi-component strategies that integrate phoneme awareness, vocabulary, and oral narrative skills. Explicit and structured teaching approaches in vocabulary instruction that include intensive use of a variety of vocabulary teaching strategies have proven more effective than implicit oral language teaching. Digital technologies, while varied in effectiveness, hold potential for enhancing specific aspects of oral language development, such as phonological and vocabulary skills.

Researchers who have undertaken meta-analyses related to oral language interventions often identify limitations with the available research evidence. They highlight the need for continued robust intervention trials in this area. However, some common characteristics are associated with effective interventions. These include the involvement of speech-language therapists in supporting teachers to implement evidenced based strategies, as well as successful outcomes from class teachers or teaching assistants implementing the oral language teaching strategies (following quality professional learning and development).

The intensity and duration of effective interventions varies depending on the severity of learners' oral language difficulties and how these challenges impacted their learning. Relatively short-term (8 – 11 weeks) targeted interventions, have proven successful for many learners with less severe/ complex needs.

In general the strategies that support accelerated oral language learning in monolingual children are effective for children from culturally and linguistically diverse backgrounds. However, greater attention to cultural background knowledge, and an increased emphasis on vocabulary and comprehension skills is important for these learners across the school-year levels.

**Reading and Writing:** Effective reading and writing interventions combine explicit instruction in phonics, phonemic awareness, and decoding with strategies to develop vocabulary and comprehension. These approaches are particularly effective in the early school years and should adapt to include more meaning-focused skills as the student progresses through primary school and into secondary school.

Children struggling with word decoding show large benefits for their word reading skills from structured early intervention. Benefits for reading comprehension in older children (late primary and secondary years) are typically smaller. However, evidence of improved reading comprehension achievement has been clearly identified given a focus on developing comprehension strategies in addition to improving word decoding skills.

Structured and systematic teaching, along with professional learning and development for teachers, and the use of high-quality resources, are crucial for all years. The Better Start Literacy Approach (BSLA) is a notable example of an effective early literacy teaching approach developed specifically for the New Zealand education context. Evidence from controlled research trials has demonstrated its effectiveness in accelerating early reading and spelling outcomes for 5 and 6 year old learners.

**Mathematics:** The findings underscore the efficacy of explicit and systematic instruction, the use of material and visual representations, and problem-solving strategies. Curriculum-based measurement and formative assessments are critical for monitoring student progress and informing instruction. These tools enable teachers to provide targeted support and adjust teaching strategies to meet students' evolving needs. Small group instruction, peer-assisted learning, and regular progress monitoring are effective in promoting accelerated learning and avoiding static ability groupings. Again, many of the key features of successful accelerated learning identified in language and literacy areas are the basis of successful mathematics acquisition and intervention. The development of tools/resources specific for New Zealand are recommended as these too will support engagement and implementation.

### **Culturally Responsive Practices:**

Increasing culturally responsive practices and engagement with whānau is essential for supporting students who identify as Māori and/ or Pacific Peoples ethnicities. Research underscores the importance of integrating cultural knowledge and perspectives into teaching to enhance learning outcomes and ensure equity. Building on learners' background knowledges is a key aspect within a science of learning approach and is consistent with the braiding of differing knowledge streams with the He Awa Whiria or Braided Rivers Approach. Considering the research evidence for accelerating children's cognitive skills within the context of effective teaching strategies to motivate and engage students in culturally relevant ways is important.

Although there are few examples of investigations into the benefits of culturally responsive practices on accelerating learning in oral language, reading, writing and mathematics, other recent studies in New Zealand shed light on facilitators of success for learners who identify as Māori or Pacific Peoples ethnicities. Alansari et al. (2022) provided evidence from four qualitative studies as to aspects that facilitate learning for Māori and Pacific Peoples learners.

**These aspects included:** supporting students to have strong and positive motivational beliefs about learning, participating in learning experiences that are culturally enhancing, having strong and positive networks of support, the development of positive and respectful home–school partnerships and strengths based teaching approaches that are both aspirational and contextually unique to the needs of Māori and Pacific Peoples learners.

Consideration of these facilitators of success alongside specific evidenced based teaching strategies in oral language, reading, writing and mathematics should support learning for Māori and Pacific Peoples. Evidence highlighting the accelerated learning for Māori and Pacific Peoples within the Better Start Literacy Approach (Gillon et al. 2023; 2024) suggest these elements to early literacy approaches are successful. Further evidence from the second study with in the Massey Early Literacy Project (MoE report) also highlight the potential benefits of quality teacher professional learning and development in evidenced based early reading instruction for Māori and Pacific Peoples learners.

### Continued research

Continued research that leads to the generation of high-quality evidence, including randomised controlled trials, is necessary to inform and refine educational practices. Future research that provides evidence as to facilitators of accelerated learning

within the context of the refreshed New Zealand Curriculum will be important. Such evidence will provide opportunities for further enhancement of effective teaching practices that are culturally appropriate for our New Zealand cultural context.

There is also a need for more research to examine the effectiveness of specific teaching strategies for children with more complex needs, including how best to facilitate transfer of taught skills across situations and into daily living.

### Conclusion

This synthesis of empirical evidence highlights the effectiveness of explicit, systematic instruction and targeted small group interventions in enhancing oral language, reading, writing, and mathematics skills. Professional learning and development for educators is crucial for implementing these interventions successfully. Additionally, integrating technology and culturally responsive teaching practices shows promise in further accelerating learning outcomes. Across all areas, the importance of well-structured, evidence-based teaching approaches is emphasised, along with the continuous monitoring of student progress to adapt and optimise interventions teaching supports effectively. These findings underscore the need for comprehensive, research-informed strategies to raise education achievement within the context of our New Zealand curriculum and our unique New Zealand cultural context.

# References

- Aaron, P. G., Joshi, R. M., Gooden, R., & Bentum, K. E. (2008). Diagnosis and treatment of reading disabilities based on the component model of reading: An alternative to the discrepancy model of LD. *Journal of Learning disabilities*, 41(1), 67-84.
- Ahmed, Y., Miciak, J., Taylor, W. P., & Francis, D. J. (2021). Structure Altering Effects of a Multicomponent Reading Intervention: An Application of the Direct and Inferential Mediation (DIME) Model of Reading Comprehension in Upper Elementary Grades. *Journal of Educational Psychology*, 113(5), 1003-1021.
- Al Otaiba, S., McMaster, K., Wanzek, J., & Zaru, M. W. (2022). What we know and need to know about literacy interventions for elementary students with reading difficulties and disabilities, including dyslexia. *Reading Research Quarterly*, 57(S1), S5-S24.
- Alansari, M., Webber, M., Overbye, S., Tuifagalele, R., & Edge, K. (2022). Conceptualising Māori and Pasifika Aspirations and Striving for Success (COMPASS). New Zealand Council for Educational Research.
- Alharbi, H., Terlektsi, E., & Kossyvaki, L. (2023). Dialogic Reading Effect on Communicative Initiations and Responses for Children with Autism: a Systematic Review. *Early Childhood Education Journal*. <https://doi.org/10.1007/s10643-023-01400-1>
- Alton-Lee, A. (2011). (Using) evidence for educational improvement. *Cambridge Journal of Education*, 41(3), 303-329.
- Aldemir, H., Solís-Campos, A., Saldaña, D., Rodríguez-Ortiz, I. R., & Camarata, S. M. (2023). A Systematic Review and Meta-Analysis of Vocabulary Interventions for Deaf/Hard of Hearing Children and Adolescents. *Journal of Speech, Language, and Hearing Research*, 66(1), 1-25.
- Algozzine, B., Mccollin, M., O'shea, D. J., & Mcquiston, K. (2009). Improving Vocabulary and Comprehension Skills of Secondary-Level Students from Diverse Backgrounds.
- Andrade, H. L., & Heritage, M. (2017). Using formative assessment to enhance learning, achievement, and academic self-regulation. Routledge.
- Arrow, A. W., & McLachlan, C. J. (2014). The development of phonological awareness and letter knowledge in young New Zealand children. *Speech, Language and Hearing*, 17(1), 49-57.
- Artzi, L., Hsin, L. B., Sanford, A. K., Esparza Brown, J., & Guin, S. (2022). Meeting the Language Needs of Emergent Multilingual Students at Risk for Learning Disabilities through Multitiered Systems of Support. American Institutes for Research.
- Aukuso, S. (2021). Nofailo i leo Samoa - Samoan phonological awareness : a study of Samoan early literacy development and implications for effective teaching strategies. Doctoral Thesis, University of Canterbury. <https://ir.canterbury.ac.nz/items/3549bad5-54bc-497b-a176-75f744d39917>
- Bailey, B., & Arciuli, J. (2020). Reading Instruction for Children with Autism Spectrum Disorders: A Systematic Review and Quality Analysis. *Review of Educational Research*, 90(1), 82-124.
- Barnett, J. E. H., & Cleary, S. (2015). Review of evidence-based mathematics interventions for students with autism spectrum disorders. *Education and training in autism and developmental disabilities*, 172-185.
- Barone, C., Fougère, D., & Martel, K. (2021). Fostering shared book reading in early childhood: A randomized controlled trial. IZA Discussion Paper No. 13458.
- Baye, A., Inns, A., Lake, C., & Slavin, R. E. (2019). A synthesis of quantitative research on reading programs for secondary students. *Reading Research Quarterly*, 54(2), 133-166. <https://doi.org/10.1002/rrq.229>
- Baye, A., & Slavin, R. E. (2018). A synthesis of quantitative research on reading programs for secondary students. *Reading Research Quarterly*, 53(4), 409-435.
- Beck, I. L., & McKeown, M. G. (2007). Increasing young low-income children's oral vocabulary repertoires through rich and focused instruction. *The Elementary School Journal*, 107(3), 251-271.
- Benassi, V., Overson, C. E., Hakala, C., Ambrose, S. A., Lovett, M., Clark, C. M., ... & Taatjes, A. (2014). Applying science of learning in education: Infusing psychological science into the curriculum. Washington, DC: Society for the Teaching of Psychology.
- Berninger, V. W. (2009). Highlights of programmatic, interdisciplinary research on writing. *Learning Disabilities Research & Practice*, 24(2), 69-80.
- Black, P., & Wiliam, D. (2018). Classroom assessment and pedagogy. *Assessment in education: Principles, policy & practice*, 25(6), 551-575.
- Bosma, E., Bakker, A., Zenger, L., & Blom, E. (2022). Supporting the development of the bilingual lexicon through translanguaging: a realist review integrating psycholinguistics with educational sciences.
- Bosma, E., Bakker, A., Zenger, L., & Blom, E. (2023). Supporting the Development of the Bilingual Lexicon through Translanguaging: A Realist Review Integrating Psycholinguistics with Educational Sciences. *European Journal of Psychology of Education*, 38(1), 225-247. <https://doi.org/10.1007/s10212-021-00586-6>
- Bouck, E. C., & Long, H. (2022). Academic Mathematics Instruction and Intervention for Students with Mild Intellectual Disability: An Updated Review. *Exceptional Children*, 88(2), 151-170.
- Bouck, E. C., Long, H., & Jakubow, L. (2022). Teaching struggling students mathematics online via explicit instruction, Preventing School Failure: Alternative Education for Children and Youth, 66(2), 126-135. <https://doi.org/10.1080/1045988X.2021.1980852>
- Bouck, E. C., & Park, J. (2018). Exploring post-school outcomes across time out of school for students with autism spectrum disorder. *Education and Training in Autism and Developmental Disabilities*, 53(3), 253-263.
- Bowman, J. A., McDonnell, J., Ryan, J. H., Fudge-Coleman, O., & Ayres, K. M. (2019). Effective mathematics instruction for students with moderate and severe disabilities: A review of the literature. *Intellectual and Developmental Disabilities*, 57(3), 183-196.
- Bowyer-Crane, C., Snowling, M. J., Duff, F. J., Fieldsend, E., Carroll, J. M., Miles, J., ... & Hulme, C. (2008). Improving early language and literacy skills: Differential effects

- of an oral language versus a phonology with reading intervention. *Journal of Child Psychology and Psychiatry*, 49(4), 422–432.
- Boyle, S. A., McNaughton, D., & Chapin, S. E. (2019). Effects of Shared Reading on the Early Language and Literacy Skills of Children With Autism Spectrum Disorders: A Systematic Review. *Research and Practice for Persons with Severe Disabilities*, 39, 30–46.
- Bratlie, S. S., Brinchmann, E. I., Melby-Lervåg, M., Von, J., & Torkildsen, K. (2022). Morphology-A Gateway to Advanced Language: Meta-Analysis of Morphological Knowledge in Language-Minority Children. *Review of Educational Research*, 92(1), 3–46.
- Bray, L., Skubik-Peplaski, C., Faota, L., & Ackerman, K. B. (2021). A Systematic Review of the Effectiveness of Interventions to Improve Handwriting and Spelling in Children with Specific Learning Disabilities.
- Bryant, D. P., Bryant, B. R., Gersten, R. M., Scammacca, N. N., Funk, C., Winter, A., ... & Pool, C. (2008). The effects of tier 2 intervention on the mathematics performance of first-grade students who are at risk for mathematics difficulties. *Learning Disability Quarterly*, 31(2), 47–63.
- Buckingham, J. (2020). Systematic phonics instruction belongs in evidence-based reading programs: A response to Bowers. *The Educational and Developmental Psychologist*, 37(2), 105–113.
- Burke, D., Cooper, E., & Werfel, K. L. (2023). The Utility of the Dynamic Indicators of Basic Early Literacy Skills as a Literacy Screener for Children Who Are Deaf or Hard of Hearing. *Perspectives of the ASHA Special Interest Groups*, 8(5), 1011–1018.
- Burgoyne, K., & Cain, K. (2022). The effect of prompts on the shared reading interactions of parents and children with Down syndrome. *International Journal of Disability, Development and Education*, 69(4), 1327–1341.
- Butvilofsky, S. A., Escamilla, K., Gumina, D., & Silva Diaz, E. (2021). Beyond monolingual reading assessments for emerging bilingual learners: Expanding the understanding of biliteracy assessment through writing. *Reading Research Quarterly*, 56(1), 53–70.
- Buzhardt, J., Greenwood, C. R., Jia, F., Walker, D., Schneider, N., Larson, A. L., ... & McConnell, S. R. (2020). Technology to guide data-driven intervention decisions: Effects on language growth of young children at risk for language delay. *Exceptional children*, 87(1), 74–91.
- Calotă, R., & Paduraru, M. (2021). Using technology to assess SEN students' phonological skills. *eLearning & Software for Education*, 1.
- Cameron, T. A., Carroll, J. L., & Schaughency, E. (2022). Concurrent validity of the Preschool Early Literacy Indicators with a New Zealand sample of 5-year-olds entering primary school. *International Journal of School & Educational Psychology*, 10(2), 208–219.
- Cameron, T. A., Taumoepeau, M., Clarke, K., McDowall, P., & Schaughency, E. (2020). Describing patterns of early literacy skill development in the first year of school and reading instruction in a New Zealand sample. *School Psychology*, 35(4), 243.
- Carretti, B., Lara-Diaz, M. F., Grigorenko, E., Fan, S., Ma, B., Song, X., & Wang, Y. (2022). Effect of language therapy alone for developmental language disorder in children: A meta-analysis. *Frontiers in Psychology*, 13, 922866.
- Catts, H. W., Fey, M. E., Tomblin, J. B., & Zhang, X. (2002). A longitudinal investigation of reading outcomes in children with language impairments. *Journal of Speech, Language, and Hearing Research*, 45, 1142–1157.
- Cavazos, L. O., & Ortiz, A. A. (2020). Incorporating oral language assessment into MTSS/RTI frameworks: The potential of personal narrative assessment. *Bilingual Research Journal*, 43(3), 323–344.
- Cervetti, G. N. (2016). A systematic review of the research on vocabulary instruction that impacts text comprehension. *Reading Research Quarterly*, 51(4), 399–416.
- Cervetti, G. N., Fitzgerald, M. S., Hiebert, E. H., & Hebert, M. (2023). Meta-Analysis Examining the Impact of Vocabulary Instruction on Vocabulary Knowledge and Skill.
- Chapman, J., Arrow, A., Braid, Greaney, and Tunmer, W. (2017). Massey University Early Literacy Project 2015–2017. Unpublished report.
- Cheesman, E., & De Pry, R. (2010). A critical review of culturally responsive literacy instruction. *Journal of Praxis in Multicultural Education*, 5(1), 10.
- Cheung, A. C., & Slavin, R. E. (2012). Effective reading programs for Spanish-dominant English language learners (ELLs) in the elementary grades: A synthesis of research. *Review of Educational Research*, 82(4), 351–395.
- 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), 120–143.
- Cirrin, F. M., & Gillam, R. B. (2008). Language intervention practices for school-age children with spoken language disorders: A systematic review. *Language, Speech, and Hearing Services in Schools*, 39, S110–S137.
- Clarke, B., Doabler, C. T., Nelson, N. J., & Shanley, C. (2015). Effective instructional strategies for kindergarten and first-grade students at risk in mathematics. *Teaching Exceptional Children*, 47(5), 259–268.
- Clarke, B., Doabler, C. T., Strand, M., Kosty, D., Baker, S., Fien, H., & Smolkowski, K. (2014). Preliminary Evaluation of a Tier 2 Mathematics Intervention for First-Grade Students: Using a Theory of Change to Guide Formative Evaluation Activities. *School Psychology Review*, 43(2).
- Clarke, P.J., Truelove, E., Hulme, C., & Snowling, M.J. (2014). Developing reading comprehension. Chichester: Wiley.
- Clausen, A. M., Tapp, M. C., Pennington, R. C., Spooner, F., & Teasdale, A. (2021). A Systematic Review of Modified Schema-Based Instruction for Teaching Students with Moderate and Severe Disabilities to Solve Mathematical Word Problems. *Research and Practice for Persons with Severe Disabilities*, 46(2), 101–119.
- Clendon, S.A., & Erickson, K.A. (2009). Literacy instruction for individuals with complex communication needs. *Acquiring Knowledge in Speech, Language and Hearing*, 11(2), 77–80.
- Clendon, S., & Erickson, K., (2023). Supporting Language and Literacy Learning for Children Who use AAC. In M.M. Smith (Ed). *Clinical Cases in Augmentative and Alternative Communication* (pp. 62–75). Routledge.
- Clendon, S., & Gillon, G. (2017). Phonological awareness of children with complex communication needs. In *Phonological awareness: From research to practice* (pp. 212–225). Guilford.
- Clendon S., Paynter, J., Walker, S., Bowen, R., Westerveld, M.F. (2021). Emergent Literacy Assessment in Children With Autism Spectrum Disorder Who Have Limited Verbal Communication Skills: A Tutorial. *Language, Speech and Hearing Services in Schools*, 52(1): 165–180.
- Cockerill, M., Thurston, A., & Taylor, A. (2015). *International Journal of Educational Research*.

- Conner, C., Allor, J.H., Stewart, J., Kearns, D.M., Gillespie Rouse, A. (2023). A Synthesis of Reading Comprehension Interventions and Measures for Students with Autism Spectrum Disorder and Intensive Support Needs. *Review Journal of Autism and Developmental Disorders*, 10: 712-728.
- Cram, F., Vette, M., Wilson M., Vaithianathan, R., Maloney, T., & Baird, S. (2018). He awa whiria—braided rivers: Understanding the outcomes from Family Start for Māori. New Zealand Council for Educational Research. <https://doi.org/https://doi.org/10.18296/em.0033>
- Cruz, R. A., Manchanda, S., Firestone, A. R., & Rodl, J. E. (2020). An examination of teachers' culturally responsive teaching self-efficacy. *Teacher Education and Special Education*, 43(3), 197-214.
- Cunningham, A. E., & Stanovich, K. E. (1997). Early reading acquisition and its relation to reading experience and ability 10 years later. *Developmental psychology*, 33(6), 934.
- Darling-Hammond, L., Flook, L., Schachner, A., & Wojcikiewicz, S. (2022). Educator Learning to Enact the Science of Learning and Development. Learning Policy Institute.
- Datchuk, S. M., Rodgers, D. B., Wagner, K., Hier, B. O., & Moore, C. T. (2021). Effects of writing interventions on the level and trend of total words written: A meta-analysis. *Exceptional Children*, 87(4), 424-444.
- Denston, A., Martin, R., Gillon, G., & Everatt, J. (2024). A better start to literacy for bilingual children in New Zealand: findings from an exploratory case study in te reo Māori and English. *International Journal of Bilingual Education and Bilingualism*, 1-14.
- Dessementet, R., Martinet, C., De Chambrier, A.-F., Martini-Willemin, B.-M., & Audrin, C. (2019). The effectiveness of phonics instruction for students with intellectual disability: A systematic review and meta-analysis. *Educational Research Review*, 29, 21-39.
- Dessementet, R., Geyer, M., Linder, A.-L., Atzemian, M., Martinet, C., Meuli, N., Audrin, C., De Chambrier, A.-F., McDuffie, A., Banasik, A., Bullard, L., Nelson, S., Feigles, R. T., & Hagerman. (2024). Effects of shared text reading for students with intellectual disability: A meta-analytical review of instructional strategies. *Education Research Review* (44): 100615
- Dietrichson J., Filges T., Klokker R. H., Viinholt B. C. A., Bøg, M., Jensen, U. H. (2020). Targeted school-based interventions for improving reading and mathematics for students with, or at risk of, academic difficulties in Grades 7–12: A systematic review. *Campbell Systematic Reviews*, 16(2), 1081. <https://doi.org/10.1002/cl2.1081>
- Dietrichson, J., Filges, T., Klokker, R. H., Viinholt, B. C. A., Bøg, M., & Jensen, U. H. (2021). Targeted school-based interventions for improving reading and mathematics for students with, or at risk of, academic difficulties in Grades 7–12: A systematic review. *Campbell Systematic Reviews*, 17(1), e1122.
- Dilgard, C., Hodges, T. S., & Coleman, J. (2022). Phonics Instruction in Early Literacy: Examining Professional Learning, Instructional Resources, and Intervention Intensity. *Reading Psychology*, 43(8), 541–575. <https://doi.org/10.1080/02702711.2022.2126045>
- Doabler, C. T., Baker, S. K., Kosty, D. B., Smolkowski, K., Clarke, B., & Fien, H. (2015). Examining the association between explicit mathematics instruction and student mathematics achievement. *The Elementary School Journal*, 115(3), 303–333.
- Dobinson, K. L., & Dockrell, J. E. (2021). Universal strategies for the improvement of expressive language skills in the primary classroom: A systematic review. *Language, Speech, and Hearing Services in Schools*, 52(1), 1–19.
- Dockrell, J. E., Law, J., Mathers, S., Forrest, C., Charlton, J., Dobinson, K., & Hewitt, L. (2023). Empowering staff to enhance oral language in the early years: Cluster randomised trial FINAL REPORT May 2023.
- Donolato, E., Toffalini, E., Rogde, K., Nordahl-Hansen, A., Lervåg, A., Norbury, C., & Melby-Lervåg, M. (2022). Oral language interventions can improve language outcomes in children with neurodevelopmental disorders: A systematic review and meta-analysis. *Disability and Rehabilitation*, 1–15.
- Dowdall, N., Melendez-Torres, G. J., Murray, L., Gardner, F., Hartford, L., & Cooper, P. J. (2019). Shared Picture Book Reading Interventions for Child Language Development: A Systematic Review and Meta-Analysis. *Child Development*, 90(1), e77–e103.
- Drosos, K., Voniati, L., Christopoulou, M., Kosma, E. I., Chronopoulos, S. K., Tafiadis, D., ... & Ziavra, N. (2021, October). Information and Communication Technologies in Speech and Language Therapy towards enhancing phonological performance. In 2021 5th International Symposium on Multidisciplinary Studies and Innovative Technologies (ISMSIT) (pp. 187-192). IEEE.
- Duff, F. J., Hulme, C., Grainger, K., Hardwick, S. J., Miles, J. N. V., & Snowling, M. J. (2014). Reading and language intervention for children at risk of dyslexia: a randomised controlled trial. *Journal of Child Psychology and Psychiatry*, 55(11), 1234–1243.
- Duhon, G. J., Poncy, B. C., Krawiec, C. F., Davis, R. E., Ellis-Hervey, N., & Skinner, C. H. (2022). Toward a more comprehensive evaluation of interventions: A dose-response curve analysis of an explicit timing intervention. *School Psychology Review*, 51(1), 84-94. <https://doi.org/10.1080/2372966X.2020.1789435>
- Dukes, C., Ming, K. M., Finnegan, L. A., & Miller, K. M. (2023). Culturally responsive literacy instruction: How is it reflected in the literature?. *Multicultural Learning and Teaching*, 18(1), 7-31.
- Dyson, N., Jordan, N. C., Beliakoff, A., & Hassinger-Das, B. (2015). A Kindergarten Number-Sense Intervention With Contrasting Practice Conditions for Low-Achieving Children. *Journal of Educational Psychology*, 107(1), 71–88.
- Ebbels, S. H., Nicoll, H., Clark, B., Eachus, B., Gallagher, A. L., Horniman, K., Jennings, M., Mcevoy, K., Nimmo, L., Turner, G., & Montgomery, K. (2012). Effectiveness of semantic therapy for word-finding difficulties in pupils with persistent language impairments: a randomized control trial. *Child Language Teaching and Therapy*, 28(2), 165–182.
- Elleman, A. M., Lindo, E. J., Morphy, P., & Compton, D. L. (2009). The impact of vocabulary instruction on passage-level comprehension of school-age children: A meta-analysis. *Journal of Research on Educational Effectiveness*, 2(1), 1–44.
- Everatt, J. & Denston, A. (2020). *Dyslexia: theories, assessment and support*. Abingdon: Routledge.
- Favot, K., Carter, M., & Stephenson, J. (2020). The Effects of Oral Narrative Intervention on the Narratives of Children with Language Disorder: a Systematic Literature Review. *Journal of Autism and Developmental Disorders*, 50(5), 1501–1518.
- Ferrier-Kerr, J., & Earl, K. (2015). Proem: Stopping for a moment: The influence of change on teachers' professional practice. *Teachers and Curriculum*, 15(1).
- Filderman, M. J., Austin, C. R., Boucher, A. N., O'Donnell, K., & Swanson, E. A. (2022). A meta-analysis of the effects of reading comprehension interventions on

- the reading comprehension outcomes of struggling readers in third through 12th grades. *Exceptional Children*, 88(2), 163-184.
- Flores, M. M., & Hinton, V. M. (2022). The effects of a CRA-I intervention on students' number sense and understanding of addition. *Remedial and Special Education*, 43(3), 183-194. <https://doi.org/10.1177/07419325211038009>
- Foorman, B. R., Herrera, S., & Dombek, J. (2018). The relative impact of aligning Tier 2 intervention materials with classroom core reading materials in grades K-2. *Early Literacy Intervention*, 483-500.
- Fricke, S., Bowyer-Crane, C., Haley, A. J., Hulme, C., & Snowling, M. J. (2013). Efficacy of language intervention in the early years. *Journal of Child Psychology and Psychiatry*, 54(3), 280-290.
- Fricke, S., Burgoyne, K., Bowyer-Crane, C., Kyriacou, M., Zosimidou, A., Maxwell, L., ... & Hulme, C. (2017). The efficacy of early language intervention in mainstream school settings: a randomized controlled trial. *British Journal of Educational Psychology*, 87(2), 290-311.
- Frizelle, P., Tolonen, A.-K., Tulip, J., Murphy, C.-A., Saldana, D., Mckean, C., & Camarata, S. M. (2021). The Impact of Intervention Dose Form on Oral Language Outcomes for Children With Developmental Language Disorder. *American Journal of Speech-Language Pathology*, 30(1), 1-17.
- Frizelle, P., Tolonen, A.-K., Tulip, J., Murphy, C.-A., Saldana, D., Mckean, C., & Storkel, H. L. (2021). The Influence of Quantitative Intervention Dosage on Oral Language Outcomes for Children With Developmental Language Disorder: A Systematic Review and Narrative Synthesis. *Journal of Speech, Language, and Hearing Research*, 64(6), 2155-2174. <https://doi.org/10.1044/2021-JSLHR-20-00360>
- Fuchs, L. S., Newman-Gonchar, R., Schumacher, R., Dougherty, B., Bucka, N., Karp, K. S., Woodward, J., Clarke, B., Jordan, N. C., Gersten, R., Jayanthi, M., Keating, B., & Morgan, S. (2021). Assisting students struggling with mathematics: intervention in the elementary grades (WWC 2021006). Washington, DC: National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, U.S. Department of Education. <https://ies.ed.gov/ncee/WWC/PracticeGuide/26>
- Fuchs, L. S., Seethaler, P. M., Sterba, S. K., Craddock, C., Fuchs, D., Compton, D. L., Geary, D. C., & Changas, P. (2021). Language comprehension and word-problem solving: Schema-based word-problem intervention with and without embedded language comprehension instruction. *Journal of Educational Psychology*, 113(1), 1-19. <https://doi.org/10.1037/edu0000463>
- Galuschka, K., Görgen, R., Kalmar, J., Haberstroh, S., Schmalz, X., & Schulte-Körne, G. (2020). Effectiveness of spelling interventions for learners with dyslexia: A meta-analysis and systematic review. *Educational Psychologist*, 55(1), 1-20.
- García-Sánchez, J.N., López-Escribano, C., Martín-Babarro, J. & Pérez-López, R. (2022). Promoting Handwriting Fluency for Preschool and Elementary-Age Students: Meta-Analysis and Meta-Synthesis of Research From 2000 to 2020. *Frontiers in Psychology*, 13, 833524.
- Gersten, R., Chard, D. J., Jayanthi, M., Baker, S. K., Morphy, P., & Flojo, J. (2009). Mathematics instruction for students with learning disabilities: A meta-analysis of instructional components. *Review of Educational Research*, 79(3), 1202-1242.
- Gersten, R., Rolffhus, E., Clarke, B., Decker, L. E., Wilkins, C., & Dimino, J. (2015). Intervention for First Graders With Limited Number Knowledge: Large-Scale Replication of a Randomized Controlled Trial. *Exceptional Children*, 81(1), 11-29.
- Gertzel-Short, L. (2018). "We Conquered This Together": Tier 2 Collaboration with Families. *School Community Journal*, 28(2), 85-112.
- Gevarter, C., Bryant, D. P., Bryant, B., Watkins, L., Zamora, C., & Sammarco, N. (2016). Mathematics interventions for individuals with autism spectrum disorder: A systematic review. *Review Journal of Autism and Developmental Disorders*, 3, 224-238.
- Gevarter, C., Bryant, D. P., Bryant, B., Watkins, L., Zamora, C., Sammarco, N., & Burton, B. (2016). Mathematics Interventions for Individuals with Autism Spectrum Disorder: A Systematic Review. *Review Journal of Autism and Developmental Disorders*, 3(3), 224-238.
- Gibbs, A. S., Reed, D. K., Hong, H., Ma, J., & Urbanski, D. P. (2024). Synthesis and Meta-Analysis of Oral Language Interventions on the Vocabulary and Listening Comprehension Development of Young Children.
- Gillam, S. L., Gillam, R. B., Fargo, J. D., Olszewski, A., & Segura, H. (2017). Monitoring indicators of scholarly language: A progress-monitoring instrument for measuring narrative discourse skills. *Communication Disorders Quarterly*, 38(2), 96-106.
- Gillespie, A., & Graham, S. (2014). A meta-analysis of writing interventions for students with learning disabilities. *The Elementary School Journal*, 115(1), 1-26.
- Gillon, G. T. (2000). The efficacy of phonological awareness intervention for children with spoken language impairment. *Language, speech, and hearing services in schools*, 31(2), 126-141.
- Gillon, G. T. (2002). Follow-up study investigating the benefits of phonological awareness intervention for children with spoken language impairment. *International journal of language & communication disorders*, 37(4), 381-400.
- Gillon, G. T. (2005). Facilitating phoneme awareness development in 3-and 4-year-old children with speech impairment. *Language, Speech, and Hearing Services in Schools*, 36, 308-324.
- Gillon, G. T. (2018). *Phonological Awareness: From Research to Practice* (2nd edition). The Guilford Press.
- Gillon, G., & Macfarlane, A. H. (2017). A culturally responsive framework for enhancing phonological awareness development in children with speech and language impairment. *Speech, Language and Hearing*, 20(3), 163-173.
- Gillon, G., Macfarlane, A. H., & Macfarlane, A. H. (2019). *Speech, Language and Hearing*. *International Journal of Speech-Language Pathology*, 21(3), 223-233.
- Gillon, G., McNeill, B., Denston, A., Scott, A., & Macfarlane, A. (2020). Evidence-based class literacy instruction for children with speech and language difficulties. *Topics in language disorders*, 40(4), 357-374.
- Gillon, G., McNeill, B., Gath, M., Scott, A., Snowling, M., & Hulme, C. (in progress). A cluster-randomised trial of the NELI-NZ to promote accelerated oral language development in new entrant students.
- Gillon, G., McNeill, B., Scott, A., Denston, A., Wilson, L., Carson, K., & Macfarlane, A. H. (2019). A better start to literacy learning: findings from a teacher-implemented intervention in children's first year at school. *Reading and Writing*, 32(3), 693-712.
- Gillon, G., McNeill, B., Scott, A., Gath, M., Macfarlane, A., & Taleni, T. (2024). Large scale implementation of effective early literacy instruction. In *Frontiers in Education* (Vol. 9, p. 1354182). <https://doi.org/10.3389/educ.2024.1354182>
- Gillon, G., McNeill, B., Scott, A., Denston, A., Wilson, L., Carson, K., & Macfarlane, A. H. (2019). A better start to literacy learning: Findings from a teacher-implemented

- intervention in children's first year at school. *Reading and Writing: An Interdisciplinary Journal*, 32(8), 1989–2012. <https://doi.org/10.1007/s11145-018-9933-7>
- Gillon, G., McNeill, B., Scott, A., Arrow, A., Gath, M., & Macfarlane, A. (2023). A better start literacy approach: Effectiveness of Tier 1 and Tier 2 support within a response to teaching framework. *Reading and Writing: An Interdisciplinary Journal*, 36(3), 565–598. <https://doi.org/10.1007/s11145-022-10303-4>
- Gillon, G. T., Moran, C. A., Hamilton, E., Zens, N., Bayne, G., & Smith, D. (2007). Phonological awareness treatment effects for children from low socioeconomic backgrounds. *Asia Pacific Journal of Speech, Language and Hearing*, 10(2), 123–140.
- Gillon, G. T., & Young, A. A. (2002). The phonological-awareness skills of children who are blind. *Journal of Visual Impairment & Blindness*, 96(1), 38–49.
- Glasse, R.; Bälter, O. Sustainable Approaches for Accelerated Learning. *Sustainability* 2021, 13, 11994. <https://doi.org/10.3390/su132111994>
- Goffreda, C. T., & Clyde DiPerna, J. (2010). An empirical review of psychometric evidence for the Dynamic Indicators of Basic Early Literacy Skills. *School Psychology Review*, 39(3), 463–483.
- Goldfeld, S., Beatson, R., Watts, A., Snow, P., Gold, L., Le, H. N., Edwards, S., Connell, J., Stark, H., Shingles, B., Barnett, T., Quach, J., Eadie, P., Denton, C. A., Fletcher, C. A., Gilbert, C., Cho, K., Kelley, C., Pullen, C., & Coyne, J. (2021). Tier 2 oral language and early reading interventions for preschool to grade 2 children: a restricted systematic review. *Child and Adolescent Mental Health*, 26(2), 159–172.
- Goldfeld, S., Beatson, R., Watts, A., Snow, P., Gold, L., Le, H. N., Edwards, S., Connell, J., Stark, H., Shingles, B., Barnett, T., Quach, J., Eadie, P., Denton, C. A., Fletcher, C. A., Gilbert, C., Cho, K., Kelley, C., Pullen, C., & Coyne, J. (2021). Tier 2 oral language and early reading interventions for preschool to grade 2 children: a restricted systematic review. *Child and Adolescent Mental Health*, 26(2), 159–172.
- Goldfeld, S., Beatson, R., Watts, A., Snow, P., Gold, L., Le, H. N., ... & 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), 65–113.
- Goldfeld, S., Snow, P., Eadie, P., Munro, J., Gold, L., Le, H. N. D., Orsini, F., Connell, J., Watts, A., & Barnett, T. (2022). Classroom Promotion of Oral Language: Outcomes From a Randomized Controlled Trial of a Whole-of-Classroom Intervention to Improve Children's Reading Achievement. *AERA Open*, 8, 1–18.
- Goodwin, A. P., & Ahn, S. (2010). A meta-analysis of morphological interventions: effects on literacy achievement of children with literacy difficulties. *Reading and Writing*, 23(2), 183–223.
- Gordon, G., & Breazeal, C. (2015). Bayesian active learning-based robot tutor for children's word-reading skills. *Proceedings of the 2015 ACM/IEEE International Conference on Human-Robot Interaction*, 367–374.
- Gough, P. B., & Tunmer, W. E. (1986). Decoding, reading and reading disability. *Remedial and Special Education*, 7, 6–10. [doi:10.1177/074193258600700104](https://doi.org/10.1177/074193258600700104)
- Graham, S. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology*, 99(3), 445–476.
- Graham, S., Liu, X., Aitken, A., Ng, C., Bartlett, B., Harris, K. R., & Holzapfel, J. (2018). Effectiveness of Literacy Programs Balancing Reading and Writing Instruction: A Meta-Analysis. *Reading Research Quarterly*, 53(3), 279–304.
- Graham, S., Silva, M., & Restrepo, M. A. (2022). Reading intervention research with emergent bilingual students: a meta-analysis. *Reading Research Quarterly*.
- Graham, S., Silva, M., & Restrepo, M. A. (2023). Reading intervention research with emergent bilingual students: A meta-analysis. *Reading and Writing: An Interdisciplinary Journal*, 36, 2433–2464. <https://doi.org/10.1007/s11145-022-10399-8>
- Graham, S., Silva, M., & Restrepo, M. A. (2022). Reading intervention research with emergent bilingual students: a meta-analysis. *Reading Research Quarterly*.
- Graham, S., Tavsanlı, O. F., & Kaldırım, A. (2021). Improving Writing Skills of Students in Turkey: a Meta-analysis of Writing Interventions. *Educational Studies*, 1–22.
- Guiberson, M., & Vining, C. B. (2023). Culturally responsive and Indigenous language strategies: Findings from a scoping review. *Communication Disorders Quarterly*, 45(1), 3–19.
- Guo, Y., Bui, Y., Deshler, Y. N., Coe, M., Smiley, W., Graham, K. R., Adkins, A., Therrien, W., Mokhtari, K., Wissinger, D. R., La Paz, S., Wolbers, K., & Saulsbury, R. (n.d.). DOES TRANSCRIPTION INSTRUCTION MAKE WRITING INTERVENTIONS MORE EFFECTIVE? A META-ANALYSIS.
- Hadley, E. B., & Mendez, K. Z. (2021). A systematic review of word selection in early childhood vocabulary instruction. *Early Childhood Research Quarterly*, 54, 44–59.
- Hall, C., Dahl-Leonard, K., Cho, E., Solari, E. J., Capin, P., Conner, C. L., Henry, A. R., Cook, L., Hayes, L., Vargas, L., Richmond, C. L., & Kehoe, K. F. (2022). Forty Years of Reading Intervention Research for Elementary Students with or at Risk for Dyslexia: A Systematic Review and Meta-Analysis Recent Meta-Analyses of Reading Intervention Research. *Exceptional Children*, 88(4), 365–387.
- Hall, C., Dahl, L. K., Cho, E., Solari, E. J., Capin, P., Conner, C. L., Henry, A. R., Cook, L., Hayes, L., Vargas, L., Richmond, C. L., & Kehoe, K. F. (2022). Forty years of reading intervention research for elementary students with or at risk for dyslexia: A systematic review and meta-analysis. *Reading Research Quarterly*. <https://doi.org/10.1002/rrq.477>
- Hall-Mills, S. S., & Marante, L. M. (2020). Explicit Text Structure Instruction Supports Expository Text Comprehension for Adolescents With Learning Disabilities: A Systematic Review. *Learning Disability Quarterly*, 43(4), 206–221.
- Hauwaert, H., Ghesquière, P., Tordoir, J., & Thomson, J. (2020). Karaton: An Example of AI Integration Within a Literacy App. In *Computers Helping People with Special Needs: 17th International Conference, ICCHP 2020, Lecco, Italy, September 9–11, 2020, Proceedings, Part I 17* (pp. 91–96). Springer International Publishing.
- Hayes, J. R., & Flower, L. S. (1980). Identifying the organization of writing processes. In L. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3–30). Hillsdale, NJ: Erlbaum
- Hebert, M., Kearns, D. M., Hayes, J. B., Bazis, P., Cooper, S., & Hogan, T. (2018). Why Children With Dyslexia Struggle With Writing and How to Help Them. *Language, Speech, and Hearing Services in Schools*, 49(4), 762–773.
- Hill, C. J., Bloom, H. S., Black, A. R. and Lipsey, M. W. (2008), Empirical benchmarks for interpreting effect sizes in research. *Child Development Perspectives*, 2: 172–177. <https://doi.org/10.1111/j.1750-8606.2008.00061.x>
- Hill, J., Hunter, J., & Hunter, R. (2019). What do Pasifika students in New Zealand value most for their mathematics learning? In P. C. e. al. (Ed.), *Values and Valuing in*

- Mathematics Education, . [https://doi.org/10.1007/978-3-030-16892-6\\_7](https://doi.org/10.1007/978-3-030-16892-6_7)
- Hjetland, H. N., Brinchmann, E. I., Scherer, R., Hulme, C., & Melby-Lervåg, M. (2020). Preschool pathways to reading comprehension: A systematic meta-analytic review. *Educational Research Review*, 30, 100323.
- Hoff, E. (2003). The specificity of environmental influence: Socioeconomic status affects early vocabulary development via maternal speech. *Child development*, 74(5), 1368-1378.
- Hoffman, A. R., Jenkins, J. E., & Dunlap, S. K. (2009). Using DIBELS: A survey of purposes and practices. *Reading Psychology*, 30(1), 1-16.
- Hoover, W. A., & Tunmer, W. E. (2018). The simple view of reading: Three assessments of its adequacy. *Remedial and Special Education*, 39(5), 304-312.
- Howe, E. R., Johnson, S., & Te Momo, F. (2021). Effective indigenization of curriculum in Canada and New Zealand: Towards culturally responsive pedagogies. *Journal of Contemporary Issues in Education*, 16(1).
- Hudson, M. E., Rivera, C. J., Grady, M. M., \* Hansen, D. L., Morgan, D. L., & Lehr, D. (2018). Research on Mathematics Instruction with Students with Significant Cognitive Disabilities: Has Anything Changed? *Journal Name, Volume(Issue), Page Numbers*.
- Hughes, E. M., & Yakubova, G. (2019). Addressing the mathematics gap for students with ASD: An evidence-based systematic review of video-based mathematics interventions. *Review Journal of Autism and Developmental Disorders*, 6, 147-158.
- Hunter, J., & Miller, J. (2022a). The use of cultural contexts for patterning tasks: supporting young diverse students to identify structures and generalise. *ZDM – Mathematics Education*, 54(6), 1349-1362. <https://doi.org/10.1007/s11858-022-01386-y>
- Hunter, J., & Miller, J. (2022b). Using a culturally responsive approach to develop early algebraic reasoning with young diverse learners. *International Journal of Science and Mathematics Education*, 20(1), 111-131. <https://doi.org/10.1007/s10763-020-10135-0>
- Hur, J. H., Snyder, P., & Reichow, B. (2020). Systematic Review of English Early Literacy Interventions for Children Who Are Dual Language Learners. *Early Childhood Research Quarterly*, 52, 217-236.
- Hwang, H., Cabell, S. Q., & Joyner, R. E. (2021). Effects of Integrated Literacy and Content-area Instruction on Vocabulary and Comprehension in the Elementary Years: A Meta-analysis. *Journal Name, Volume(Issue), pages*.
- Jensen de López, K. M., Kuvač Kraljević, J., Bang Struntze, E. L., & Jensen, K. M. (2022). Efficacy, model of delivery, intensity and targets of pragmatic interventions for children with developmental language disorder: A systematic review. *International Journal of Language & Communication Disorders*, 57(2), 239-259.
- Jesús-Nicasio García-Sánchez, Carmen López-Escribano, Javier Martín-Babarro, Raquel Pérez-López (2022). Promoting Handwriting Fluency for Preschool and Elementary-Age Students: Meta-Analysis and Meta-Synthesis of Research From 2000 to 2020.
- Joffe, V. L., Rixon, L., & Hulme, C. (2019). Improving storytelling and vocabulary in secondary school students with language disorder: a randomized controlled trial. *Journal of Speech, Language, and Hearing Research*, 62(7), 2233-2256.
- Johnson, S.S., O’Keeffe, B.V., & Stokes, K. (2018). Early Literacy Support for Students With Physical Disabilities and Complex Communication Needs. *Teaching Exceptional Children*, (51) 2 91-99.
- Joseph, L., Ross, K., Xia, Q., Amspaugh, L.A., & Accurso, J. (2023). Reading Comprehension Instruction for Students with Intellectual Disabilities: A Systematic Literature Review. *International Journal of Disability, Development and Education*, 70 (3): 314-339.
- Kamii, C., & Manning, M. (2005). Dynamic Indicators of Basic Early Literacy Skills (DIBELS): A tool for evaluating student learning? *Journal of Research in Childhood Education*, 20(2), 75-90.
- Kearns, J. F., Towles-Reeves, E., Kleinert, H. L., Kleinert, J. O., & Thomas, M. K.-K. (2011). Characteristics of and Implications for Students Participating in Alternate Assessments Based on Alternate Academic Achievement Standards. *The Journal of Special Education*, 45(1), 3-14. <https://doi.org/10.1177/0022466909344223>
- Kelly, J., Kunkel, A. K., Smith, A., Gerzel-Short, L., Park, S., & Moore, A. (2023). The role of culture in reading comprehension interventions for students with learning disabilities: A systematic review. *Learning Disabilities: A Contemporary Journal*, 21(1), 17-36.
- Kennedy, C., & Mcloughlin, A. (2022). Developing the Emergent Literacy Skills of English Language Learners Through Dialogic Reading: A Systematic Review. *Early Childhood Education Journal*. <https://doi.org/10.1007/s10643-021-01291-1>
- Kesler, T. (2011). Teachers’ texts in culturally responsive teaching. *Language arts*, 88(6), 419-428.
- Kim, M., & Sankey, D. (2022). The science of learning and development in education. Cambridge University Press.
- Kim, Y. S. G., & Schatschneider, C. (2017). Expanding the developmental models of writing: A direct and indirect effects model of developmental writing (DIEW). *Journal of educational psychology*, 109(1), 35.
- King, S. A., Lemons, C. J., & Davidson, K. A. (2016). Math interventions for students with autism spectrum disorder: A best-evidence synthesis. *Exceptional Children*, 82(4), 443-462.
- Kraft, M. A. (2020). Interpreting effect sizes of education interventions. *Educational Researcher*, 49(4), 241-253. <https://doi.org/10.3102/0013189X20912798>
- Kruythoff-Broekman, A., Wiefferink, C., Rieffe, C., & Uilenburg, N. (2019). Parent-implemented early language intervention programme for late talkers: parental communicative behaviour change and child language outcomes at 3 and 4 years of age. *International Journal of Language & Communication Disorders*, 54(3), 451-464.
- Kunkel, A. K., Kelly, J., Smith, A., Gerzel-Short, L., Park, S., & Moore, A. (2022). The Role of Culture in Reading Comprehension Interventions for Students with Learning Disabilities: A Systematic Review. *Learning Disability Quarterly*, 45(4), 235-250.
- Law, J., Dennis, J. A., Charlton, J. J. V., Dennis, J. A., Charlton, J. J. V., Yoder, & Yoder, P. J. (2017). Speech and language therapy interventions for children with primary speech and/or language disorders (Protocol). *Cochrane Database of Systematic Reviews*.
- Law, J., Garrett, Z., & Nye, C. (n.d.). The Efficacy of Treatment for Children With Developmental Speech and Language Delay/ Disorder: A Meta-Analysis.
- Lemons, C. J., Powell, S. R., King, S. A., & Davidson, K. A. (2015). Mathematics interventions for children and adolescents with Down syndrome: a research synthesis. *Journal of Intellectual Disability Research*, 59(8), 767-783.
- Lin, J. (2013). The effects of code-based literacy interventions on spelling achievement: A meta-analysis. City University of New York.

- Linan-Thompson, S., Lara-Martinez, J. A., & Cavazos, L. O. (2018). Exploring the Intersection of Evidence-Based Practices and Culturally and Linguistically Responsive Practices. *Intervention in School and Clinic, 54*(1), 27–35.
- Liu, D., Mao, Y., Cai, W., Lei, Q., Kang, R., & Zeng, Y. (2023). Meta-Analysis of Tablet-Mediated Interventions to Teach Mathematics for Individuals With Autism Spectrum Disorder and/or Intellectual Disability. *Exceptional Children, 50*(1), 1–13.
- Liu, S., Reynolds, B. L., Thomas, N., & Soyoof, A. (2024). The use of digital technologies to develop young children's language and literacy skills: A systematic review. *SAGE Open, 14*(1), 21582440241230850.
- Liu, X., Zhao, W., Qi, Q., & Luo, X. (2023). A Survey on Autism Care, Diagnosis, and Intervention Based on Mobile Apps: Focusing on Usability and Software Design. *Sensors, 23*(14), 6260.
- 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), 108–128.
- Macfarlane, A., Derby, M., & Macfarlane, S. (2024). He Awa Whiria: Braiding the knowledge streams in research, policy and practice. Canterbury University Press: Christchurch, New Zealand.
- Macfarlane, A. H., & Macfarlane, S. L. (2012). 13. Weaving the dimensions of culture and learning: Understanding teaching and learning: Classroom research revisited, 213.
- Malec, A., Peterson, S. S., & Elshereif, H. (2017). Assessing young children's oral language: Recommendations for classroom practice and policy. *Canadian Journal of Education/Revue canadienne de l'éducation, 40*(3), 362–392.
- Mandak, K., Light, J., & Boyle, S. (2018). The effects of literacy interventions on single-word reading for individuals who use aided AAC: a systematic review. *Augmentative and Alternative Communication, 34*(2), 136–145.
- Marulis, L. M., & Neuman, S. B. (2010). The effects of vocabulary intervention on young children's word learning: A meta-analysis. *Review of Educational Research, 83*(3), 300–335.
- Marulis, L. M., & Neuman, S. B. (2013). How vocabulary interventions affect young children at risk: A meta-analytic review. *Developmental Psychology, 49*(12), 2228–2239.
- MBIE (2014). National Science Challenges. Available at: <https://www.mbie.govt.nz/science-and-technology/science-and-innovation/funding-information-and-opportunities/investment-funds/national-science-challenges>
- McClain, M.B., Haverkamp, C.R., Benallie, K.J., Schwartz, S.E., Simonsmeier, V. (2021). How Effective are Reading Comprehension Interventions for Children with ASD? A Meta-analysis of Single-case Design Studies. *School Psychology 36*(2): 107-121
- McDowall, S., Cameron, M., Dingle, R., Gilmore, A., & MacGibbon, L. (2007). Evaluation of the literacy professional development project. Report prepared for the Ministry of Education by the New Zealand Council of Educational Research, 83(3), 300–335 and the University of Canterbury). Retrieved June, 12, 2009.
- McKean, C., & Reilly, S. (2023). Creating the conditions for robust early language development for all: Part two: Evidence informed public health framework for child language in the early years. *International Journal of Language & Communication Disorders, 00*, 1–16. <https://doi.org/10.1111/1460-6984.12789>
- McLachlan, C., & Arrow, A. (2010). Alphabet and Phonological Awareness: Can It Be Enhanced in the Early Childhood Setting?. *International Research in Early Childhood Education, 1*(1), 84–94.
- McLeod, S., Harrison, L.J., & Wang, C. (2019). A longitudinal population study of literacy and numeracy outcomes for children identified with speech, language, and communication needs in early childhood. *Early Childhood Research Quarterly, 47*, 507–517.
- McMaster, K. L., Kunkel, A., Shin, J., Jung, P.-G., & Lembke, E. (2018). Early writing intervention: A best evidence synthesis. *Exceptional Children, 83*(3), 304–322.
- McNeill, B. C., Gillon, G. T., & Dodd, B. (2009). Effectiveness of an integrated phonological awareness approach for children with childhood apraxia of speech (CAS). *Child Language Teaching and Therapy, 25*(3), 341–366.
- Md, L. (2017). SLP-educator classroom collaboration: A review to inform reason-based practice. [No journal name provided].
- Meinzen-Derr, K., Giannini, L., Frizelle, P., & Mckean, C. (2022). Using Theory to Drive Intervention Efficacy: The Role of Dose Form in Interventions for Children with DLD. *American Journal of Speech-Language Pathology, 31*(2), 1–13.
- Méndez, L. I., Crais, E. R., Castro, D. C., & Kainz, K. (2015). A culturally and linguistically responsive vocabulary approach for young Latino dual language learners. *Journal of Speech, Language, and Hearing Research, 58*(1), 93–106.
- Miciak, J., & Fletcher, J. M. (2020). The critical role of instructional response for identifying dyslexia and other learning disabilities. *Journal of learning disabilities, 53*(5), 343–353.
- Mich, O., Mana, N., Gretter, R., Matassoni, M., & Falavigna, D. (2020). Automatically assess children's reading skills. [Paper presentation].
- Michaelides, M.P., Brown, G.T.L., Eklöf, H., Papanastasiou, E.C. (2019). The Relationship of Motivation with Achievement in Mathematics. In: *Motivational Profiles in TIMSS Mathematics*. IEA Research for Education, vol 7. Springer, Cham. [https://doi.org/10.1007/978-3-030-26183-2\\_2](https://doi.org/10.1007/978-3-030-26183-2_2)
- Middleton, J. A., & Spanias, P. A. (1999). Motivation for achievement in mathematics: Findings, generalizations, and criticisms of the research. *Journal for research in Mathematics Education, 30*(1), 65–88.
- Ministry of Education (2023). Action Plan for Pacific Education 2020-2030: 2023 refresh. [https://assets.education.govt.nz/public/Documents/our-work/strategies-and-policies/action-plan-for-pacific-education/Action-Plan-for-Pacific-Education-2023\\_070723.pdf](https://assets.education.govt.nz/public/Documents/our-work/strategies-and-policies/action-plan-for-pacific-education/Action-Plan-for-Pacific-Education-2023_070723.pdf)
- Ministry of Education (2022). Literacy & Communication and Maths Action Plans. <https://assets.education.govt.nz/public/Documents/our-work/Literacy-and-Communication-and-Maths-Strategy/Literacy-Communication-and-Maths-Action-Plans.pdf>
- Ministry of Education (2022). Literacy & Communication and Maths Strategy. [https://assets.education.govt.nz/public/Documents/Ministry/Changes-in-education/ELS-0778-Maths-and-Literacy-Strategies-Doc\\_web.pdf](https://assets.education.govt.nz/public/Documents/Ministry/Changes-in-education/ELS-0778-Maths-and-Literacy-Strategies-Doc_web.pdf)
- Ministry of Education (2023). Te Mātaiaho: The refreshed New Zealand curriculum - Draft. [https://curriculumrefresh-live-assetstorages3bucket-l5wodsj7zmbm.s3.amazonaws.com/s3fs-public/2023-04/PDF%20Te%20Mataiaho%20March%202023\\_0.pdf?VersionId=DGq6slLW5tA\\_59tWwTzHugo8qP\\_cSUF](https://curriculumrefresh-live-assetstorages3bucket-l5wodsj7zmbm.s3.amazonaws.com/s3fs-public/2023-04/PDF%20Te%20Mataiaho%20March%202023_0.pdf?VersionId=DGq6slLW5tA_59tWwTzHugo8qP_cSUF)
- Ministry of Education (2024). Common Practice Model. <https://www.education.govt.nz/common-practice-model/>

- govt.nz/our-work/changes-in-education/curriculum-and-assessment-changes/common-practice-model/
- Ministry of Education (2024). He Pikorua: Flexible and integrated supports. <https://hepikorua.education.govt.nz/how-we-work/flexible-tailored-model-of-support/>
- Moats, L. C. (2010). *Speech to print: Language essentials for teachers* (2nd ed.). Baltimore, MD: Brookes.
- Moats, L. C. (2020). Teaching Reading” Is” Rocket Science: What Expert Teachers of Reading Should Know and Be Able to Do. *American Educator*, 44(2), 4.
- Moats, L. C. (2023). Creating Confident Readers: How LETRS Supports Teachers-and Their Students. *American Educator*, 47(1), 4-11.
- Mol, S. E., Bus, A. G., & De Jong, M. T. (2009). Interactive book reading in early education: A tool to stimulate print knowledge as well as oral language. *Review of Educational Research*, 79(2), 979-1007.
- Murphy, A., Bailey, B., Arciuli, J., Owen, A. J., & Van Horne, A. (2022). Exploring the Effects of Literacy Instruction for Children With Cerebral Palsy: A Systematic Review. *Language, Speech, and Hearing Services in Schools*, 53(2), 463-481.
- 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), 1-35. <https://doi.org/10.1080/19345747.2022.2080131>
- Neitzel, A. J., Lake, C., Pellegrini, M., & Slavin, R. E. (2021). Effective programs for struggling readers: A best-evidence synthesis. *Reading Research Quarterly*, 56(1), 35-60. doi:10.1002/rrq.371
- Neitzel, A. J., Lake, C., Pellegrini, M., & Slavin, R. E. (2022). A synthesis of quantitative research on programs for struggling readers in elementary schools. *Reading Research Quarterly*, 57(1), 149-179. <https://doi.org/10.1002/rrq.379>
- Newbury, D. F., Mesa, C., Puglisi, M., Nash, M., Nag, S., Hulme, C., & Snowling, M. J. (2022). Challenges for implementation in diverse settings: reflections on two randomised controlled trials of educational interventions in South American communities. *International Journal of Educational Research*, 114, 101958.
- Nicholson, T. & Dymock, S. (2023). *The New Zealand dyslexia handbook* (second edition). NZCER Press.
- Niklas, F., Wirth, A., Mues, A., & Birtwistle, E. (2023). Development in the context of the home literacy environment. *Routledge International Handbook of Visual-motor skills, Handwriting, and Spelling: Theory, Research, and Practice*, 366.
- Nordahl-Hansen, A., Donolato, E., Lervåg, A., Norbury, C. F., & Melby-Lervåg, M. (2019). PROTOCOL: Language interventions for improving oral language outcomes in children with neurodevelopmental disorders: A systematic review.
- O'Donnell, A. W., Redmond, G., Arciuli, J., Robinson, S., Skattebol, J., Raghavendra, P., Thomson, C., Wang, J. J., & Emerson, E. (2022). The Association between Parental Educational Expectations and School Functioning among Young People with Disabilities: A Longitudinal Investigation. *Exceptional Children*, 89(1), 60-78. <https://doi.org/10.1177/00144029221087392>
- Oranga Tamariki (2020). Social workers in schools (SWiS). Available at: <https://www.orangatamariki.govt.nz/about-us/research/our-research/social-workers-in-schools-2020/>
- Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., ... & Moher, D. (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *bmj*, 372.
- Pan, B. A., Rowe, M. L., Singer, J. D., & Snow, C. E. (2005). Maternal correlates of growth in toddler vocabulary production in low-income families. *Child development*, 76(4), 763-782.
- Park, J., Bouck, E. C., & Josol, C. K. (2020). Maintenance of mathematical skills for students with intellectual disability: A systematic review. *Research in Developmental Disabilities*, 97, 103549.
- Petersen-Brown, S., & Kromminga, K. R. (2024). Systematic review and meta-analysis of the implementation and effectiveness of spelling instruction and intervention. *Psychology in the Schools*, 1-24. <https://doi.org/10.1002/pits.23223>
- Petersen, D. B., Staskowski, M., Spencer, T. D., Foster, M. E., Brough, M. P., & Storkel, H. L. (2021). The Effects of a Multitiered System of Language Support on Kindergarten Oral and Written Language: A Large-Scale Randomized Controlled Trial. *Language, Speech, and Hearing Services in Schools*, 52(2), 443-461.
- Piazza, S. V., Rao, S., & Protacio, M. S. (2015). Converging recommendations for culturally responsive literacy practices: Students with learning disabilities, English language learners, and socioculturally diverse learners. *Intervention in School and Clinic*, 51(1), 57-63.
- Pico, D. L., & Woods, C. (2022). Shared Book Reading for Spanish-Speaking Emergent Bilinguals: A Review of Experimental Studies.
- Pico, D. L., & Woods, C. (2023). Shared book reading for Spanish-speaking emergent bilinguals: A review of experimental studies. *Review of Educational Research*, 93(1), 103-138. <https://doi.org/10.3102/00346543221095112>
- Powell, S.R., Mason, E. N., Bos, S. E., Hirt, S., Ketterlin-Geller, L. R. and Lembke, E. S. (2021). A systematic review of mathematics interventions for middle-school students experiencing mathematics difficulty. *Learning Disabilities Research & Practice*, 36, 295-329. <https://doi.org/10.1111/ldrp.12263>
- Powell, S. R., Berry, K. A., Fall, A. M., Roberts, G., Barnes, M. A., Fuchs, L. S., ... Lin, X. (2022). Does word-problem performance maintain? Follow-up one year after implementation of a word-problem intervention. *Journal of Research on Educational Effectiveness*, 15(1), 52-77. <https://doi.org/10.1080/19345747.2021.1961332>
- Rachmani, R. (2020). The effects of a phonological awareness and alphabet knowledge intervention on four-year-old children in an early childhood setting. *Australasian Journal of Early Childhood*, 45(3), 254-265.
- Rajesh, V., & Venkatesh, L. (2019). Preliminary evaluation of a low-intensity parent training program on speech-language stimulation for children with language delay. *International Journal of Pediatric Otorhinolaryngology*, 122, 99-104.
- Reese, E., Sparks, A., & Leyva, D. (2010). A review of parent interventions for preschool children's language and emergent literacy. *Journal of early childhood literacy*, 10(1), 97-117.
- Rehfeld, D. M., Kirkpatrick, M., O'Guinn, N., Renbarger, R., & Storkel, H. L. (2022). A Meta-Analysis of Phonemic Awareness Instruction Provided to Children Suspected of Having a Reading Disability. *Language, Speech, and Hearing Services in Schools*, 53(2), 463-481.
- Reichow, B., Lemons, C. J., Maggin, D. M., & Hill, D. R. (2014). Beginning reading interventions for children and adolescents with intellectual disability

- (Review). Cochrane Database of Systematic Reviews, (1).
- Reilly, S., & McKean, C. (2023). Creating the conditions for robust early language development for all-Part 1: Evidence-informed child language surveillance in the early years. *International Journal of Language & Communication Disorders*.
- Reichow, B., Lemons, C.J., Maggin, D.M., & Hill, D.R. (2019). Beginning reading interventions for children and adolescents with intellectual disability. *Cochrane Database Syst Rev*. 2019 Dec 5;12(12):CD011359. doi: 10.1002/14651858.CD011359.pub2.
- Reynolds, A. J., Temple, J. A., Ou, S.-R., Robertson, D. L., Mersky, J. P., Topitzes, J. W., & Niles, M. D. (2007). Effects of a School-Based, Early Childhood Intervention on Adult Health and Well-being: A 19-Year Follow-up of Low-Income Families. *Archives of Pediatrics & Adolescent Medicine*, 161(8), 730-739. <https://doi.org/10.1001/archpedi.161.8.730>
- Rethlefsen, M. L., Kirtley, S., Waffenschmidt, S., Ayala, A. P., Moher, D., Page, M. J., & Koffel, J. B. (2021). PRISMA-S: an extension to the PRISMA statement for reporting literature searches in systematic reviews. *Systematic reviews*, 10, 1-19.
- Rice, M., & Wijekumar, K. (2024). Inference Skills for Reading: A Meta-Analysis of Instructional Practices.
- Rinaldi, S., Caselli, M. C., Cofelice, V., D'amico, S., De Cagno, A. G., Della Corte, G., ... & Michelazzo, L. (2021). Efficacy of the Treatment of Developmental Language Disorder: A Systematic Review. *Brain Sciences*, 11(3), 407.
- Roberts, M. Y., Curtis, P. R., Sone, B. J., & Hampton, L. H. (2019). Association of parent training with child language development: A systematic review and meta-analysis. *JAMA pediatrics*, 173(7), 671-680.
- Rogers, L. A., & Graham, S. (2008). A Meta-Analysis of Single Subject Design Writing Intervention Research. *Remedial and Special Education*, 29(5), 279-292.
- Root, J. R., Ingelin, B., & Cox, S. K. (2021). Teaching Mathematical Word Problem Solving to Students with Autism Spectrum Disorder: A Best-Evidence Synthesis.
- Schickedanz, J. A., & McGee, L. M. (2010). The NELP Report on Shared Story Reading Interventions (Chapter 4): Extending the Story. *Educational Researcher*, 39(4), 323-329.
- Schnepel, S., & Aunio, P. (2022). Characteristics of effective mathematics interventions for students with intellectual disabilities aged 5 to 12: A systematic review. *European Journal of Special Needs Education*, 37(2), 193-211.
- Schumacher, R., Smolkowski, K., Karp, K., Johns Hopkins, & Haymond, K. (2022). Impact of a Tier 2 Fractions Intervention on Fifth-Grade Students' Fractions. *Journal of Educational Psychology*, 114(1), 1-18.
- Scott, A., Gath, M. E., Gillon, G., McNeill, B., & Ghosh, D. (2024). Facilitators of Success for Teacher Professional Development in Literacy Teaching Using a Micro-Credential Model of Delivery. *Education Sciences*, 14(6), 578.
- Scott, A., Gillon, G., McNeill, B., and Kopach, A. (2022). The evolution of an innovative online task to monitor children's oral narrative development. *Front. Psychol.* 13:903124. doi: 10.3389/fpsyg.2022.903124
- Sedgwick, A., & Stothard, J. (2019). A systematic review of school-based, mainstream, oral language interventions for key stage 1 children. *Support for Learning*, 34(1), 107-143.
- Sénéchal, M., & Young, L. (2008). The effect of family literacy interventions on children's acquisition of reading from kindergarten to grade 3: A meta-analytic review. *Review of educational research*, 78(4), 880-907.
- Sexton, S. S. (2024). Culturally responsive teaching through primary science in Aotearoa New Zealand. *London Review of Education*, 22(1), 1-12.
- Shelton, A., Wexler, J., Silverman, R. D., & Stapleton, L. M. (2019). A synthesis of reading comprehension interventions for persons with mild intellectual disability: A systematic review and meta-analysis. *Educational Research Review*, 29, 21-37. *Exceptional Children*, 85(3), 329-347
- Si'ilata, R., Jacobs, M., Aseta, M., Hansell, K., & Tu'itahi, S. (2023). Pacific wayfinding educational leadership through Tautai o le Moana. Available through AUT Open Repository. <https://openrepository.aut.ac.nz/items/02c6d529-3e1a-4e93-a6d3-00126e3ec82c>
- Si'ilata, R. K., Jacobs, M. M., Gaffney, J. S., Aseta, M., & Hansell, K. (2023). Making Space for Young Children's Embodied Cultural Literacies and Heritage Languages with Dual Language Books. *The Reading Teacher*, 77(1), 24-36.
- Si'ilata, R., Samu, T. W., & Siteine, A. (2017). The Va'atele Framework: Redefining and Transforming Pasifika Education. In E. A. McKinley & L. T. Smith (Eds.), *Handbook of Indigenous Education* (pp. 1-28). Springer. [https://doi.org/10.1007/978-981-10-1839-8\\_34-1](https://doi.org/10.1007/978-981-10-1839-8_34-1)
- Silverman, R. D., Johnson, E., Keane, K., & Khanna, S. (2021). Beyond Decoding: A Meta-Analysis of the Effects of Language Comprehension Interventions on K-5 Students' Language and Literacy Outcomes. *Review of Educational Research*, 91(3), 346-384.
- Skaalvik, E. M., Federici, R. A., & Klassen, R. M. (2015). Mathematics achievement and self-efficacy: Relations with motivation for mathematics. *International Journal of Educational Research*, 72, 129-136.
- Skene, K., O'farrelly, C. M., Byrne, E. M., Kirby, N., Stevens, E. C., & Ramchandani, P. G. (2022). Can guidance during play enhance children's learning and development in educational contexts? A systematic review and meta-analysis.
- Slavin, R. E., Lake, C., Chambers, B., Cheung, A., & Davis, S. (2009). Effective reading programs for the elementary grades: A best-evidence synthesis. *Review of Educational Research*, 79(4), 1391-1466. doi:10.3102/0034654309341374"
- Sleeman, M., Everatt, J., Arrow, A., & Denston, A. (2024). Exploring the distribution and cognitive profiles of poor readers across varying levels of reading difficulty: implications for identification and support. *Journal of Research in Reading*.
- Smyth, H. (2013). What Does Research Say About the Effectiveness of Professional Learning and Development for Culturally Responsive Teaching at Primary School Level?. *Teachers' Work*, 10(1), 169-189.
- Snow, P. C., Eadie, P. A., Connell, J., Dalheim, B., Mccusker, H. J., & Munro, J. K. (2014). Oral language supports early literacy: A pilot cluster randomized trial in disadvantaged schools. *International Journal of Speech-Language Pathology*, 16(5), 495-506.
- Snowling M. J., Bishop D. V. M., Stothard S. E., Chipchase B., Kaplan C. (2006). Psychosocial outcomes at 15 years of children with a preschool history of speech-language impairment. *Journal of Child Psychology and Psychiatry*, 47, 759-765.
- Snowling, M. J., Hulme, C., & Nation, K. (2020). Defining and understanding dyslexia: past, present and future. *Oxford review of education*, 46(4), 501-513.
- 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), 85-103.
- Solari, E. J., Kehoe, K. F., Cho, E., Hall, C., Vargas, I., Dahl-Leonard, K., Richmond, C. L., Henry, A. R., Cook, L., Hayes, L., & Conner, C. (2022). Effectiveness of Interventions for English Learners with Word Reading Difficulties: A Research Synthesis.
- 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), 150-165. <https://doi.org/10.1177/0741932517751055>
- Squires, K. E., & Wolter, J. A. (2016). The Effects of Orthographic Pattern Intervention on Spelling Performance of Students With Reading Disabilities: A Best Evidence Synthesis. *Remedial and Special Education*, 37(6), 342-352.
- Stecker, P. M., Fuchs, L. S., & Fuchs, D. (2005). Using curriculum-based measurement to improve student achievement: Review of research. *Psychology in the Schools*, 42(8), 795-819.
- Stevens, A., Garritty, C., Hersi, M., & Moher, D. (2018). Developing PRISMA-RR, a reporting guideline for rapid reviews of primary studies (Protocol). *Equator Network*.
- Strong, G. K., Torgerson, C. J., Torgerson, D., & Hulme, C. (2011). A systematic meta-analytic review of evidence for the effectiveness of the 'Fast ForWord' language intervention program. *Journal of Child Psychology and Psychiatry*, 52(3), 224-235.
- Superu. 2017. An evidence rating scale for New Zealand: Understanding the effectiveness of interventions in the social sector. Social Policy and Evaluation Research Unit. Superu: Wellington, New Zealand. Available at: [https://thehub.swa.govt.nz/assets/documents/Evidence\\_Rating\\_Scale.pdf](https://thehub.swa.govt.nz/assets/documents/Evidence_Rating_Scale.pdf)
- Superu. (2018). Bridging cultural perspectives. Ministry of Social Policy Evaluation and Research Unit. <https://thehub.swa.govt.nz/assets/Uploads/Bridging-Cultural-Perspectives-FINAL-0.pdf>
- Supovitz, J. (2012). Getting at Student Understanding – The Key to Teachers' Use of Test Data. *Teachers College Record*, 114, 1-29.
- Swanson, E. A., Wanzek, J., Petscher, Y., Vaughn, S., Heckert, J., Cavanaugh, C., ... & Tackett, K. (2011). A synthesis of read-aloud interventions on early reading outcomes among preschool through third graders at risk for reading difficulties. *Reading Research Quarterly*, 46(4), 356-381.
- Synergia (2021). OLLi Impact Evaluation Report. Available from the Ministry of Education.
- Taleni, T. a. O. (2023). O le Fa'atamasoali'iga a Tautai Matapalapala A Soul-Searching and Far-Reaching Voyage of the Tautai (The Master Navigator): How and why effective educational leadership can advance Pacific students' learning, health and wellbeing. Doctoral Thesis. University of Canterbury. <https://ir.canterbury.ac.nz/items/e3136b1c-197d-4664-927f-33ba598183a4>
- Tam, J.Y.C., Barrett, E.A., & Hin Ho, A.Y. (2022). Narrative intervention in school-aged children with autism spectrum disorder: a systematic review. *Speech, Language and Hearing*, 25 (4): 463-480.
- Tan, E., Barton, A. C., Gutiérrez, M. V., & Turner, E. (2012). Empowering science and mathematics education in urban schools. University of Chicago Press.
- Tarraga-Minguez, R.T., Gomez-Mari, I., Sanz-Cervera, P. (2021). Interventions for Improving Reading Comprehension in Children with ASD: A Systematic Review. *Behavioural Sciences*, 11(1): 3. <https://doi.org/10.3390/bs11010003>
- Tarvainen, S., Launonen, K., & Stolt, S. (2021). Oral language comprehension interventions in school-age children and adolescents with developmental language disorder: A systematic scoping review. *Autism & Developmental Language Impairments*, 6, 1-22.
- Tarvainen, S., Stolt, S., & Launonen, K. (2021). Oral language comprehension interventions in 1-8-year-old children with language disorders or difficulties: A systematic scoping review. *International Journal of Language & Communication Disorders*, 56(2), 233-251.
- Thompson, C. G., & Von Gillern, S. (2021). A meta-analysis of the effectiveness of video-game based instruction for English as a foreign language vocabulary acquisition. *Educational Research Review*, 33, 100374.
- Timperley, H. S., Parr, J. M., & Bertanees, C. (2009). Promoting professional inquiry for improved outcomes for students in New Zealand. *Professional development in education*, 35(2), 227-245.
- Toppel, K. (2015). Enhancing core reading programs with culturally responsive practices. *The Reading Teacher*, 68(7), 552-559.
- Trewartha, C. (2020). He awa whiria, braiding the rivers of kaupapa Māori and Western evidence on community mobilisation. *Bicultural Issues*, 16-22.
- TNTP (2020). Learning Acceleration Guide. Available at: <https://drive.google.com/file/d/1zkL8h5xymtMvqulCmOnmQ6zWu8V1eeML/view>
- Trewartha, C., Ransfield, K., Falaoa-Rakaupai, M., Mullany, M., McKenzie, A., Penman, Z., & Langston, L. (2024). Te Whakaoreore Aromatawai Hāpai ki te Hapori: He Awa Whiria approach to assessing change in communities. In Macfarlane A H., M. Derby, & Macfarlane S. (Eds.), *He Awa Whiria* (pp. 193-207). University of Canterbury Press.
- Tricco, A. C., Zarin, W., Rios, P., Nincic, V., Khan, P. A., Ghassemi, M., ... & Langlois, E. V. (2018). Engaging policy-makers, health system managers, and policy analysts in the knowledge synthesis process: a scoping review. *Implementation Science*, 13, 1-19.
- Trinick, T., Meaney, T., Fairhall, U. (2017). Cultural and Mathematical Symmetry in Māori Meeting Houses (Whareniui). In: Rosa, M., Shirley, L., Gavarrete, M., Alanguui, W. (eds) *Ethnomathematics and its Diverse Approaches for Mathematics Education*. ICME-13 Monographs. Springer, Cham. [https://doi.org/10.1007/978-3-319-59220-6\\_10](https://doi.org/10.1007/978-3-319-59220-6_10)
- Truong, N. (2019). Aligning Education Policy with the Science of Learning and Development. *iNACOL*.
- Tunmer, W. E., & Hoover, W. A. (2019). The cognitive foundations of learning to read: A framework for preventing and remediating reading difficulties. *Australian Journal of Learning Difficulties*, 24(1), 75-93.
- United Nations Convention on the Rights of the Child (1989). [https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg\\_no=IV-11&chapter=4](https://treaties.un.org/Pages/ViewDetails.aspx?src=IND&mtdsg_no=IV-11&chapter=4)
- United Nations Sustainable Development Goals (2015). <https://sdgs.un.org/goals>
- van Bysterveldt, A. K., Gillon, G., & Foster-Cohen, S. (2010). Integrated speech and phonological awareness intervention for pre-school children with Down syndrome. *International Journal of Language & Communication Disorders*, 45(3), 320-335.

- van der Pluijijm, M., van Gelderen, A., & Kessels, J. (2019). Activities and strategies for parents with less education to promote the oral language development of their children: A review of empirical interventions. *School Community Journal*, 29(1), 317-362.
- Vega, H., Howell, E., Kaminski, R., & Bates, C. C. (2024). Reaching teachers of early multilingual learners through professional development: a systematic literature review. [Journal Name].
- Von Hagen, A., Kohnen, S., & Stadie, N. (2020). Foreign Language Attainment of Children/Adolescents with Poor Literacy Skills: a Systematic Review and Meta-analysis. *Educational Psychology Review*, 1-31.
- von Hagen, A., Kohnen, S., & Stadie, N. (2021). Foreign language attainment of children/adolescents with poor literacy skills: A systematic review and meta-analysis. *Educational Psychology Review*, 33(2), 459-488. <https://doi.org/10.1007/s10648-020-09566-6>
- Wakeman, S. Y., Karvonen, M., Flowers, C., & Ruhter, L. (2021). Alternate assessments and monitoring student progress in inclusive classrooms. In *Handbook of Effective Inclusive Elementary Schools* (pp. 302-321). Routledge.
- Wang, A., Hamlett, C. L., Jordan, N. C., Siegler, R. S., & Changas, P. (2015). Effects of intervention to improve at-risk fourth graders' fraction knowledge. *Journal of Educational Psychology*, 107(3), 628-649.
- Wang, Z., Colomer Feliu, J., García-Aracil, A., Spycher, P., & Kim, Y. (2022). A Systematic Review of Effective Instructional Interventions in Supporting Kindergarten English Learners' English Oral Language Development. *Early Childhood Education Journal*, 50(2), 231-247.
- Wanzek, J., Vaughn, S., Scammacca, N., Gatlin, B., Walker, M. A., Capin, P., ... & O'Connor, R. E. (2016). Meta-Analyses of the Effects of Tier 2 Type Reading Interventions in Grades K-3. *Educational Psychology Review*, 28(3), 551-576.
- Washburn, J. (2021). Reviewing Evidence on the Relations Between Oral Reading Fluency and Reading Comprehension for Adolescents.
- Washburn, J. (2022). Reviewing evidence on the relations between oral reading fluency and reading comprehension for adolescents. *Journal of Learning Disabilities*, 55(1), 22-42. <https://doi.org/10.1177/00222194211045122>
- Watt, S. J., & Therrien, W. J. (2016). Examining a Preteaching Framework to Improve Fraction Computation Outcomes Among Struggling Learners. *Preventing School Failure: Alternative Education for Children and Youth*, 60(4), 311-320.
- Weingarten, Z., Zumeta Edmonds, R., & Arden, S. (2020). Better Together: Using MTSS as a Structure for Building School-Family Partnerships. *TEACHING Exceptional Children*, 53(2), 122-130. <https://doi.org/10.1177/0040059920937733>
- West, G., Lervåg, A., Birchenough, J. M., Korell, C., Rios Diaz, M., Duta, M., ... & Hulme, C. (2024). Oral language enrichment in preschool improves children's language skills: a cluster randomised controlled trial. *Journal of Child Psychology and Psychiatry*.
- West, G., Lervåg, A., Snowling, M. J., Buchanan-Worster, E., Duta, M., & Hulme, C. (2022). Early language intervention improves behavioral adjustment in school: Evidence from a cluster randomized trial. *Journal of Child Psychology and Psychiatry*.
- West, G., Snowling, M. J., Lervåg, A., Buchanan-Worster, E., Duta, M., Hall, A., ... & Hulme, C. (2021). Early language screening and intervention can be delivered successfully at scale: evidence from a cluster randomized controlled trial. *Journal of Child Psychology and Psychiatry*, 62(12), 1425-1434.
- Westerveld, M. F., Gillon, G. T., & Moran, C. (2008). A longitudinal investigation of oral narrative skills in children with mixed reading disability. *International Journal of Speech-Language Pathology*, 10(3), 132-145.
- Whitehead, D. (2010). The year after: sustaining the effects of literacy professional development in New Zealand secondary schools. *Language and Education*, 24(2), 133-149.
- Wiliam, D. (2011). *Embedded formative assessment*. Solution tree press.
- Williams, K. J., Austin, C. R., & Vaughn, S. (2018). A synthesis of spelling interventions for secondary students with disabilities. *Remedial and Special Education*, 39(5), 295-308.
- Williamson (2020). Virtual training events keep practitioners connected. Available at: [https://www.corrections.govt.nz/news/2020/virtual\\_training\\_events\\_keep\\_practitioners\\_connected](https://www.corrections.govt.nz/news/2020/virtual_training_events_keep_practitioners_connected)
- Williamson, A. (2022). Culturally and Linguistically Responsive Teaching Practices for English Learners. Available at: [https://digitalcommons.csp.edu/cgi/viewcontent.cgi?article=1058&context=teacher-education\\_masters](https://digitalcommons.csp.edu/cgi/viewcontent.cgi?article=1058&context=teacher-education_masters)
- Winstanley M., Webb R. T., Conti-Ramsden G. (2018). More or less likely to offend? Young adults with a history of identified developmental language disorders. *International Journal of Language & Communication Disorders*, 53, 256-270.
- Wright, T. S., & Cervetti, G. N. (2017). A systematic review of the research on vocabulary instruction that impacts text comprehension. *Reading Research Quarterly*, 52(2), 203-226. <https://doi.org/10.1002/rrq.163>
- Yorke, A.M., Gosnell-Caron, A., Pukys, N., Sternad, E., Grecol, C., & Shermak, C. (2021). Foundational Reading Interventions Adapted for Individuals Who Require Augmentative and Alternative Communication (AAC): a Systematic Review of the Research. *Journal of Developmental and Physical Disabilities*, 33: 537-582.
- Young, A. R., Beitchman, J. H., Johnson, C., Douglas, L., Atkinson, L., Escobar, M., & Wilson, B. (2002). Young adult academic outcomes in a longitudinal sample of early identified language impaired and control children. *Journal of Child Psychology and Psychiatry*, 43(5), 635-645.
- Zhang, S., Prykanowski, D. A., & Koppenhaver, D. A. (2022). Reading comprehension instruction for students with autism spectrum disorder: A systematic review and meta-analysis. *Exceptional Children*, 88(3), 271-292.
- Zhang, S., Prykanowski, D.A., & Koppenhaver, D.A. (2023). Using Construction-Integration Theory to Interpret Reading Comprehension Instruction for Students with Autism Spectrum Disorder: A Systematic Review and Meta-Analysis. *Reading Research Quarterly*, 58 (1): 126-159.
- Zhang, J., Rispoli, M., Xin, Y. P., Sulu, M. D. (2022). Mathematics interventions for secondary students with autism spectrum disorder: A review of research quality. *Education and Training in Autism and Developmental Disabilities*. 57(3), 247-260.
- Zhang, Z., Xu, Q., & Joshi, R. M. (2019). A meta-analysis on the effectiveness of intervention in children with primary speech and language delays/disorders: Focusing on China and the United States. *International Journal of Language & Communication Disorders*, 54(5), 725-744.

# Appendix Tables for Meta-analyses Systematic Reviews

The tables in this appendix have been generated using ELICIT Research Assistant AI (Paid premium subscription version with full capabilities).

This software extracts data from research articles that we have uploaded into the software following our systematic search of meta-analyses and systematic reviews using academic and search engines such as Scopus. The software allows the researcher to click on detail within the tables to be taken to the relevant point in the published paper to confirm the accuracy of information presented in the table.

## Contents

Appendix A: Oral Language . . . . .	81
Table 1: Oral Language - Multicomponent . . . . .	81
Table 2: Oral Language - Vocabulary . . . . .	95
Table 3: Oral Language - English Language Learners. . . . .	100
Appendix B: Reading and Writing . . . . .	103
Table 4: Early Reading . . . . .	103
Table 5: Dyslexia – Primary Years . . . . .	122
Table 6: Dyslexia – Secondary Years . . . . .	131
Table 7: Dyslexia – English Language Learners. . . . .	138
Table 8: Writing and Spelling. . . . .	143
Table 9: Children with Complex Needs – Phonological Awareness, Phonics, and Word Reading. . . . .	152
Table 10: Children with Complex Needs – Reading Comprehension, Shared Reading, and Narrative Instruction. . . . .	158
Appendix C: Mathematics . . . . .	168
Table 11: Mathematics . . . . .	168
Table 12: Mathematics – Children with Complex Needs . . . . .	176

## Appendix A: Oral Language

Table 1: Oral Language - Multicomponent

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Carretti, B., Lara-Diaz, M. F., Grigorenko, E., Fan, S., Ma, B., Song, X., & Wang, Y. (2022). Effect of language therapy alone for developmental language disorder in children: A meta-analysis. <i>Frontiers in Psychology</i> , 13, 922866.	15	<ul style="list-style-type: none"> <li>• Children aged 18 months to 12 years</li> <li>• More common in males than females (sex ratio of 1.2:1)</li> <li>• No general developmental disorders indicative of a language disorder</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic search of databases: PubMed, Cochrane Library, Wanfang Database, CNKI</li> <li>• Inclusion of randomised controlled trials</li> <li>• Data analysis with RevMan software</li> <li>• Detailed search strategy with specific free-text terms</li> <li>• Outcomes defined across various linguistic levels</li> <li>• Initial identification of 2,623 publications, filtered to 2,167 after removing duplicates</li> <li>• Application of strict inclusion/exclusion criteria</li> </ul>	<ul style="list-style-type: none"> <li>• Language intervention has a positive immediate effect at most levels of expressive language.</li> <li>• Long-term effects of language therapy on DLD are unsatisfactory.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall expressive language development:               <ul style="list-style-type: none"> <li>- Intervention: SMD = 0.46 (95% CI: 0.12-0.80, p = 0.008)</li> </ul> </li> <li>• Overall expressive vocabulary development:               <ul style="list-style-type: none"> <li>- Intervention: SMD = 0.43 (95% CI: 0.17-0.69, p = 0.001)</li> </ul> </li> <li>• Overall receptive language development:               <ul style="list-style-type: none"> <li>- Intervention: SMD = 0.24 (95% CI: -0.04-0.51, p = 0.09)</li> </ul> </li> <li>• Long-term effects on overall expressive language development:               <ul style="list-style-type: none"> <li>- Intervention: SMD = 0.14 (95% CI: -0.11-0.38, p = 0.28)</li> </ul> </li> <li>• Long-term effects on overall receptive language development:               <ul style="list-style-type: none"> <li>- Intervention: SMD = 0.19 (95% CI: -0.04-0.42, p = 0.10)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Cirrin, F. M., &amp; Gillam, R. B. (2008). Language Intervention Practices for School-Age Children With Spoken Language Disorders: A Systematic Review. <i>Language, Speech, and Hearing Services in Schools</i>, 39, S110-S137.</p>	<p>21</p>	<ul style="list-style-type: none"> <li>• school-age children (year 0 through year 12)</li> <li>• children over the age of 5</li> <li>• children with specific language impairment (SLI) or language learning disability (LLD)</li> <li>• children with moderate to severe language impairments</li> <li>• children with receptive language impairments</li> <li>• participants aged between 6;11 and 8;11 years</li> <li>• participants aged between 8 and 14 years</li> <li>• year 0 students aged 5 to 6 years</li> <li>• recruited from special language education schools and special classes within mainstream schools</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted computer searches of electronic databases.</li> <li>• Included studies focusing on experimental measures of language intervention outcomes.</li> <li>• Considered a broad range of experimental studies including specific methods, service delivery models, and dosage.</li> <li>• Focused on school-age students with primary disabilities in oral language.</li> <li>• Included randomised clinical trials (RCTs), meta-analyses of RCTs, systematic reviews of RCTs, nonrandomised comparison studies, or multiple-baseline single-subject design studies.</li> <li>• Studies had to be published since 1985 in peer-reviewed journals.</li> <li>• Calculated and reported effect sizes when sufficient data were provided.</li> <li>• Initial search yielded 593 reports; after applying selection criteria, 21 studies met all criteria.</li> </ul>	<ul style="list-style-type: none"> <li>• The systematic review revealed a significant gap in high-quality research evidence on language intervention practices for school-age children with spoken language disorders.</li> <li>• Only 21 studies met the criteria for inclusion, indicating a lack of comprehensive guidelines for clinical practice.</li> <li>• There is insufficient high-quality evidence to guide evidence-based practice for SLPs working with school-age children with language disorders.</li> </ul>	<p>Syntax and Morphology:</p> <ul style="list-style-type: none"> <li>• Modeling and modeling plus evoked production: PND between .64 and 1.00 (moderate to large effect size)</li> <li>• Imitation instructions: Morpheme production probes: <math>d = .78</math>; Morpheme comprehension probes: <math>d = 1.3</math> (large effects)</li> <li>• Computerised intervention treatments: Sentence comprehension: <math>d = .37</math> to <math>.77</math>; Story comprehension: <math>d = -.03</math> to <math>-.84</math>; MLU: <math>d = -.03</math> to <math>-.84</math></li> </ul> <p>Semantics and Vocabulary:</p> <ul style="list-style-type: none"> <li>• Phonologically based treatment strategy: TWF scores: <math>d = .7</math> (moderately large)</li> <li>• Semantic-based treatment strategy: TWF scores: <math>d = .6</math> (moderately large)</li> <li>• Mediated learning and bridging strategies: Large positive effects</li> <li>• CRS treatment group: CREVT expressive scores: <math>d = .5</math> (moderate)</li> <li>• Collaborative, classroom-based, traditional pull-out models: <math>d = 1.2</math> to <math>3.5</math> (large)</li> <li>• Slow rate presentation: Production and comprehension probes: <math>d = 1.1</math> (large); Emphatic stress: Lexical production: <math>d = .74</math> (moderate); Lexical comprehension: no effect</li> </ul> <p>Phonological Awareness:</p> <ul style="list-style-type: none"> <li>• Treatment group vs control: <math>d = 1.5</math> SD better (large)</li> <li>• Phonological awareness training: <math>d = .67</math> to <math>1.77</math> (moderately high to high)</li> </ul>

					<ul style="list-style-type: none"> <li>Phoneme manipulation probes: 85% above baseline; Encoding probes: 98% above baseline</li> <li>Phonological awareness computer games: <math>d = .29</math> (small)</li> </ul> <p>Language Processing:</p> <ul style="list-style-type: none"> <li>FFW-L vs control: <math>d = .27</math> to <math>.09</math> (small to trivial)</li> <li>Gillam et al.: Language gains: <math>d = .56</math> to <math>.79</math> (moderate); Follow-up: <math>d = .93</math> to <math>1.34</math> (large)</li> </ul>
--	--	--	--	--	---

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Dobinson, K. L., & Dockrell, J. E. (2021). Universal strategies for the improvement of expressive language skills in the primary classroom: A systematic review. Educational Review, 1-25.	31	<ul style="list-style-type: none"> <li>Children aged 4-7</li> <li>Equal representation of male and female participants</li> <li>Majority African American (47%), followed by White/Caucasian (26%) and Hispanic/Latino (17%)</li> <li>Some participants with special educational needs (SEND)</li> <li>Some participants receiving language support or at risk of language/reading problems</li> <li>Participants from economically deprived areas</li> </ul>	<ul style="list-style-type: none"> <li>Followed PRISMA guidelines for systematic reviews.</li> <li>Conducted systematic searches using specific Boolean search terms.</li> <li>Screened 44,709 papers in two stages: titles/abstracts and full texts.</li> <li>Used EPPI Reviewer 4 for data collation and removal of duplicates.</li> <li>Employed a data extraction form based on EPPI-Centre guidelines.</li> <li>Conducted a domain-based risk assessment using an adapted Cochrane tool.</li> <li>Grouped extracted data by variables and quantified the evidence base.</li> </ul>	<ul style="list-style-type: none"> <li>The majority of the 31 studies reviewed reported significant positive impacts on expressive language skills.</li> <li>Interactive Book Reading (IBR) generally showed positive outcomes.</li> <li>Manualised curricula and whole-class instruction led by SLTs significantly improved expressive language skills.</li> </ul>	<ul style="list-style-type: none"> <li>Interactive Book Reading (IBR): <ul style="list-style-type: none"> <li>General vocabulary (small group): <math>d = 1.12</math> (Simsek &amp; Erdogan, 2015)</li> <li>General vocabulary (whole class): <math>d = 0.62</math> (Okyay &amp; Kandir, 2017)</li> <li>Specifically targeted vocabulary (whole class): <math>d = 2.00</math> (Opel et al., 2009)</li> <li>Specifically targeted vocabulary (small group): <math>d = 0.66</math> (Lever &amp; Sénéchal, 2011)</li> </ul> </li> <li>Narrative competence: retelling <math>d = 0.28</math>, production <math>d = 0.38</math> (Lever &amp; Sénéchal, 2011)</li> <li>Professional Development: <ul style="list-style-type: none"> <li>Narrative competence: omnibus story grammar measure: <math>d = 0.33</math> (Snow et al., 2013)</li> </ul> </li> <li>Play-based Teaching: <ul style="list-style-type: none"> <li>Narrative competence: length <math>d = 3.32</math>, linguistic coherence <math>d = 4.4</math>, narrative complexity <math>d = 0.61</math> (Baumer et al., 2005)</li> <li>Narrative retell abilities: <math>d = 0.87</math> (Stagnitti et al., 2016)</li> </ul> </li> <li>Vocabulary Games: <ul style="list-style-type: none"> <li>Acquisition of target vocabulary: <math>d = 0.54</math> (Hassinger-Das et al., 2016)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Donolato, E., Toffalini, E., Rogde, K., Nordahl-Hansen, A., Lervåg, A., Norbury, C., & Melby-Lervåg, M. (2022). Oral language interventions can improve language outcomes in children with neurodevelopmental disorders: A systematic review and meta-analysis. <i>Journal of Child Psychology and Psychiatry</i> .	42	<ul style="list-style-type: none"> <li>• children aged 2 to 18 years</li> <li>• majority male (median percentage of 75%)</li> <li>• diagnosed with Developmental Language Disorder, autism, intellectual disability, Down syndrome, Fragile X syndrome, or Williams syndrome</li> <li>• mean non-verbal IQ of approximately 84.68</li> <li>• average global language level at baseline of approximately 80.93</li> <li>• includes both clinically diagnosed children and those with language difficulties without a formal diagnosis</li> </ul>	<ul style="list-style-type: none"> <li>• Electronic search conducted up to April 2022.</li> <li>• Intervention studies targeting language skills in children aged 2 to 18 with specific neurodevelopmental disorders.</li> <li>• Control groups included business-as-usual, waiting list, passive or active conditions.</li> <li>• Eligible interventions included explicit and structured activities and implicit and broad activities.</li> <li>• Data collection involved screening 8195 records, leading to full-text examinations of 448 records.</li> </ul>	<ul style="list-style-type: none"> <li>• Oral language interventions can improve language skills in children with neurodevelopmental disorders.</li> <li>• These interventions yield moderate effects at post-test and smaller effects at follow-up.</li> <li>• The quality of evidence is unclear due to poor reporting and potential publication bias.</li> </ul>	<ul style="list-style-type: none"> <li>• Post-test effect size: <math>d = 0.27</math> [95% CI: 0.15, 0.38]</li> <li>• Follow-up effect size: smaller but still positive and statistically significant after an average of 6 months</li> <li>• Bias-corrected post-test effect size: <math>d = -0.13</math> [95% CI: -0.45, 0.19], <math>p = 0.439</math> (not significant)</li> <li>• Bias-corrected follow-up effect size: <math>d = -0.34</math> [-0.82, 0.13], <math>p = 0.159</math> (not significant)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Goldfeld, S., Beatson, R., Watts, A., Snow, P., Gold, L., Le, H., ... & Le, H. N. (2021). Tier 2 oral language and early reading interventions for preschool to grade 2 children: a restricted systematic review. Restricted systematic review.	55	<ul style="list-style-type: none"> <li>• children aged 4-9 years</li> <li>• attending mainstream education settings</li> <li>• identified as at-risk or experiencing oral language or reading difficulties</li> <li>• majority from North America (84%)</li> <li>• smaller percentages from the United Kingdom (9%), New Zealand (4%), Australia (2%), and the Netherlands (2%)</li> </ul>	<ul style="list-style-type: none"> <li>• Study protocol registered with PROSPERO.</li> <li>• Comprehensive literature search across multiple databases and registers.</li> <li>• Search strategy developed using a PICO-based framework.</li> <li>• Clear inclusion criteria for selecting relevant studies.</li> <li>• Data extraction by an experienced reviewer covering various aspects.</li> <li>• Risk of bias evaluated using an 11-item checklist.</li> <li>• Evidence rating system used to shortlist interventions.</li> <li>• Narrative synthesis of findings presented.</li> </ul>	<ul style="list-style-type: none"> <li>• The review identified six small-group Tier 2 interventions with strong evidence for improving oral language or reading outcomes in young children.</li> <li>• Effective interventions typically involved small groups of 3-5 students, frequent sessions, a minimum duration of 11 weeks, and a combination of skills in the content.</li> <li>• These findings aim to guide future interventions and inform educators and policymakers.</li> </ul>	<ul style="list-style-type: none"> <li>• Early Reading Intervention: <ul style="list-style-type: none"> <li>- WRMT subscales: 0.54 to 0.76 at immediate post-test (significant)</li> <li>- WRMT subscales: 0.39 to 0.64 at 1-year follow-up (significant)</li> </ul> </li> <li>• Responsive Reading Intervention: <ul style="list-style-type: none"> <li>- TOWRE: 0.44 (significant)</li> <li>- WJIII subscales: 0.63 (significant)</li> </ul> </li> <li>• General findings: <ul style="list-style-type: none"> <li>- Effect sizes ranged from very small (&lt;0.20) to quite large (2.17)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Goldfeld, S., Snow, P., Eadie, P., Munro, J., Gold, L., Le, H. N. D., Orsini, F., Connell, J., Watts, A., & Barnett, T. (2022). Classroom Promotion of Oral Language: Outcomes From a Randomised Controlled Trial of a Whole-of-Classroom Intervention to Improve Children's Reading Achievement. <i>American Educational Research Journal</i> , 23328584221131530.	Not applicable	<ul style="list-style-type: none"> <li>Total students: 1,360</li> <li>Gender: Approximately equal distribution of male and female</li> <li>Average age: 5.4 years</li> <li>Health status: Majority in excellent/very good health</li> <li>Aboriginal and Torres Strait Islander status: Small percentage</li> <li>Language background other than English: Significant portion</li> <li>Home language: Majority spoke English</li> <li>Nationality: Majority Australian born</li> <li>Preschool/year 0 attendance: High percentage</li> <li>Socio-economic status: Considerable portion from disadvantaged backgrounds</li> <li>Mother's education: Varied, with many having completed some high school</li> </ul>	<ul style="list-style-type: none"> <li>Cluster randomised controlled trial (RCT) with 1,360 students.</li> <li>Intervention: Four days of face-to-face professional learning (PL) for teachers over ten months.</li> <li>Supplementary components: Online learning network and CPOL implementation coaches.</li> <li>Control group: Usual teaching practices.</li> <li>Primary outcome: Student reading ability at year 3 using NAPLAN reading scores.</li> <li>Secondary outcomes: Oral language, reading comprehension, mental health at years 1 and 3.</li> <li>Data collection: School census data, SEHQ questionnaires, ICSEA values, EOI assessments, NAPLAN scores.</li> </ul>	<ul style="list-style-type: none"> <li>No differences were detected between the intervention and control arms in terms of student outcomes.</li> <li>The CPOL intervention did not improve oral language, literacy, mental health, numeracy, reading, or writing skills compared to usual teaching practice.</li> <li>The intervention was not cost-effective in improving student outcomes within the two-year timeframe.</li> </ul>	<ul style="list-style-type: none"> <li>NAPLAN Reading score at year 3: <ul style="list-style-type: none"> <li>- Intervention: 423.52 (SD 86.61)</li> <li>- Control: 426.59 (SD 87.77)</li> <li>- Adjusted difference: -12.90 [-36.47; 10.67]; <math>p = 0.283</math> (non-significant)</li> </ul> </li> <li>Reading comprehension at year 1: No significant difference</li> <li>Oral language at year 1: No significant difference</li> <li>Mental health at year 1: No significant difference</li> <li>Writing skills at year 3: No significant difference</li> <li>Language at year 3: No significant difference</li> <li>Numeracy at year 3: No significant difference</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Hwang, H., Cabell, S. Q., & Joyner, R. E. (2021). Effects of Integrated Literacy and Content-area Instruction on Vocabulary and Comprehension in the Elementary Years: A Meta-analysis. <i>Journal of Educational Psychology</i> .	35	<ul style="list-style-type: none"> <li>• primary school students (year 0 through year 5)</li> <li>• large sample size (13,289 students)</li> <li>• majority from minoritised groups (66%)</li> <li>• majority eligible for lunch services (62%)</li> <li>• notable percentage with reading or learning difficulties (16%)</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic search of literature using ERIC, PsychInfo, and ProQuest Dissertations &amp; Theses Global.</li> <li>• Calculation of standardised mean differences at posttest (Cohen's d).</li> <li>• Use of random-effects models to combine effect sizes.</li> <li>• Incorporation of robust variance estimation using Robumeta statistical package in R.</li> <li>• Conducting meta-regression analyses for potential moderators.</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated literacy and content-area instruction significantly improved vocabulary (ES = 0.91) and comprehension (ES = 0.40) in primary students.</li> <li>• Standardised comprehension outcomes showed a significant positive effect (ES = 0.25), but standardised vocabulary outcomes did not.</li> <li>• Integrated instruction also significantly enhanced content knowledge (ES = 0.89).</li> </ul>	<ul style="list-style-type: none"> <li>• Vocabulary: <ul style="list-style-type: none"> <li>- Overall: ES = 0.91 (p &lt; .01)</li> <li>- Standardised: ES = 0.64 (p = .42, not significant)</li> <li>- Researcher-developed: ES = 0.86 (p &lt; .01)</li> </ul> </li> <li>• Comprehension: <ul style="list-style-type: none"> <li>- Overall: ES = 0.40 (p &lt; .001)</li> <li>- Standardised: ES = 0.25 (p &lt; .05)</li> <li>- Researcher-developed: ES = 0.54 (p &lt; .01)</li> </ul> </li> <li>• Content Knowledge: <ul style="list-style-type: none"> <li>- Overall: ES = 0.89 (p &lt; .001)</li> <li>- Standardised: ES = 0.68 (p = .13, not significant)</li> <li>- Researcher-developed: ES = 0.94 (p &lt; .001)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Law, J., Garrett, Z., & Nye, C. (2003). The efficacy of treatment for children with developmental speech and language delay/disorder: A meta-analysis. <i>Journal of Speech, Language, and Hearing Research</i> , 46(5), 924-943.	13	-	<ul style="list-style-type: none"> <li>• Meta-analysis of interventions for children with primary developmental speech and language delays/disorders.</li> <li>• Participants randomly assigned to experimental/control groups; other designs excluded.</li> <li>• Included children/adolescents with primary speech/language difficulties.</li> <li>• Outcomes related to speech/expressive/receptive phonology, syntax, vocabulary.</li> <li>• Interventions coded by administrator type, intensity, duration, interactive/directive nature.</li> <li>• Effect sizes calculated using SMD; combined using DerSimonian and Laird random effects model.</li> </ul>	<ul style="list-style-type: none"> <li>• Speech and language therapy is effective for children with phonological or expressive vocabulary difficulties.</li> <li>• There is mixed evidence for the effectiveness of intervention for children with expressive syntax difficulties and limited evidence for receptive language difficulties.</li> <li>• No significant differences were found between interventions administered by trained parents and those administered by clinicians.</li> </ul>	<ul style="list-style-type: none"> <li>• Expressive phonology: <ul style="list-style-type: none"> <li>- Overall development: <ul style="list-style-type: none"> <li>- Combined effect size: SMD = 0.44 (CI = 0.01–0.86)</li> </ul> </li> </ul> </li> <li>• Expressive vocabulary: <ul style="list-style-type: none"> <li>- Overall development: <ul style="list-style-type: none"> <li>- Combined effect size: SMD = 0.98 (CI = -0.59–2.56)</li> </ul> </li> <li>- Different words in language sample: <ul style="list-style-type: none"> <li>- Combined effect size: SMD = 1.08 (CI = 0.61–1.55)</li> </ul> </li> </ul> </li> <li>• Parent report of vocabulary: <ul style="list-style-type: none"> <li>- Combined effect size: SMD = 0.89 (CI = 0.21–1).</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Rinaldi, S., Caselli, M. C., Cofelice, V., D'amico, S., De Cagno, A. G., Della Corte, G., ... & Michelazzo, L. (2021). Efficacy of the Treatment of Developmental Language Disorder: A Systematic Review. <i>Brain Sciences</i> , 11(3), 407.	27	<ul style="list-style-type: none"> <li>• Preschool and primary school children up to 8 years old</li> <li>• Diagnosed with Developmental Language Disorder (DLD)</li> <li>• No cognitive delay, deafness, autism spectrum disorders, genetic syndromes, neurological deficits, pervasive developmental disorders, traumatic brain injuries, primary disorders (sensory, neurological, psychiatric), dysphonia, dysarthria, dysrhythmias or stuttering, dyslalias or specific speech articulation disorder, or bilingualism</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic analysis of interventions for DLD.</li> <li>• Included systematic reviews, meta-analyses of RCTs, and control group cohort studies.</li> <li>• Followed PRISMA guidelines and used PICO approach.</li> <li>• Comprehensive literature search across multiple databases until December 2020.</li> <li>• Screening by two independent reviewers; data extraction and quality evaluation by three independent reviewers.</li> <li>• Used AMSTAR 2 checklist for internal validity of systematic reviews.</li> <li>• Assessed biases in RCTs based on Cochrane Collaboration criteria.</li> <li>• Evaluated external validity based on transferability to clinical practice.</li> <li>• Presented characteristics of studies in tables; narrative results due to data heterogeneity.</li> </ul>	<ul style="list-style-type: none"> <li>• Early intensive intervention in young children positively affects phonological expressive and receptive skills, with medium-term maintenance.</li> <li>• There is limited evidence for the effectiveness of interventions on expressive vocabulary and no evidence for receptive vocabulary.</li> <li>• Interventions on morphological and syntactic skills are effective for expressive skills but not for receptive skills, with some inconsistent results.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonological expressive skills: <ul style="list-style-type: none"> <li>- No treatment: SMD = 0</li> <li>- Intervention: SMD = 0.44 (95% CI: 0.01, 0.86)</li> <li>- Excluding parent-given treatments: SMD = 0.67 (95% CI: 0.19, 1.16)</li> <li>- Treatments lasting at least eight weeks: SMD = 0.74 (95% CI: 0.14, 1.33)</li> </ul> </li> <li>• Phonological receptive skills: <ul style="list-style-type: none"> <li>- No significant differences between intervention and control groups</li> </ul> </li> <li>• Expressive vocabulary: <ul style="list-style-type: none"> <li>- No intervention: SMD = 0</li> <li>- Intervention: SMD = 1.08 (95% CI: 0.61, 1.55)</li> <li>- Compared to other cognitive therapies: SMD = 0.62 (95% CI: -0.24, 1.49)</li> </ul> </li> <li>• Receptive vocabulary: <ul style="list-style-type: none"> <li>- No studies found</li> </ul> </li> <li>• Morphological and syntactic expressive skills: <ul style="list-style-type: none"> <li>- No intervention: SMD = 0</li> <li>- Intervention: SMD = 1.02 (95% CI: 0.04, 2.01) excluding severe comprehension difficulties</li> </ul> </li> <li>• Narrative skills: <ul style="list-style-type: none"> <li>- Inferential comprehension scores increased significantly from pre-to post-intervention</li> </ul> </li> <li>• Meta-phonological skills: <ol style="list-style-type: none"> <li>1. Limited evidence but indicated potential effectiveness</li> </ol> </li> <li>• General language skills: <ul style="list-style-type: none"> <li>- Mixed results with some studies showing negative results</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Sedgwick, A., & Stothard, J. (2019). A systematic review of schoolbased, mainstream, oral language interventions for key stage 1 children. <i>Support for Learning</i> , 34(1), 107-134.	17	<ul style="list-style-type: none"> <li>• Children aged 5 to 7</li> <li>• Majority with speech, language, and communication needs (SLCN)</li> <li>• Some from areas of high socioeconomic deprivation</li> <li>• Excludes children with English as an additional language</li> <li>• Some identified as 'at risk of reading failure'</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review of literature on school-based oral language interventions for KS1 children.</li> <li>• Data reported using PRISMA guidelines.</li> <li>• 681 records identified through database searching; additional records from manual searches.</li> <li>• 21 potentially relevant papers identified after removing duplicates and screening titles/abstracts.</li> <li>• Full texts read to ensure they met inclusion criteria: published within last ten years, written in English, quantitative studies, peer-reviewed.</li> <li>• Interventions related to oral language, deliverable by school staff in mainstream settings.</li> <li>• Population: children aged 5 to 7 with SLCN, educated in mainstream settings.</li> <li>• Ten studies meeting criteria included in final synthesis.</li> </ul>	<ul style="list-style-type: none"> <li>• Nine studies reported significant positive effects of the intervention on children's language skills.</li> <li>• Non-specialist staff can effectively deliver these interventions with proper training and adherence to the program.</li> <li>• Both general oral language interventions and specific vocabulary acquisition interventions are effective in improving KS1 pupils' oral language skills.</li> </ul>	<ul style="list-style-type: none"> <li>• General language skills/specific vocabulary acquisition: Significant positive effects in nine studies.</li> <li>• Small group interventions: All five studies showed significant positive effects.</li> <li>• Targeted support intervention (ART) vs. control group (ARC): ART children had higher post-test scores on receptive and contextual measures of word knowledge.</li> <li>• Expressive and receptive measures: Significant difference for anchored and extended instructions over embedded instruction; no significant difference between extended and anchored although anchored was higher.</li> <li>• Delayed post-test: Differences between extended and embedded were no longer significant for receptive measures; differences between extended and anchored had become significant.</li> <li>• Expressive and receptive target word knowledge: Significant positive effects based on TOLD's oral vocabulary and picture vocabulary subtests.</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Silverman, R. D., Johnson, E., Keane, K., & Khanna, S. (2021). Beyond Decoding: A Meta-Analysis of the Effects of Language Comprehension Interventions on K-5 Students' Language and Literacy Outcomes. <i>Review of Educational Research</i> , 91(4), 547-587.	43	<ul style="list-style-type: none"> <li>• K-5 students</li> <li>• Diverse racial/ethnic composition: 38% Caucasian, 35% Hispanic, 24% African American, 4% Asian</li> <li>• High or mid-high poverty samples</li> <li>• Included English learners</li> <li>• Included students with disabilities</li> <li>• Included students considered at risk</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic search using ERIC and PsycINFO databases.</li> <li>• Inclusion criteria: sustained language comprehension instruction (five or more sessions), focus on instruction.</li> <li>• Data extraction: recording sample sizes, means, standard deviations; coding for design, outcome, participant, intervention characteristics.</li> <li>• Coding for experimental design types (RCTs, quasi-experimental, within-subjects), control conditions (business as usual or alternative treatment), measures (custom vs. standardised).</li> <li>• Coding for sample demographics (race/ethnicity, income status, language status, disabilities).</li> <li>• Coding for intervention characteristics (duration, group size, language components addressed).</li> <li>• Calculation of effect sizes using standardised mean differences; adjustment for small sample bias.</li> </ul>	<ul style="list-style-type: none"> <li>• Language comprehension interventions have positive effects on custom measures of vocabulary, listening comprehension, and reading comprehension but not on standardised measures.</li> <li>• These interventions are particularly effective for English learners and show promise when they include multiple components or technology.</li> <li>• More research is needed to support language comprehension in underserved populations and to optimise interventions for generalisable outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Vocabulary (custom measures): <math>g = 1.27</math> (<math>p &lt; .01</math>)</li> <li>• Vocabulary (standardised measures): <math>g = 0.03</math> (<math>p = 0.17</math>)</li> <li>• Listening comprehension (custom measures): <math>g = 0.19</math> (<math>p &lt; .01</math>)</li> <li>• Listening comprehension (standardised measures): <math>g = 0.03</math> (<math>p &lt; .01</math>)</li> <li>• Reading comprehension (custom measures): <math>g = 0.68</math> (<math>p &lt; .01</math>)</li> <li>• Reading comprehension (standardised measures): <math>g = 0.08</math> (<math>p &lt; .01</math>)</li> <li>• Morphology: <math>g = 1.14</math> (<math>p &lt; .01</math>)</li> <li>• Academic language: <math>g = 0.08</math> (<math>p = .04</math>)</li> <li>• Syntax: <math>g = 0.01</math> (<math>p = .99</math>)</li> <li>• Decoding: <math>g = 0.05</math> (<math>p = .73</math>)</li> <li>• Delayed effects on vocabulary: <math>g = 0.73</math> (<math>p &lt; .01</math>)</li> <li>• Delayed effects on reading comprehension: <math>g = 0.35</math> (<math>p &lt; .01</math>)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Strong, G. K., Torgerson, C. J., Torgerson, D., & Hulme, C. (2011). A systematic meta-analytic review of evidence for the effectiveness of the 'Fast ForWord' language intervention program. <i>Journal of Child Psychology and Psychiatry</i> , 52(3), 224-235.	6	<ul style="list-style-type: none"> <li>• Children aged 6 to 12.5 years</li> <li>• English-speaking</li> <li>• Referred due to limited reading programs or language impairments</li> <li>• Excluded autistic and emotionally disturbed children</li> <li>• Normal auditory acuity and normal/corrected vision</li> <li>• Often performing below year level in reading or language skills</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review using PRISMA guidelines.</li> <li>• Comprehensive literature search across multiple databases.</li> <li>• Inclusion criteria: RCTs or quasi-experiments with baseline equivalence.</li> <li>• Screening by two independent reviewers with arbitration by a third.</li> <li>• Data extraction focused on standardised reading and language tests.</li> <li>• Quality appraisal using CONSORT-based risk of bias tool.</li> <li>• Meta-analyses comparing intervention groups with control groups.</li> </ul>	<ul style="list-style-type: none"> <li>• Metaanalyses indicated no significant effect of Fast ForWord on any outcome measure compared to control groups.</li> <li>• There is no evidence that Fast ForWord is effective for treating children's oral language or reading difficulties.</li> <li>• The study found no convincing evidence that Fast ForWord improves single word reading, passage reading comprehension, receptive language, or expressive language skills.</li> </ul>	<ul style="list-style-type: none"> <li>• Receptive Vocabulary: <ul style="list-style-type: none"> <li>- Given et al.: <ul style="list-style-type: none"> <li>- Intervention: 3.42 (9.69)</li> <li>- Control: 4.15 (11.19)</li> </ul> </li> <li>- Gillam et al.: <ul style="list-style-type: none"> <li>- Intervention: 83.0 (13.3)</li> <li>- Control: 82.1 (11.4)</li> </ul> </li> <li>- Cohen et al.: <ul style="list-style-type: none"> <li>- Intervention: 72.22 (6.04)</li> <li>- Control: 72.44 (5.77)</li> </ul> </li> <li>- Pokorni et al.: <ul style="list-style-type: none"> <li>- Intervention: 79.0 (32.6)</li> <li>- Control: 62.8 (30.4)</li> </ul> </li> </ul> </li> <li>• Expressive Vocabulary: <ul style="list-style-type: none"> <li>- Given et al.: <ul style="list-style-type: none"> <li>- Intervention: 5.25 (10.60)</li> <li>- Control: 9.15 (7.29)</li> </ul> </li> <li>- Gillam et al.: <ul style="list-style-type: none"> <li>- Intervention: 83.0 (13.3)</li> <li>- Control: 82.1 (11.4)</li> </ul> </li> <li>- Cohen et al.: <ul style="list-style-type: none"> <li>- Intervention: 68.35 (5.83)</li> <li>- Control: 68.81 (4.80)</li> </ul> </li> <li>- Pokorni et al.: <ul style="list-style-type: none"> <li>- Intervention: 72.5 (23.6)</li> <li>- Control: 62.2 (20.7)</li> </ul> </li> </ul> </li> <li>• Statistical significance: <ul style="list-style-type: none"> <li>- None of the pooled effect sizes were reliably different from zero.</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Tarvainen, S., Stolt, S., & Launonen, K. (2021). Oral language comprehension interventions in 1-8-year-old children with language disorders or difficulties: A systematic scoping review. <i>International Journal of Language &amp; Communication Disorders</i> , 56(2), 231-251.	25	<ul style="list-style-type: none"> <li>• Children aged 1-8 years</li> <li>• Diagnosed with SLI, LI, DLD, autism spectrum disorders, developmental delay, or Down syndrome</li> <li>• Described as having language delay, language difficulties, high risk for reading comprehension difficulties, low listening comprehension, low receptive vocabulary skills, or poor expressive and receptive language skills</li> <li>• No sensory impairments</li> <li>• Low socio-economic status associated with poor language skills</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic scoping review of eight databases</li> <li>• Five-stage methodological approach: identifying research question, identifying relevant studies, study selection, charting data, collating and summarising results</li> <li>• Categorisation by intervention focus, efficacy, and level of evidence</li> <li>• Inclusion criteria: participant ages <math>\leq 8</math> years, language disorder or difficulties, no sensory impairments, detailed intervention description, pre-and post-intervention assessment, peer-reviewed publication between 1996–2019, published in English</li> </ul>	<ul style="list-style-type: none"> <li>• The review identified interventions focusing on modifying the communicative environment, targeting the child's language, or targeting the child's language processing.</li> <li>• 80% of the included studies indicated positive effects on oral language comprehension.</li> <li>• The evidence base is limited, but moderate confidence can be placed in the results, suggesting that these interventions can ameliorate difficulties in oral language comprehension.</li> </ul>	<ul style="list-style-type: none"> <li>• Modifying the communicative environment: <ul style="list-style-type: none"> <li>- Roberts &amp; Kaiser (2011): Small effect size, positive effect</li> <li>- Colmar (2014): Effect size <math>d = 2.24</math>, positive effect</li> <li>- Gallagher &amp; Chiat (2009): Effect size <math>d = 1.1</math> to <math>1.3</math>, positive effect on receptive vocabulary and morphosyntax</li> <li>- van Kleeck et al. (2006): Effect size <math>d = 1.07</math>, large effect on literal language comprehension</li> </ul> </li> <li>• Targeting the child's language processing: <ul style="list-style-type: none"> <li>- Center et al. (1999): Effect size <math>d = .27</math> to <math>1.07</math>, positive effect on oral language comprehension</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Zhang, Z., Xu, Q., & Joshi, R. M. (2019). A meta-analysis on the effectiveness of intervention in children with primary speech and language delays/disorders: Focusing on China and the United States. <i>International Journal of Language &amp; Communication Disorders</i> , 54(5), 725-744.	44	<ul style="list-style-type: none"> <li>• children and adolescents with primary speech and language delays or disorders</li> <li>• age range from 16 months to school entry age (about 5 years)</li> <li>• gender distribution: 36% female, 64% male</li> <li>• diverse national origin (China, United States, France)</li> </ul>	<ul style="list-style-type: none"> <li>• Random effect model used to pool effect sizes.</li> <li>• Publication bias evaluation and moderating effect analysis conducted using CMA 2.0.</li> <li>• Inclusion criteria: peer-reviewed RCTs published between 2002-2018, involving children with primary speech and language delays/disorders.</li> <li>• Exclusion criteria: non-RCT studies, qualitative studies, insufficient data.</li> <li>• Initial search identified 2,246 articles; narrowed down to 44 after applying criteria.</li> <li>• Effect sizes calculated using Hedges' g; heterogeneity assessed using Q test, tau-squared, I<sup>2</sup> value.</li> </ul>	<ul style="list-style-type: none"> <li>• Interventions for children with primary speech and language delays/disorders show a moderate immediate effect (g = 0.70) but a small long-term effect (g = 0.23).</li> <li>• The effectiveness of interventions is significantly moderated by factors such as type of measure, language of intervention, parental involvement, intervention content, study quality, and duration of intervention.</li> <li>• More randomised controlled trials are needed to investigate the long-term effects and to explore underlying variables that moderate the effectiveness of interventions.</li> </ul>	<ul style="list-style-type: none"> <li>• Immediate effect: g = 0.70</li> <li>• Long-term effect: g = 0.23 (95% CI: -0.01 to 0.47)</li> <li>• Outcomes of Various Language Measures: <ul style="list-style-type: none"> <li>- Expressive vocabulary outcomes: g = 0.62 (p &lt; .001)</li> <li>- Expressive syntax outcomes: g = 0.46 (p &lt; .01)</li> <li>- Expressive phonology outcomes: g = 0.72 (p &lt; .01)</li> <li>- Receptive vocabulary outcomes: g = 0.40 (p = .04)</li> <li>- Receptive syntax outcomes: g = 0.35 (p = .11)</li> <li>- Receptive phonology outcomes: g = 0.57 (p &lt; .01)</li> <li>- Composite language outcomes: g = 1.12 (p &lt; .001)</li> <li>- Long-term effect: g = 0.23 (p = .06)</li> </ul> </li> </ul>

**Table 2: Oral Language - Vocabulary**

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Cervetti, G. N., Fitzgerald, M. S., Hiebert, E. H., &amp; Hebert, M. (2023). Meta-Analysis Examining the Impact of Vocabulary Instruction on Vocabulary Knowledge and Skill.</p>	<p>39</p>	<ul style="list-style-type: none"> <li>• Children in year 0 through year 5</li> <li>• Mixed racial composition (proportion of nonwhite and non-Asian students relative to the national average)</li> <li>• Mixed language status (proportion of EL students relative to the national average)</li> <li>• Mixed socioeconomic status (proportion of students who receive free or reduced-price lunch as lower or higher than average)</li> </ul>	<ul style="list-style-type: none"> <li>• Meta-analysis of 39 experimental and quasi-experimental studies.</li> <li>• Inclusion criteria: focused on vocabulary instruction, K-5 participants, control groups, peer-reviewed or dissertation.</li> <li>• Search strategy: ProQuest databases, references from previous meta-analyses.</li> <li>• Coding for instructional focus, outcome measures, study design, participant characteristics.</li> <li>• Effect sizes calculated with standardised mean difference ES (g), small sample correction.</li> <li>• Outliers identified and winsorised.</li> <li>• Multi-level, multivariate meta-regression for overall average weighted ESs.</li> <li>• Random effects model specified.</li> <li>• Publication bias tested with funnel plots, Egger’s test, Begg’s rank correlation test.</li> </ul>	<ul style="list-style-type: none"> <li>• Interventions targeting word meaning instruction do not show overall positive effects on measures of breadth of vocabulary knowledge.</li> <li>• Strategy interventions improve word-solving skills on near transfer measures but do not significantly impact overall breadth of vocabulary knowledge.</li> <li>• Direct teaching of vocabulary words may not be effective for building overall vocabulary knowledge among primary-aged students.</li> </ul>	<ul style="list-style-type: none"> <li>• Word meaning instruction on breadth of vocabulary knowledge outcomes:               <ul style="list-style-type: none"> <li>- Effect size (ES): 0.08 (p = 0.152, non-significant)</li> </ul> </li> <li>• Semantic strategy instruction on strategy outcomes:               <ul style="list-style-type: none"> <li>- Effect size (ES): 0.53 (p = 0.002, significant)</li> </ul> </li> <li>• Semantic strategy instruction on breadth of vocabulary knowledge outcomes:               <ul style="list-style-type: none"> <li>- Effect size (ES): 0.25 (p = 0.152, non-significant)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Elleman, A. M., Lindo, E. J., Morphy, P., & Compton, D. L. (2009). The Impact of Vocabulary Instruction on Passage-Level Comprehension of School-Age Children: A Meta-Analysis.	37	<ul style="list-style-type: none"> <li>• Students in grades pre-K through 12</li> <li>• First language is English</li> <li>• Includes students with and without reading difficulties</li> <li>• Socioeconomic status: Low (12.5%), Middle (18.8%), High (6.3%), Not reported (62.5%)</li> <li>• Majority of students in years 3-5 (56.3%)</li> </ul>		<ul style="list-style-type: none"> <li>• Vocabulary instruction significantly improves comprehension when custom measures are used (<math>d = 0.50</math>), but has minimal effect on standardised measures (<math>d = 0.10</math>).</li> <li>• Students with reading difficulties benefit more from vocabulary instruction in terms of comprehension (<math>d = 1.23</math>) compared to students without reading problems (<math>d = 0.39</math>).</li> <li>• Vocabulary gains are similar across different reading abilities, but the correlation between vocabulary and comprehension gains is modest (<math>r = .43</math>).</li> </ul>	<ul style="list-style-type: none"> <li>• - Comprehension Outcomes: <ul style="list-style-type: none"> <li>- Standardised measures: <math>d = 0.10</math> (<math>p = .08</math>)</li> <li>- Custom measures: <math>d = 0.50</math> (<math>p &lt; .01</math>)</li> <li>- Students with reading difficulties (custom measures): <math>d = 1.23</math></li> <li>- Students without reading difficulties (custom measures): <math>d = 0.39</math></li> </ul> </li> <li>• Vocabulary Outcomes: <ul style="list-style-type: none"> <li>- Standardised measures: <math>d = 0.29</math> (<math>p &lt; .01</math>)</li> <li>- Custom measures: <math>d = 0.79</math> (<math>p &lt; .01</math>)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Gibbs, A. S., Reed, D. K., Hong, H., Ma, J., & Urbanski, D. P. (2024). Synthesis and meta-analysis of oral language interventions on the vocabulary and listening comprehension development of young children.	16	<ul style="list-style-type: none"> <li>• children aged 3-6 years</li> <li>• at risk for reading difficulties</li> <li>• economically disadvantaged</li> <li>• English-speaking</li> </ul>	<ul style="list-style-type: none"> <li>• Conducting electronic, manual, and ancestral searches to identify relevant studies</li> <li>• Applying inclusion criteria to the 12,308 studies identified, such as focusing on 3-6 year old children at risk for reading difficulties, interventions delivered in educational settings, and outcomes related to vocabulary or listening comprehension</li> <li>• Extracting relevant information from the included studies using a code sheet</li> <li>• Calculating Hedges g effect sizes (SMDs) from the extracted assessment data</li> </ul>	<ul style="list-style-type: none"> <li>• OL instruction significantly improved children's vocabulary and listening comprehension, with a multivariate weighted average SMD of 0.52.</li> <li>• The interventions were feasible for classroom teachers to implement effectively.</li> <li>• Vocabulary outcomes showed larger effect sizes compared to listening comprehension, particularly when measured with researcher-developed assessments.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect on vocabulary and LC: SMD = 0.52 (95% CI = 0.29 - 0.76), p &lt; 0.001</li> <li>• Effect on LC: SMD = 0.36 (95% CI = 0.08 - 0.64), p = 0.014</li> <li>• Effect on vocabulary: SMD = 0.57 (95% CI = 0.29 - 0.85), p = 0.001</li> <li>• Effect of researcher-developed outcome measures: SMD = 0.69 (95% CI = 0.41 - 0.97), p &lt; 0.001</li> <li>• Effect of standardised outcome measures: SMD = 0.30 (95% CI = 0.11 - 0.50), p = 0.005</li> </ul>
Hadley, E. B., & Mendez, K. Z. (2021). Early Childhood Research Quarterly Review A systematic review of word selection in early childhood vocabulary instruction.	76	<ul style="list-style-type: none"> <li>• Children in preschool or kindergarten</li> <li>• Majority pre-K (63.2%)</li> <li>• Significant proportion of dual language learners (DLLs)</li> <li>• Majority from low socioeconomic status (SES) backgrounds (59.2%)</li> </ul>	<ul style="list-style-type: none"> <li>• Inclusion criteria: preschool/ kindergarten participants, English-speaking setting, intervention implemented by teacher/researcher/ interventionist, no diagnosed developmental disabilities, intentional teaching of new content and assessment of learning, vocabulary words taught during study, words selected by researchers.</li> <li>• Search strategy: Web of Science, PsycInfo, ERIC, Scopus databases with specific search terms.</li> <li>• Data sources: English Lexicon Project database, Kuperman et al. (2012) for age of acquisition, Corpus of Contemporary American English for frequency.</li> </ul>	<ul style="list-style-type: none"> <li>• The most common method for selecting target words was the BMK Tier System, particularly Tier 2 words.</li> <li>• The majority of target words were nouns and concrete words.</li> <li>• There was a significant use of narrative contexts for teaching words.</li> </ul>	<ul style="list-style-type: none"> <li>• All studies reported statistically significant effects on at least one measure of child vocabulary knowledge.</li> <li>• Meta-analysis by Marulis and Neuman (2010): positive effect size (g = 0.88) for early childhood vocabulary interventions.</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Marulis, L. M., & Neuman, S. B. (2010). The effects of vocabulary intervention on young children's word learning: A meta-analysis. <i>Review of Educational Research</i> , 80(3), 300-335.	67	<ul style="list-style-type: none"> <li>• Children aged birth through 9 (primarily pre-K and kindergarten)</li> <li>• No mental, physical, or sensory handicaps</li> <li>• English-speaking</li> <li>• Includes both low SES and middle to high SES groups</li> <li>• Includes at-risk children</li> </ul>	<ul style="list-style-type: none"> <li>• Meta-analysis examining vocabulary interventions on children's receptive and expressive language.</li> <li>• Inclusion criteria: intervention to increase word learning, (quasi)experimental design, participants aged birth through 9 without handicaps, conducted in English, measured word learning outcomes.</li> <li>• Comprehensive search in multiple databases.</li> <li>• Citations managed using Endnote and underwent exclusion coding.</li> <li>• Effect sizes calculated using Comprehensive Meta-Analysis program and standardised by change score SDs.</li> <li>• Hedges's g used for effect size estimates.</li> <li>• Random effects model used to address heterogeneity.</li> <li>• Mean effect size per study used to avoid dependency in effect size data.</li> <li>• Fail-safe N calculated to ensure robustness of results.</li> </ul>	<ul style="list-style-type: none"> <li>• Vocabulary interventions had a significant positive impact on young children's word learning with an overall effect size of .88.</li> <li>• Interventions were more effective when delivered by trained adults and using combined explicit and implicit instructional methods.</li> <li>• Middle- and upper-income at-risk children benefited more from the interventions than poor at-risk children, but the interventions were not sufficient to close the vocabulary gap.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size: <ul style="list-style-type: none"> <li>- Vocabulary intervention: <math>g = .88</math> (<math>p &lt; .0001</math>)</li> </ul> </li> <li>• Effect sizes by delay in posttest: <ul style="list-style-type: none"> <li>- Immediate posttest: <math>g = .88</math></li> <li>- Delayed posttest: <math>g = 1.02</math></li> </ul> </li> <li>• Effect sizes by trainer: <ul style="list-style-type: none"> <li>- Experimenter: <math>g = .96</math></li> <li>- Teacher: <math>g = .92</math></li> <li>- Parent: <math>g = .76</math></li> <li>- Child care provider: <math>g = .13</math></li> </ul> </li> <li>• Effect sizes by duration: <ul style="list-style-type: none"> <li>- One week or less: <math>g = 1.35</math></li> <li>- More than one week: <math>g = .85</math></li> </ul> </li> <li>• Effect sizes by frequency: <ul style="list-style-type: none"> <li>- Five sessions or fewer: <math>g = 1.42</math></li> <li>- More than five sessions: <math>g = .83</math></li> </ul> </li> <li>• Effect sizes by type of training: <ul style="list-style-type: none"> <li>- Explicit: <math>g = 1.11</math></li> <li>- Implicit: <math>g = .62</math></li> <li>- Combination: <math>g = 1.21</math></li> </ul> </li> <li>• Effect sizes by focus of vocabulary measure: <ul style="list-style-type: none"> <li>- Receptive vocabulary: <math>g = .80</math></li> <li>- Expressive vocabulary: <math>g = .69</math></li> <li>- Combination: <math>g = 1.11</math></li> </ul> </li> <li>• Effect sizes by type of learner: <ul style="list-style-type: none"> <li>- At risk: <math>g = .85</math></li> <li>- Average and above-average learners: <math>g = .91</math></li> </ul> </li> <li>• Effect sizes by SES status: <ul style="list-style-type: none"> <li>- Low SES: <math>g = .75</math></li> <li>- Middle to high SES: <math>g = .99</math></li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Marulis, L. M., & Neuman, S. B. (2013). How vocabulary interventions affect young children at risk: A meta-analytic review. <i>Child Development</i> , 84(3), 765-782.	51	<ul style="list-style-type: none"> <li>• children aged 0 to 6 years</li> <li>• low socioeconomic status (SES) families</li> <li>• marginalised racial groups (African American and Hispanic)</li> <li>• urban and rural communities</li> <li>• English Language Learners (ELLs)</li> <li>• children with language impairments</li> <li>• children with language delays</li> <li>• children with low academic achievement</li> </ul>	The study is a meta-analysis reviewing 51 studies with 138 effect sizes involving 7,403 children aged 0 to 6 years who were at risk for reading difficulties. It used a random-effects model to calculate effect sizes and conducted moderator analyses to identify factors influencing outcomes. Comprehensive Meta-Analysis software was used to compute effect sizes, adjusting for various study designs. The study examined publication bias and found the results robust. Detailed coding and training procedures ensured accuracy in data extraction and analysis. Various factors such as type of training, group size, dosage characteristics, risk factors, and methodological characteristics were analysed.	<ul style="list-style-type: none"> <li>• Vocabulary interventions had a strong overall effect size of nearly one standard deviation on word learning.</li> <li>• Children from low-SES families experienced significantly lower gains compared to their middle- and upper-SES peers.</li> <li>• The combination of explicit and implicit instructional strategies was more effective than implicit instruction alone.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size: <math>g = 0.87</math> (SE = 0.08), <math>p &lt; .001</math></li> <li>• Type of training: <ul style="list-style-type: none"> <li>- Explicit: <math>g = 0.91</math> (SE = 0.17), <math>p &lt; .001</math></li> <li>- Implicit: <math>g = 0.61</math> (SE = 0.15), <math>p &lt; .001</math></li> <li>- Combination: <math>g = 1.18</math> (SE = 0.15), <math>p &lt; .001</math></li> </ul> </li> <li>• Group size: <ul style="list-style-type: none"> <li>- Individual: <math>g = 0.96</math> (SE = 0.21), <math>p &lt; .001</math></li> <li>- Small (5 or less): <math>g = 0.90</math> (SE = 0.15), <math>p &lt; .001</math></li> <li>- Large (6 or more): <math>g = 0.85</math> (SE = 0.17), <math>p &lt; .001</math></li> <li>- Large + Small: <math>g = 1.19</math> (SE = 0.26), <math>p &lt; .001</math></li> </ul> </li> <li>• Dosage: <ul style="list-style-type: none"> <li>- Frequency of training: <ul style="list-style-type: none"> <li>- <math>\leq 30</math> sessions: <math>g = 1.00</math> (SE = 0.21), <math>p &lt; .001</math></li> <li>- <math>&gt; 30</math> sessions: <math>g = 0.94</math> (SE = 0.18), <math>p &lt; .001</math></li> </ul> </li> <li>- Duration of training: <ul style="list-style-type: none"> <li>- <math>&lt; 56</math> days: <math>g = 0.82</math> (SE = 0.17), <math>p &lt; .001</math></li> <li>- <math>&gt; 56</math> days: <math>g = 1.03</math> (SE = 0.14), <math>p &lt; .001</math></li> </ul> </li> <li>- Intensity of training: <ul style="list-style-type: none"> <li>- <math>\leq 20</math> min: <math>g = 1.16</math> (SE = 0.20), <math>p &lt; .001</math></li> <li>- <math>&gt; 20</math> min: <math>g = 1.12</math> (SE = 0.21), <math>p &lt; .001</math></li> </ul> </li> </ul> </li> <li>• Risk factors: <ul style="list-style-type: none"> <li>- Low SES: <math>\beta = -0.44</math>, <math>p = 0.01</math>; <math>g = 0.76</math> (SE = 0.10), <math>p &lt; .001</math></li> <li>- Middle to high SES: <math>g = 1.49</math> (SE = 0.25), <math>p &lt; .001</math></li> </ul> </li> </ul>

**Table 3: Oral Language - English Language Learners**

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Bratlie, S. S., Brinchmann, E. I., Melby-Lervåg, M., Von, J., &amp; Torkildsen, K. (2022). Morphology-A Gateway to Advanced Language: Meta-Analysis of Morphological Knowledge in Language-Minority Children. <i>Review of Educational Research</i>, 92(1), 3-46.</p>	43	<ul style="list-style-type: none"> <li>• Children aged approximately 6.9 to 10 years</li> <li>• Language-minority children primarily with immigrant backgrounds</li> <li>• Bilingual to varying degrees</li> <li>• Lower educational attainment compared to language-majority peers</li> <li>• Home languages include Romance/Spanish, Chinese, Turkish, and mixed language backgrounds</li> <li>• Socioeconomic status considered as a moderator</li> </ul>	<ul style="list-style-type: none"> <li>• Followed PRISMA guidelines and preregistered in PROSPERO.</li> <li>• Included empirical studies from 1987 onwards in English or Scandinavian languages.</li> <li>• Search strategy involved multiple databases guided by experts.</li> <li>• Screened titles and abstracts using EndNote and DistillerSR software.</li> <li>• Data extraction using Comprehensive Meta-Analysis Software (CMA).</li> <li>• Computed effect sizes using Hedges' g formula.</li> <li>• Conducted moderator analyses using regression models in R Robumeta package.</li> <li>• Assessed publication bias using various statistical methods.</li> <li>• Analyses based on robust variance estimation (RVE) with correlational weights.</li> </ul>	<ul style="list-style-type: none"> <li>• Language-majority children have significantly better morphological knowledge than language-minority children.</li> <li>• Larger differences were found in inflectional morphology compared to derivational and compounding morphology.</li> <li>• Test format and age of participants influenced the size of the group differences in morphological knowledge.</li> </ul>	<ul style="list-style-type: none"> <li>• Morphological knowledge overall: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -0.76</math> (95% CI [-0.95, -0.58], <math>p &lt; .0001</math>)</li> </ul> </li> <li>• Listening comprehension: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -0.97</math> (95% CI [-1.28, -0.65], <math>p &lt; .001</math>)</li> </ul> </li> <li>• Vocabulary: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -1.16</math> (95% CI [-1.34, -0.98], <math>p &lt; .0001</math>)</li> </ul> </li> <li>• Syntactic knowledge: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -0.79</math> (95% CI [-1.00, -0.57], <math>p &lt; .0001</math>)</li> </ul> </li> <li>• Reading comprehension: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -0.50</math> (95% CI [-0.72, -0.28], <math>p &lt; .001</math>)</li> </ul> </li> <li>• Decoding: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -0.18</math> (95% CI [-0.30, -0.05], <math>p = .01</math>)</li> </ul> </li> <li>• Phonological awareness: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -0.19</math> (95% CI [-0.30, -0.07], <math>p = .004</math>)</li> </ul> </li> <li>• Inflections <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -1.07</math> (95% CI [-1.37, -0.77], <math>p &lt; .0001</math>)</li> </ul> </li> <li>• Compounds: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -0.22</math> (95% CI [-0.64, -0.21], <math>p = .244</math>)</li> </ul> </li> <li>• Derivations: <ul style="list-style-type: none"> <li>- Language-majority: <math>g = -0.50</math> (95% CI [-0.65, -0.35], <math>p &lt; .0001</math>)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Graham, S., Silva, M., & Restrepo, M. A. (2022). Reading intervention research with emergent bilingual students: a meta-analysis. <i>Reading Research Quarterly</i> .	32	<ul style="list-style-type: none"> <li>• emergent bilingual students</li> <li>• preschool to year 12</li> <li>• majority Hispanic (86%)</li> <li>• many living in poverty or near-poverty</li> <li>• primarily attending underperforming schools</li> <li>• predominantly from urban areas</li> </ul>	<ul style="list-style-type: none"> <li>• Meta-analysis of experimental and quasi-experimental studies.</li> <li>• Included students from preschool to year 12.</li> <li>• Effect sizes calculated using Hedges' <i>g</i>.</li> <li>• Statistical analysis conducted using CMA software with a weighted random-effects model.</li> </ul>	<ul style="list-style-type: none"> <li>• Teaching reading to emergent bilingual students had a small but statistically significant positive impact on their reading skills.</li> <li>• The strongest effects were observed for standardised tests across all years.</li> <li>• Variability in effects was influenced by the type and duration of treatments, student challenges, and study quality.</li> </ul>	<ul style="list-style-type: none"> <li>• All reading measures: <ul style="list-style-type: none"> <li>- All years: <math>g = 0.17</math> [95% CI: 0.07, 0.28], <math>p &lt; .001</math></li> <li>- Preschool to year 3: <math>g = 0.05</math> [95% CI: -0.10, 0.20], <math>p = .527</math></li> <li>- Years 4 to 8: <math>g = 0.25</math> [95% CI: 0.11, 0.40], <math>p = .001</math></li> <li>- Years 9 to 12: <math>g = 0.25</math> [95% CI: -0.04, 0.33], <math>p = .087</math></li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Wang, Z., Colomer Feliu, J., García-Aracil, A., Spycher, P., &amp; Kim, Y. (2022). A Systematic Review of Effective Instructional Interventions in Supporting Kindergarten English Learners' English Oral Language Development. <i>Early Childhood Education Journal</i>, 50(3), 443-457.</p>	<p>7</p>	<ul style="list-style-type: none"> <li>• Kindergarten children</li> <li>• Majority English Learners (ELs)</li> <li>• Low socioeconomic status (SES)</li> <li>• Predominantly native Spanish speakers, with some Chinese and Korean speakers</li> <li>• Studies conducted mainly in California and Texas</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a systematic review focusing on effective interventions for kindergarten English Learners' (EL) oral language development.</li> <li>• Collaborated with a professional librarian for comprehensive literature search.</li> <li>• Defined inclusion criteria: kindergarten ELs, interventions aimed at improving oral language development, pre- and post-assessment, U.S.-based studies, peer-reviewed quantitative studies.</li> <li>• Applied exclusion criteria to select 7 empirical studies for in-depth review.</li> <li>• Followed PRISMA guidelines for decision-making process.</li> </ul>	<ul style="list-style-type: none"> <li>• Effective interventions significantly improve kindergarten ELs' English oral language outcomes.</li> <li>• Quality of intervention is as important as the language of instruction.</li> <li>• Specific instructional methods like anchored and analytical instruction are more effective than contextual instruction.</li> </ul>	<ul style="list-style-type: none"> <li>• Integrated oral + written language instruction: More beneficial for oral language development compared to oral language instruction only.</li> <li>• Intervention class (Spycher): Recognised more target vocabulary and could elaborate more on scientific concepts compared to control peers.</li> <li>• Enhanced instruction (Tong et al.): Significantly positive growth in English oral language; developed at a faster rate than typical instruction.</li> <li>• ELLA conditions (Tong et al.): Male students outperformed peers in phonological skills and oral proficiency; girls developed faster in phonological skills.</li> <li>• Anchored and analytical instruction (Silverman): More effective for improving children's oral vocabulary learning than contextual instruction.</li> <li>• Separate ELD block (Saunders et al.): Modest but significantly higher performance in oral language development compared to classrooms without ELD block.</li> </ul>

## Appendix B: Reading and Writing

Table 4: Early Reading

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Al Otaiba, S., McMaster, K., Wanzek, J., & Zaru, M. W. (2022). What we know and need to know about literacy interventions for elementary students with reading difficulties and disabilities, including dyslexia. <i>Reading Research Quarterly</i> , 57(S1), S19-S36.	14	<ul style="list-style-type: none"> <li>• Primary school students (years 0-5)</li> <li>• Students with reading difficulties or disabilities, including dyslexia</li> <li>• At-risk for reading disabilities</li> </ul>	The methodology involved reviewing 14 meta-analyses and systematic reviews of experimental and quasi-experimental studies published in the last decade. The search was conducted using ERIC and PsychINFO databases with specific search terms related to reading and writing interventions for primary school students with reading difficulties and disabilities. Studies included spanned years 0-5 and beyond year 5 to capture upper primary students. Ethical approval was not required as the study synthesised existing data.	<ul style="list-style-type: none"> <li>• Explicit and systematic interventions focusing on code and meaning dimensions improve foundational reading skills.</li> <li>• Standardised protocols, multiple components, and longer duration yield stronger effects in upper primary years.</li> <li>• Integrating reading and writing interventions shows promise.</li> </ul>	<ul style="list-style-type: none"> <li>• One-to-one tutoring by certified teachers: ES = 0.39</li> <li>- Less explicit and systematic approach (Reading Recovery): ES = 0.23</li> <li>- Explicit and systematic approach to phonics: ES = 0.56</li> </ul>
Barquero, L. A., Davis, N., & Cutting, L. E. (2014). Neuroimaging of reading intervention: A systematic review and activation likelihood estimate meta-analysis. <i>PLoS ONE</i> , 9(1), e83668. <a href="https://doi.org/10.1371/journal.pone.0083668">https://doi.org/10.1371/journal.pone.0083668</a>	8	<ul style="list-style-type: none"> <li>• children with reading difficulties (RD) or dyslexia</li> <li>• age range from lower-primary to upper-primary</li> <li>• identified as at-risk for RD or already diagnosed with RD</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted systematic searches in PubMed and Web of Science.</li> <li>• Applied six inclusion criteria to select relevant studies.</li> <li>• Gathered data from articles and supplemental materials.</li> <li>• Used GingerALE software for ALE meta-analysis on fMRI studies with post-intervention data.</li> <li>• Included only one experiment or contrast per study in the meta-analysis.</li> <li>• Meta-analysis included eight experiments with 173 participants and 90 activation foci.</li> </ul>	<ul style="list-style-type: none"> <li>• Reading interventions are associated with increased activation in the left thalamus, right insula/inferior frontal gyrus (IFG), left IFG, right posterior cingulate, and left middle occipital gyrus.</li> <li>• These changes suggest a normalisation of previously underactive areas in individuals with reading difficulties (RD).</li> <li>• Some changes may be compensatory rather than purely normalising.</li> </ul>	<ul style="list-style-type: none"> <li>• Left Thalamus: Volume = 1200 mm<sup>3</sup>, Activation increase observed in 3 studies.</li> <li>• Right Insula/Inferior Frontal Gyrus (IFG): Volume = 896 mm<sup>3</sup>, Activation increase observed in 4 studies.</li> <li>• Left Inferior Frontal Gyrus (IFG): Volume = 432 mm<sup>3</sup>, Activation increase observed in 3 studies.</li> <li>• Right Posterior Cingulate: Volume = 400 mm<sup>3</sup>, Activation increase observed in 2 studies.</li> <li>• Left Middle Occipital Gyrus: Volume = 320 mm<sup>3</sup>, Activation increase observed in 2 studies.</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Bus, A. G., & van IJzendoorn, M. H. (1999). Phonological awareness and early reading: A meta-analysis of experimental training studies. <i>Journal of Educational Psychology</i> , 91(3), 403-414.	36	<ul style="list-style-type: none"> <li>• young children in preschool, kindergarten, and primary school</li> <li>• normal development</li> <li>• at risk for reading difficulties</li> <li>• studies conducted in the U.S., Europe, and other locations</li> </ul>	The study is a quantitative meta-analysis that searched major databases and used a snowball method to find relevant studies. It included 32 articles with 36 studies on phonological awareness and 34 on reading. Various types of training programs and outcome measures were analysed. Predictor variables included publication year, journal impact, country, population type, school level, design characteristics, control group type, reading measure type, training program characteristics, setting, number of sessions, and person implementing the training. Statistical tests were transformed into common metrics like Cohen's d and Fisher's Z. Tests for homogeneity were applied, and a homogeneous subset of U.S. studies was selected for more precise estimates.	<ul style="list-style-type: none"> <li>• Phonological awareness training significantly improves both phonological awareness and reading skills in children.</li> <li>• Programs combining phonological and letter training are more effective than purely phonological programs.</li> <li>• Long-term effects of phonological awareness training on reading are smaller compared to short-term effects.</li> </ul>	<ul style="list-style-type: none"> <li>• - For phonological awareness: <ul style="list-style-type: none"> <li>- Short-term effects: Combined d = 1.04 (r = .46), significant (p &lt; .001)</li> <li>- Long-term effects: Combined d = 0.48 (r = .23), significant (p &lt; .001)</li> <li>- In the subset of US studies: Combined d = 0.73 (r = .34), significant (p &lt; .001)</li> </ul> </li> <li>• For reading: <ul style="list-style-type: none"> <li>- Short-term effects: Combined d = 0.44 (r = .21), significant (p &lt; .001)</li> <li>- Long-term effects: Combined d = 0.16 (r = .08), non-significant (p &lt; .06)</li> <li>- In the subset of US studies: Combined d = 0.70 (r = .33), significant (p &lt; .001)</li> </ul> </li> </ul> <p>The meta-analysis also found that the intervention effects were generally stronger when the training included letter-sound relationships compared to purely phonological training.</p>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Choe, S., & Lee, K. (2020). The effects of phonemic awareness instructions on L2 listening comprehension: A meta-analysis. <i>The Journal of Asia TEFL</i> , 17(4), 1294-1309. <a href="http://dx.doi.org/10.18823/asiatefl.2020.17.4.9.1294">http://dx.doi.org/10.18823/asiatefl.2020.17.4.9.1294</a>	8	<ul style="list-style-type: none"> <li>• primary school students</li> <li>• secondary school students</li> <li>• university students</li> <li>• beginner proficiency level</li> <li>• lower intermediate proficiency level</li> <li>• intermediate proficiency level</li> <li>• mixed proficiency levels</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic search using Publish or Perish software with specific keywords.</li> <li>• Search conducted on Google Scholar and Crossref.</li> <li>• Inclusion criteria: phonemic awareness instructions, listening measurements, L2 English learners, between-group design.</li> <li>• Eight studies with 13 samples selected.</li> <li>• Comprehensive Meta-Analysis (CMA) software used for analysis.</li> <li>• Hedges' g calculated for effect size.</li> <li>• Subgroup analyses conducted to explore variations in effectiveness.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonemic awareness instruction has a large positive effect on L2 listening skills (Hedges' g = 0.99).</li> <li>• It is particularly effective for beginners and primary school students.</li> <li>• Phonemic awareness instruction is more effective than phonics instruction and is better assessed using intensive listening measurements.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size: Hedges' g = 0.99 (large effect)</li> <li>• Effect size for beginners: Hedges' g = 0.86 (large effect)</li> <li>• Effect size for primary school students: Hedges' g = 3.67 (large effect)</li> <li>• Effect size for phonemic awareness instruction: Hedges' g = 1.43 (large effect)</li> <li>• Effect size for phonics instruction: Hedges' g = 0.45 (medium effect)</li> <li>• Effect size for intensive listening measures: Hedges' g = 1.43 (large effect)</li> <li>• Effect size for selective listening measures: Hedges' g = 0.80 (medium-large effect)</li> </ul>
Dilg, C., Hodges, T. S., Coleman, J., & Dilgard, C. (2022). Phonics instruction in early literacy: Examining professional learning, instructional resources, and intervention intensity. [Journal name not provided].	23	<ul style="list-style-type: none"> <li>• Year 0-3 students</li> <li>• Striving readers</li> <li>• At-risk students</li> <li>• English language learners</li> <li>• Students with learning disabilities</li> <li>• Students with dyslexia</li> <li>• Low socioeconomic status</li> </ul>	Systematic literature review methodology involving extensive literature search, screening with predefined criteria, analysis using a rubric, and qualitative coding of themes. The study included quantitative, mixed methods, and action research studies.	<ul style="list-style-type: none"> <li>• Professional learning, instructional resources, and intervention intensity are key themes in effective phonics instruction.</li> <li>• Evidence-based resources and explicit instruction are crucial for supporting teachers and improving student achievement.</li> <li>• Balancing decoding and encoding is an effective strategy for phonics interventions.</li> </ul>	<ul style="list-style-type: none"> <li>• Word reading: Large effect size (d = 1.01) (Ehri &amp; Flugman, 2018)</li> <li>• Spelling: Small effect size (d = 0.32) (Martínez, 2011)</li> <li>• Other reading outcomes: Medium effect sizes</li> </ul> <p>The paper indicates the interventions had varying effects on different reading outcomes, with some having a larger impact on word reading compared to comprehension.</p>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Ehri, L. C., Nunes, S. R., Willows, D. M., Schuster, B. V., Yaghoub-Zadeh, Z., & Shanahan, T. (2001). Phonemic awareness instruction helps children learn to read: Evidence from the National Reading Panel's meta-analysis. <i>Reading Research Quarterly</i> , 36(3), 250-287.	52	<ul style="list-style-type: none"> <li>• Preschool to year 6 students</li> <li>• Normally developing readers</li> <li>• At-risk readers (low PA, low reading skills, low SES, developmental or language delays, cognitive disabilities)</li> <li>• Reading disabled students (reading below year level despite average cognitive ability)</li> <li>• Participants from English-speaking countries and other languages (Danish, Dutch, Finnish, German, Hebrew, Norwegian, Spanish, Swedish)</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a quantitative meta-analysis.</li> <li>• Included 52 peer-reviewed studies with 96 treatment-control comparisons.</li> <li>• Used effect size as the primary statistic.</li> <li>• Employed specific inclusion criteria for studies.</li> <li>• Searched ERIC and PsychInfo databases for relevant articles.</li> <li>• Coded studies for various characteristics and ensured reliability.</li> <li>• Used SPSS for data entry and DSTAT for statistical analysis.</li> </ul>	<ul style="list-style-type: none"> <li>• PA instruction significantly helps children acquire phonemic awareness (<math>d = 0.86</math>).</li> <li>• PA instruction has a moderate positive impact on reading (<math>d = 0.53</math>) and spelling (<math>d = 0.59</math>).</li> <li>• PA instruction is most effective when taught with letters, focusing on one or two skills, in small groups, and for 5 to 18 hours.</li> </ul>	<ul style="list-style-type: none"> <li>• Acquisition of phonemic awareness: Large and statistically significant effect size of <math>d = 0.86</math></li> <li>• Reading outcomes: Moderate and statistically significant effect size of <math>d = 0.53</math></li> <li>• Spelling outcomes: Moderate and statistically significant effect size of <math>d = 0.59</math></li> <li>• PA instruction was effective for various types of readers (normally developing, at-risk, disabled) and year levels (preschool, year 0, year 1)</li> <li>• PA instruction improved reading but not spelling in disabled readers</li> </ul>
Erbeli, F., Rice, M., Xu, Y., Bishop, M. E., & Goodrich, J. M. (2024). A meta-analysis on the optimal cumulative dosage of early phonemic awareness instruction. [Journal name unknown].	16	<ul style="list-style-type: none"> <li>• Children aged 4.17-6.67 years (mean age = 5.20 years)</li> <li>• Participants in early childhood programs, preschool, year 0, or year 1</li> <li>• Some participants at risk for reading disabilities (low PA skills, low socioeconomic status, teacher referral, special education services)</li> <li>• Mix of students at risk and not at risk for reading disabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Nonlinear meta-analysis conducted.</li> <li>• Included 16 experimental and quasi-experimental studies (35 effect sizes).</li> <li>• Cumulative dosage response model was concave parabolic.</li> <li>• Moderator analyses performed.</li> <li>• Four-step search process: database search, title/abstract screening, full-text screening, coding.</li> <li>• Databases: PsycINFO, ERIC, Academic Search Ultimate.</li> <li>• Standardised mean-change measure for effect size.</li> <li>• Separate moderator analyses conducted.</li> </ul>	<ul style="list-style-type: none"> <li>• The optimal cumulative dosage of PA instruction is 10.20 hours, with a maximum effect size of <math>d = 0.74</math>.</li> <li>• This optimal dosage holds for students at risk for reading disabilities and basic PA skills instruction.</li> <li>• PA instruction with letters shows increasing effects after 16 hours of instruction.</li> </ul>	<ul style="list-style-type: none"> <li>• - Overall PA instruction: <ul style="list-style-type: none"> <li>- Maximum effect size: <math>d = 0.74</math> at 10.20 hours (<math>p = .0005</math>)</li> </ul> </li> <li>• Individual PA instruction: <ul style="list-style-type: none"> <li>- Maximum effect size: <math>d = 0.99</math> at 16.63 hours (<math>p &lt; .0001</math>)</li> </ul> </li> <li>• PA instruction with no letters <ul style="list-style-type: none"> <li>- Effect size: Not significantly different from overall model: <math>t(15) = -0.86</math>, <math>p = .41</math></li> </ul> </li> <li>• PA instruction with letters: <ul style="list-style-type: none"> <li>- Minimum effect size: <math>d = 0.41</math> at 16.10 hours (<math>p &lt; .0001</math>)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Gersten, R., Haymond, K., Newman-Gonchar, R., Dimino, J., &amp; Jayanthi, M. (2020). Meta-analysis of the impact of reading interventions for students in the primary grades. <i>Journal of Research on Educational Effectiveness</i>, 13(2), 187-217.</p>	<p>33</p>	<ul style="list-style-type: none"> <li>• Students in years 1-3</li> <li>• At risk for reading difficulties (scoring below the 40th percentile on standardised tests)</li> </ul>	<ul style="list-style-type: none"> <li>• Random-effects meta-regression models with robust variance estimates were used.</li> <li>• A search identified 2,423 publications, screened for eligibility.</li> <li>• Inclusion criteria: U.S.-based studies, years 1-3, at-risk students, reading interventions, RCTs or QEDs.</li> <li>• Studies meeting WWC standards were coded for characteristics.</li> <li>• Random effects robust variance estimation (RVE) techniques were applied.</li> </ul>	<ul style="list-style-type: none"> <li>• Reading interventions had a significant positive effect on reading outcomes for students in years 1-3, with a mean effect size of 0.39.</li> <li>• The highest effect size was observed in word or pseudoword reading (0.41), followed by reading comprehension (0.32) and passage reading fluency (0.31).</li> <li>• Interventions focusing on encoding or writing yielded higher effect sizes, while those focusing on phonological awareness had smaller effects.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall mean effect size: 0.39 (significant at <math>p &lt; 0.001</math>)</li> <li>• Word/pseudoword reading: 0.41 (significant at <math>p &lt; 0.001</math>)</li> <li>• Reading comprehension: 0.32 (significant at <math>p &lt; 0.001</math>)</li> <li>• Passage reading fluency: 0.31 (significant at <math>p &lt; 0.001</math>)</li> </ul> <p>The paper also reports significant positive effects on other reading-related outcomes like phonological awareness, decoding, encoding, and writing.</p>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Goldfeld, S., Beatson, R., Watts, A., Snow, P., Gold, L., Le, H., Edwards, S., Connell, J., Stark, H., Shingles, B., Barnett, T., Quach, J., Eadie, P., & Le, H. N. (2021). Tier 2 oral language and early reading interventions for preschool to grade 2 children: A restricted systematic review. [Journal name].	55	<ul style="list-style-type: none"> <li>• children aged 4-9 years</li> <li>• attending mainstream education settings</li> <li>• identified as at-risk of or experiencing oral language or reading difficulties</li> <li>• majority from North America (84%) <ul style="list-style-type: none"> <li>- smaller numbers from the United Kingdom (9%), New Zealand (4%), Australia (2%), and the Netherlands (2%)</li> </ul> </li> <li>• majority targeted reading difficulties (67%) <ul style="list-style-type: none"> <li>- some targeted oral language difficulties (24%)</li> <li>- a few targeted combined risks (9%)</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Study protocol registered with PROSPERO.</li> <li>• Comprehensive literature search across multiple databases and registers.</li> <li>• Search strategy developed using a PICO-based framework.</li> <li>• Clear inclusion criteria for selecting relevant studies.</li> <li>• Data extraction by an experienced reviewer.</li> <li>• Risk of bias assessed using an 11-item checklist.</li> <li>• Three evidence rating systems used for assessing interventions.</li> <li>• Narrative synthesis of findings.</li> </ul>	<ul style="list-style-type: none"> <li>• Six small-group Tier 2 interventions were identified as having strong evidence for improving oral language or reading outcomes in young children.</li> <li>• Effective interventions typically involved small groups, frequent sessions, a minimum duration of 11 weeks, and trained personnel.</li> <li>• Most studies reported statistically significant positive effects of these interventions compared to usual practice.</li> </ul>	<ul style="list-style-type: none"> <li>• - Early Reading Intervention: <ul style="list-style-type: none"> <li>- WRMT subscales: 0.54 to 0.76 at immediate post-test, 0.39 to 0.64 at 1-year follow-up</li> </ul> </li> <li>• Responsive Reading Intervention: <ul style="list-style-type: none"> <li>- TOWRE: 0.44</li> <li>- WJIII subscales: 0.63</li> </ul> </li> <li>• General findings: <ul style="list-style-type: none"> <li>- Effect sizes ranged from very small (&lt;0.20) to quite large (2.17)</li> <li>- Most studies reported at least one statistically significant positive effect</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Graham, S., Liu, X., Aitken, A., Ng, C., Bartlett, B., Harris, K. R., & Holzapfel, J. (2018). Effectiveness of literacy programs balancing reading and writing instruction: A meta-analysis. <i>Reading Research Quarterly</i> , 53(3), 279-304.	47	<ul style="list-style-type: none"> <li>• Preschool through secondary students</li> <li>• Majority from the United States (89%)</li> <li>• English learners (15%)</li> <li>• Students experiencing difficulty with literacy (26%)</li> <li>• Gender: 52% girls</li> <li>• Race: 58% minority groups</li> <li>• Socioeconomic status: 47% from poor to median income households</li> </ul>		<ul style="list-style-type: none"> <li>• Literacy programs balancing reading and writing instruction significantly improve students' reading performance, with effect sizes of .39 for reading comprehension, .53 for decoding, and .35 for reading vocabulary.</li> <li>• These programs also enhance writing performance, with effect sizes of .47 for writing quality, .18 for writing mechanics, and .69 for writing output.</li> </ul>	<p>Reading outcomes:</p> <ul style="list-style-type: none"> <li>• Overall reading: ES = 0.39 (statistically significant)</li> <li>• Reading comprehension: ES = 0.39 (statistically significant)</li> <li>• Decoding: ES = 0.53 (statistically significant)</li> <li>• Reading vocabulary: ES = 0.35 (statistically significant)</li> </ul> <p>Writing outcomes:</p> <ul style="list-style-type: none"> <li>• Overall writing: ES = 0.37 (statistically significant)</li> <li>• Writing quality: ES = 0.47 (statistically significant)</li> <li>• Writing mechanics: ES = 0.18 (statistically significant)</li> <li>• Writing output: ES = 0.69 (statistically significant)</li> </ul> <p>The paper also found that most of the different types of balanced reading/writing programs tested resulted in statistically significant improvements in either reading or writing.</p>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Hall, C., Dahl-Leonard, K., Cho, E., Solari, E. J., Capin, P., Conner, C. L., Henry, A. R., Cook, L., Hayes, L., Vargas, I., Richmond, C. L., & Kehoe, K. F. (2022). This meta-analysis included experimental or quasi-experimental intervention studies conducted between 1980 and 2020 that aimed to improve reading outcomes for year 0-5 students with or at risk for dyslexia (i.e., students with or at risk for word reading difficulties, defined as scoring at or below normreferenced screening or mean baseline performance thresholds articulated in our inclusion criteria). [Paper].	53	<ul style="list-style-type: none"> <li>• Students in years 0-5 (ages approximately 5-11)</li> <li>• Students with or at risk for dyslexia</li> <li>• Some participants experienced economic disadvantage</li> <li>• A small percentage of participants were emergent multilingual students learning English</li> <li>• Participants did not have intellectual disabilities, autism spectrum disorders, or sensory disabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Meta-analysis of experimental or quasi-experimental studies from 1980 to 2020.</li> <li>• Robust variance estimation to handle dependent effect sizes.</li> <li>• Meta-regression to identify influence of various characteristics.</li> <li>• PRIMSA guidelines followed for study identification.</li> <li>• Abstracts screened by multiple reviewers; full texts reviewed for eligibility.</li> <li>• Specific inclusion criteria for studies.</li> <li>• Data coding for participant characteristics, interventions, outcome measures, and research methods.</li> <li>• Effect sizes calculated using Hedges' g.</li> <li>• Analyses conducted using metafor and clubSandwich packages in R.</li> <li>• Publication bias examined using modified Egger's regression.</li> <li>• Heterogeneity described using restricted maximum likelihood estimates.</li> <li>• Single and multiple meta-regression analyses conducted.</li> </ul>	<ul style="list-style-type: none"> <li>• Reading interventions significantly improve norm-referenced reading outcomes for students with or at risk for dyslexia (<math>g = 0.33</math>).</li> <li>• Higher dosage interventions are associated with larger effect sizes.</li> <li>• Reading comprehension outcomes show smaller effects compared to word reading/spelling outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Main effect of intervention on norm-referenced reading outcomes: <math>g = 0.33</math> (<math>p &lt; .001</math>)</li> <li>• Dosage: Beta = 0.002 (<math>p = .040</math>)</li> <li>• Year 0-2: Effect size (beta) = 0.36 (<math>p &lt; .01</math>)</li> <li>• Year 3-5: Effect size (beta) = 0.16 (<math>p = .16</math>)</li> <li>• One-on-One: Effect size (beta) = 0.30 (<math>p &lt; .01</math>)</li> <li>• Small group: Effect size (beta) = 0.40 (<math>p &lt; .01</math>)</li> <li>• Multisensory: No: Effect size (beta) = 0.34 (<math>p &lt; .01</math>); Yes: Effect size (beta) = 0.20 (<math>p = .14</math>)</li> <li>• Morphology/Vocabulary: No: Effect size (beta) = 0.33 (<math>p &lt; .01</math>); Yes: Effect size (beta) = 0.34 (<math>p &lt; .01</math>)</li> <li>• Spelling: No: Effect size (beta) = 0.23 (<math>p &lt; .01</math>); Yes: Effect size (beta) = 0.37 (<math>p &lt; .01</math>)</li> <li>• PA: No: Effect size (beta) = 0.22 (<math>p = .01</math>); Yes: Effect size (beta) = 0.38 (<math>p &lt; .01</math>)</li> <li>• Outcome measure domains: <ul style="list-style-type: none"> <li>- PA: Effect size (beta) = 0.44 (<math>p &lt; .01</math>)</li> <li>- Word reading/Spelling: Effect size (beta) = 0.34 (<math>p &lt; .01</math>)</li> <li>- Text reading: Effect size (beta) = 0.25 (<math>p &lt; .01</math>)</li> <li>- Reading comprehension: Effect size (beta) = 0.26 (<math>p &lt; .01</math>)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Jiang, Y., Gai, X., Üstün-Yavuz, M. S., Zhang, M., & Thomson, J. M. (2023). A meta-analysis of training effects on English phonological awareness and reading in native Chinese speakers. [Journal name unknown].	33	<ul style="list-style-type: none"> <li>• native Chinese speakers learning English as a second language</li> <li>• special populations (e.g., individuals with dyslexia or learning disabilities)</li> </ul>	<ul style="list-style-type: none"> <li>• Followed PRISMA guidelines.</li> <li>• Conducted electronic search in Scopus, PsycInfo, Web of Science, and CNKI.</li> <li>• Used different search strategies for English and Chinese databases.</li> <li>• Inclusion criteria: randomised control trials and quasi-experimental designs, native Chinese speakers learning English, relevant topic, EPA as a dependent variable.</li> <li>• Retained 33 articles for data extraction and coding.</li> <li>• Effect size measure: Hedges's g.</li> </ul>	<ul style="list-style-type: none"> <li>• Training significantly improved English phonological awareness (<math>g = 0.651</math>) and reading (<math>g = 0.498</math>) in native Chinese speakers.</li> <li>• Programs integrating lexical semantic knowledge had the largest impact on enhancing English phonological awareness.</li> <li>• Upper primary students benefited the most from instructional training.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall English phonological awareness: <math>g = 0.651</math> (<math>n = 3137</math>), significant</li> <li>• Overall reading: <math>g = 0.498</math> (<math>n = 1506</math>), significant</li> <li>• Syllable awareness: <math>g = 0.468</math> (<math>p &lt; .05</math>)</li> <li>• Rhyme awareness: <math>g = .948</math> (<math>p &lt; .001</math>)</li> <li>• Phoneme awareness: <math>g = .736</math> (<math>p &lt; .001</math>)</li> <li>• Word reading: <math>g = .297</math> (<math>p &lt; .01</math>)</li> <li>• Pseudoword reading: <math>g = .586</math> (<math>p &lt; .01</math>)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Kennedy, C., & Mcloughlin, A. (2022). Developing the emergent literacy skills of English language learners through dialogic reading: A systematic review. <i>Early Childhood Education Journal</i> , 50(2), 231-244. <a href="https://doi.org/10.1007/s10643-021-01291-1">https://doi.org/10.1007/s10643-021-01291-1</a>	6	<ul style="list-style-type: none"> <li>• children aged 3 years and 8 months to 5 years</li> <li>• 40.7% female, 59.3% male</li> <li>• attending preschools in the USA</li> <li>• majority first language Spanish</li> </ul>	<ul style="list-style-type: none"> <li>• Followed PRISMA procedures for systematic reviews.</li> <li>• Conducted a comprehensive literature search using multiple databases.</li> <li>• Used specific search terms to identify relevant studies.</li> <li>• Removed duplicates and non-journal articles.</li> <li>• Screened articles based on predefined exclusion criteria.</li> <li>• Assessed full texts for eligibility.</li> <li>• Used Gough's Weight of Evidence framework to evaluate studies.</li> <li>• Combined results from WoE A, B, and C to form an overall weighting score (WoE D).</li> </ul>	<ul style="list-style-type: none"> <li>• Dialogic reading interventions are effective for developing the emergent oral language skills of English Language Learners (ELLs).</li> <li>• Dialogic reading interventions may not be effective for developing the emergent reading or writing skills of ELLs.</li> </ul>	<ul style="list-style-type: none"> <li>• Emergent oral language skills: <ul style="list-style-type: none"> <li>- Brannon &amp; Dauksas (2014): Significant improvement in oral language skills.</li> <li>- McCabe et al. (2010): Significant improvement in oral language skills; 55.55% variance accounted for by intervention status.</li> <li>- Correa et al. (2015), Huennekens &amp; Xu (2010, 2015): Statistically significant gains in oral language skills.</li> </ul> </li> <li>• Emergent reading skills: <ul style="list-style-type: none"> <li>- Brannon &amp; Dauksas (2014): Significant improvement in reading abilities.</li> <li>- McCabe et al. (2010): Control group showed significantly higher increases in emergent reading skills than the intervention group.</li> </ul> </li> <li>• Emergent writing skills: <ul style="list-style-type: none"> <li>- Correa et al. (2015), Huennekens &amp; Xu (2010, 2015): Statistically significant gains in emergent writing.</li> </ul> </li> <li>• Vocabulary skills: <ul style="list-style-type: none"> <li>- Cohen et al. (2012): Large effects on emergent vocabulary skills (<math>\eta^2 = 0.09</math>).</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Melby-Lervåg, M., Lyster, S.-A. H., & Hulme, C. (2012). Phonological skills and their role in learning to read: A meta-analytic review. <i>Psychological Bulletin</i> , 138(2), 322-352. <a href="https://doi.org/10.1037/a0026744">https://doi.org/10.1037/a0026744</a>	135	<ul style="list-style-type: none"> <li>• Children aged 5 years 4 months to 16 years 10 months</li> <li>• Children with dyslexia</li> <li>• Typically developing children</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic meta-analytic review</li> <li>• Included 235 studies with 995 effect sizes</li> <li>• Used random-effects models</li> <li>• Considered various moderators (age, reading level, IQ, oral language ability, orthography, test type)</li> <li>• Assessed methodological quality</li> <li>• Data collection and coding with high intercoder reliability</li> <li>• Analyses conducted using Comprehensive Meta-Analysis program</li> <li>• Computed effect sizes using Cohen's d and Pearson's r</li> <li>• Calculated weighted average effect sizes</li> </ul>	<ul style="list-style-type: none"> <li>• Children with dyslexia show a large deficit in phonemic awareness compared to typically developing children and reading-level matched controls.</li> <li>• Phonemic awareness is the strongest correlate of individual differences in word reading ability.</li> <li>• Direct instruction targeting phonemic awareness is necessary to help children with dyslexia learn to read.</li> </ul>	<ul style="list-style-type: none"> <li>• Training phonemic awareness on word reading: Effect size = 0.67 (National Institute for Literacy, 2008)</li> <li>• Training children to manipulate phonemes in unfamiliar words improved phonemic manipulation and serial recall (Melby-Lervåg &amp; Hulme, 2010)</li> <li>• Training on rime tasks improved rime skills but had no significant effect on serial recall or phoneme manipulation (Melby-Lervåg &amp; Hulme, 2010)</li> <li>• Several randomised trials show that training in phonemic awareness in the context of high-quality phonically based reading instruction is effective in ameliorating word-level reading difficulties (Bowyer-Crane et al., 2008; Hatcher, Hulme, &amp; Ellis, 1994; Hatcher et al., 2006; National Institute for Literacy, 2008; Torgesen et al., 2001; Torgesen et al., 1999)</li> </ul>
Nilvius, C., Carlsson, R., Fälth, L., Nordström, T., Nordström, T., King, S., & Hui, F. (n.d.). Tier 2 interventions within the RtI-model for developing students' word decoding -a systematic review and meta-analysis.	4	<ul style="list-style-type: none"> <li>• K-2 students</li> <li>• At-risk for reading impairments (scoring at or below the 40th percentile in word decoding)</li> <li>• Conducted in the US</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-registered systematic review and meta-analysis.</li> <li>• Eligibility: RCTs with N &gt; 30 per group, K-2 students at risk, tier 2 reading interventions, school setting, at least 20 sessions.</li> <li>• Databases: ERIC, PsycINFO, LLBA, WOS, Google Scholar; updated searches.</li> <li>• Assessments: Cochrane's Risk of Bias 2, R-index, funnel plots.</li> <li>• Analysis: Random-effects model using R package Metafor.</li> <li>• Included studies: Four out of seven met criteria and had necessary statistics.</li> </ul>	<ul style="list-style-type: none"> <li>• Students who participated in tier 2 interventions developed their decoding skills better than those who received the school's ordinary practice.</li> <li>• The overall effect size of the interventions was small but positive (Hedges' g = .31, 95% CI [0.12, 0.50]).</li> <li>• The interventions had a statistically significant impact on improving word decoding skills in at-risk students.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size (Hedges' g): .31, 95% CI [0.12, 0.50], p = .0015</li> <li>• Study-specific results: <ul style="list-style-type: none"> <li>- *Case et al. (2014): <ul style="list-style-type: none"> <li>- TAU: M = 104.72, SD = 11.05, N = 62</li> <li>- Tier 2: M = 107.07, SD = 9.57, N = 61</li> </ul> </li> <li>- *Denton et al. (2014): <ul style="list-style-type: none"> <li>- TAU: M = 90.37, SD = 11.93, N = 66</li> <li>- Tier 2: M = 94.71, SD = 9.95, N = 70</li> </ul> </li> <li>- *Fien et al. (2015): <ul style="list-style-type: none"> <li>- TAU: M = 106.7, SD = 7.7, N = 132</li> <li>- Tier 2: M = 109.2, SD = 7.4, N = 107</li> </ul> </li> <li>- *Simmons et al. (2011): <ul style="list-style-type: none"> <li>- TAU: M = 105.16, SD = 10.99, N = 94</li> <li>- Tier 2: M = 108.09, SD = 9.20, N = 112</li> </ul> </li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Odo, D. M., & Murphy, D. (2021). A meta-analysis of the effect of phonological awareness and/or phonics instruction on word and pseudo word reading of English as an L2. SAGE Open.	46	<ul style="list-style-type: none"> <li>• Learners of English as a second language (ESL) and English as a foreign language (EFL)</li> <li>• Students in primary school</li> <li>• Excluded students beyond upper-primary school age</li> <li>• Excluded students with learning disabilities</li> <li>• First language writing systems: alphabetic, abjad, syllabary, logographic</li> </ul>	<ul style="list-style-type: none"> <li>• Comprehensive search of literature from 1990 to 2019.</li> <li>• Included both published research studies and unpublished dissertations.</li> <li>• Searched various databases using specific keywords.</li> <li>• Inclusion criteria: ESL/EFL learners, excluding first language English learners.</li> <li>• Interventions based on phonological awareness or phonics instruction.</li> <li>• Data extraction: recorded study details, participant characteristics, and interventions.</li> <li>• Analysed data using “Metafor” package in R with a random effects model.</li> <li>• Conducted moderator analysis to explore potential variables affecting results.</li> </ul>	<ul style="list-style-type: none"> <li>• L2 PA and phonics instruction has a moderate effect on L2 word reading (<math>g = 0.53</math>) and a large effect on pseudo word reading (<math>g = 1.51</math>).</li> <li>• Various moderators, including testing method, type of intervention, and instructional context, influence the effectiveness of PA and phonics instruction.</li> <li>• PA and phonics instruction support decoding skill development and word reading ability in L2 learners.</li> </ul>	<ul style="list-style-type: none"> <li>• Effect of PA and/or phonics instruction on L2 word reading: <math>g = 0.53</math> (moderate, statistically significant)</li> <li>• Effect of PA and/or phonics instruction on L2 pseudo-word reading: <math>g = 0.79</math> (large, statistically significant)</li> </ul> <p>The paper also found that the intervention effects were moderated by:</p> <ul style="list-style-type: none"> <li>• Type of assessment (smaller effects for standardised tests)</li> <li>• Instructional approach (largest effects for phonics-only instruction)</li> <li>• Instructional context (larger effects in foreign language contexts)</li> <li>• Duration of instruction (larger effects with longer instruction)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Perdue, M. V., Mahaffy, K., Vlahcevic, K., Wolfman, E., Erbeli, F., Richlan, F., &amp; Landi, N. (2021). Reading intervention and neuroplasticity: A systematic review and meta-analysis of brain changes associated with reading intervention. <i>Neuroscience &amp; Biobehavioral Reviews</i>, 131, 1-22.</p>	8	<ul style="list-style-type: none"> <li>• school-age children and adolescents</li> <li>• mean ages ranging from approximately 5.6 to 44 years</li> <li>• participants with or at-risk for developmental reading disability (dyslexia)</li> </ul>		<ul style="list-style-type: none"> <li>• Behavioral interventions for reading disabilities are effective, but the underlying brain mechanisms are not well understood.</li> <li>• Evidence shows changes in brain activation, connectivity, and structure in various regions associated with reading.</li> <li>• Meta-analysis did not find significant changes in brain activation, likely due to methodological heterogeneity among studies.</li> </ul>	<ul style="list-style-type: none"> <li>• Increased activation in left hemisphere reading network hubs like left STG, IPL, and OT, indicating recovery of typical reading network function</li> <li>• Elimination of group differences in brain activation between RD and TD groups after intervention, though RD groups still had poorer behavioral reading outcomes</li> <li>• Increased activation in right hemisphere regions like right IFG, which was positively associated with improvements in reading and phonological processing</li> <li>• Changes in functional connectivity, including decreased connectivity between right IPL and left anterior cingulate, but increased connectivity between right IPL and right IFG</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Pfost, M. (2015). Children's phonological awareness as a predictor of reading and spelling: A systematic review of longitudinal research in German-speaking countries. <i>Reading and Writing</i>, 28(4), 613-639.</p>	21	<ul style="list-style-type: none"> <li>• children aged 60-90 months (mean age 77 months)</li> <li>• from German-speaking countries (Germany, Austria, German-speaking part of Switzerland)</li> <li>• assessed at year 0 age or in the year 1 of primary school</li> </ul>	<ul style="list-style-type: none"> <li>• Meta-analysis of longitudinal studies from German-speaking countries.</li> <li>• Literature search included electronic databases and manual searches.</li> <li>• Inclusion criteria: phonological awareness assessed at year 0 or year 1, reading/spelling assessed after formal education began, studies conducted in German-speaking regions, at least two measurement points, reported zero-order correlations.</li> <li>• Phonological awareness categorised into syllable/rhyme level, phoneme level, composite scores.</li> <li>• Reading/spelling outcomes categorised into reading speed, accuracy, comprehension, spelling.</li> <li>• Bivariate correlations coded.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonological awareness has a moderate predictive power for later reading and spelling skills with a mean effect size of <math>Zr = 0.318</math> (<math>r = .308</math>).</li> <li>• Phonological awareness at the phoneme level is more predictive of reading and spelling outcomes than at the rhyme level.</li> <li>• The predictive power of phonological awareness remains substantial even for children beyond year 2.</li> </ul>	

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Raposo-Rivas, M., Halabi-Echeverry, A. X., Sarmiento Campos, J. A., & García-Fuentes, O. (2024). Associations among Variables in Technology-Enhanced Phonological Awareness Programmes Based on a Meta-Analysis. <i>Educ. Sci.</i> , 14, x.	12	<ul style="list-style-type: none"> <li>• Preschool children aged 4, 5, or above 5 years old</li> <li>• Some participants are ethnic minorities at risk of exclusion</li> <li>• Participants include those with cognitive diversity</li> <li>• Participants from different language backgrounds (e.g., Hebrew, Portuguese)</li> </ul>	<ul style="list-style-type: none"> <li>• Quasi-experimental designs with post-intervention measurements.</li> <li>• Inclusion of experimental and control groups.</li> <li>• Followed standard Cochrane methodology.</li> <li>• Five steps: problem formulation, search for studies, selection of moderating variables, statistical compilation, dissemination and replicability.</li> <li>• Effect size calculated using Hedges' g.</li> </ul>	<ul style="list-style-type: none"> <li>• Technology-based phonological awareness interventions showed significant positive effects compared to non-technological interventions.</li> <li>• Gamification-based interventions were particularly effective, especially for participants around 5 years old and with program durations longer than 500 minutes.</li> <li>• Non-random assignment of participants and the use of standardised measurement instruments also influenced the effectiveness of the interventions.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size (Hedges' g): 0.92 (p = 0.01, 95% CI [0.22, 1.62])</li> <li>• Age: <ul style="list-style-type: none"> <li>- &gt;5 years: estimate = 0.8891 (p = 0.1631)</li> <li>- 4 years: estimate = 0.1326 (p = 0.7725)</li> <li>- 5 years: estimate = 13.476 (p = 0.0000)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Rehfeld, D. M., Kirkpatrick, M., O'guinn, N., Renbarger, R., & Storkel, H. L. (2022). A meta-analysis of phonemic awareness instruction provided to children suspected of having a reading disability.	138	<ul style="list-style-type: none"> <li>• children aged 18 years or younger</li> <li>• mean age of 6.36 years</li> <li>• suspected of having a reading disability</li> <li>• eligible for free or reduced school lunch programs (low socioeconomic status)</li> <li>• interventions conducted in English, Spanish, or Chinese</li> <li>• socioeconomic status: low, mid/high, mixed</li> <li>• years: preschool to year 3 and up</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic search of seven databases.</li> <li>• Inclusion criteria: original data, experimental/quasi-experimental design, children under 18 with intact sensory abilities and reading below expected levels.</li> <li>• Data extraction: participant demographics, intervention details, outcome measures.</li> <li>• Random effects model for meta-analysis.</li> <li>• Quality assessment using established criteria.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonemic awareness instruction had a medium effect on composite and segmentation outcomes and a small effect on blending, first sound identification, and deletion outcomes.</li> <li>• Instruction effects were strongest in year 0 and year 1, but positive outcomes were also found for older children.</li> <li>• There was no significant relationship between cumulative intervention intensity and child performance.</li> </ul>	<ul style="list-style-type: none"> <li>• Composite outcomes: <math>g = 0.511</math> (medium effect)</li> <li>• Segmentation: <math>g = 0.571</math> (medium effect)</li> <li>• Blending: <math>g = 0.341</math> (small effect, <math>p &lt; .001</math>)</li> <li>• First sound identification (FSID): <math>g = 0.428</math> (small effect, <math>p &lt; .001</math>)</li> <li>• Deletion: <math>g = 0.248</math> (small effect, <math>p &lt; .001</math>)</li> <li>• Phonemic awareness instruction alone: <math>g = 1.002</math> (large effect)</li> <li>• Phonemic awareness instruction with other literacy skills: <math>g = 0.340</math> (small effect)</li> <li>• Interventions including graphemes: <math>g = 0.545</math> (medium effect)</li> <li>• Interventions not including graphemes: <math>g = 0.250</math> (small effect)</li> <li>• Preschool-age children segmentation: <math>g = 0.953</math> (large effect)</li> <li>• Children across multiple year levels segmentation: <math>g = 0.734</math> (medium effect)</li> </ul>
Senéchal, M., & Young, L. (2008). The effect of family literacy interventions on children's acquisition of reading from kindergarten to grade 3: A meta-analytic review. <i>Review of Educational Research</i> , 78(4), 880-907.	16	<ul style="list-style-type: none"> <li>• Children in year 0 to year 3</li> <li>• Normal and special reading levels</li> <li>• Low to middle-high socioeconomic status</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic search of electronic databases, review articles, and reference sections.</li> <li>• Selection criteria: peer-reviewed, experimental/quasi-experimental design, hypothesis testing, minimum 5 participants, available statistics for effect size calculation.</li> <li>• Meta-analytic procedures to calculate effect sizes and assess homogeneity.</li> <li>• Coding for intervention characteristics, participant characteristics, and study design aspects.</li> </ul>	<ul style="list-style-type: none"> <li>• Parent involvement has a positive effect on children's reading acquisition, with a mean weighted effect size of 0.65.</li> <li>• Training parents to tutor their children using specific literacy activities produced the largest effect size of 1.15.</li> <li>• Interventions where parents read to their children did not result in significant reading gains.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall parent involvement interventions: 0.65 effect size, corresponding to 10-point gain on standardised test</li> <li>• Parent tutoring of specific literacy activities: 1.15 effect size, 17-point gain</li> <li>• Parent listening to child read: 0.52 effect size, 8-point gain</li> <li>• Parent reading to child: 0.18 effect size, not significantly different from 0</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Stalega, M. V., Kearns, D. M., Bourget, J., Bayer, N., & Hebert, M. (2024). Is phonological-only instruction helpful for reading?: A meta-analysis.	38	<ul style="list-style-type: none"> <li>• children in preschool through year 1</li> <li>• average age 5 years 7 months</li> <li>• proficient in the language of instruction</li> <li>• typically received phonics instruction in school</li> </ul>	<ul style="list-style-type: none"> <li>• Robust variance estimation used to analyse effectiveness across 38 studies and 293 effect sizes.</li> <li>• Sample: 3,880 participants in preschool through year 1.</li> <li>• Moderator analyses conducted for outcome differences, comparison conditions, and participant characteristics.</li> <li>• Inclusion criteria: specific participant age, PA-only instruction, comparison group without PA activities, true/quasi-experimental design, English language, alphabetic language instruction.</li> <li>• Abstracts screened using ASReview and Abstrackr software.</li> <li>• Effect sizes calculated using Hedges' g.</li> <li>• Robust variance estimation for overall effect size and moderator analysis.</li> </ul>	<ul style="list-style-type: none"> <li>• PA-only instruction has a moderate overall effect on reading-related outcomes.</li> <li>• PA-only instruction is less effective than print-based instruction for word reading outcomes.</li> <li>• The effectiveness of PA-only instruction varies based on the type of reading outcome and the comparison condition.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect of PA-only instruction on reading-related outcomes: <math>g = 0.57</math> (<math>p &lt; .001</math>)</li> <li>• Effect on PA outcomes: <math>g = 0.64</math> (<math>p &lt; .001</math>)</li> <li>• Effect on word reading outcomes: <math>g = -0.33</math> (<math>p = .05</math>)</li> <li>• Effect on nonword reading outcomes: <math>g = -0.17</math> (<math>p = .53</math>)</li> <li>• Effect compared to print-based instruction: <math>g = -0.54</math> (<math>p &lt; .001</math>)</li> <li>• Effect in year 0: <math>g = 0.57</math> (<math>p &lt; .001</math>)</li> <li>• Effect in preschool: <math>g = -0.22</math> (<math>p = .29</math>)</li> <li>• Effect in year 1: <math>g = -0.02</math> (<math>p = .92</math>)</li> <li>• Effect for typical readers: <math>g = 0.59</math> (<math>p &lt; .001</math>)</li> <li>• Effect for at-risk readers: <math>g = -0.03</math> (<math>p = .84</math>)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Stentiford, L., Koutsouris, G., & Norwich, B. (2018). A systematic literature review of the organisational arrangements of primary school-based reading interventions for struggling readers. <i>British Educational Research Journal</i> , 44(4), 608-625.	64	<ul style="list-style-type: none"> <li>• children aged 5-8 years</li> <li>• struggling readers</li> <li>• participants from various countries including the United States, United Kingdom, Netherlands, Australia, Canada, Ireland, Finland, France, Norway, South Africa, and Sweden</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic literature review focusing on reading interventions for struggling readers aged 5-8 years.</li> <li>• Search included published and unpublished studies from 1970 to 2017.</li> <li>• Studies had to employ RCT or quasi-experimental design.</li> <li>• Initial screening of titles and abstracts by one reviewer, with subset checked by two reviewers.</li> <li>• Studies categorised according to RTI model (tier 1, tier 2, tier 3).</li> </ul>	<ul style="list-style-type: none"> <li>• Tier 2/3 interventions are predominantly delivered in pull-out sessions by individuals other than the classroom teacher.</li> <li>• Students receiving tier 2/3 support have less access to their teacher's time and expertise.</li> <li>• There is a strong preference for classroom teachers to lead tier 1 interventions, while other staff or specially recruited individuals handle tiers 2 and 3.</li> </ul>	
Suggate, S. P. (2016). A meta-analysis of the long-term effects of phonemic awareness, phonics, fluency, and reading comprehension interventions. <i>Journal of Learning Disabilities</i> , 49(1), 77-96.	71	<ul style="list-style-type: none"> <li>• Children primarily in early years (mean year 1.18)</li> <li>• Majority boys (55.45%)</li> <li>• Normal readers, at-risk readers (low socioeconomic status or below the 50th percentile), low readers (11th to 25th percentile), reading disabled (below the 10th percentile or with a reading-IQ discrepancy), and learning disabled students</li> <li>• Predominantly from English-speaking countries</li> </ul>	<ul style="list-style-type: none"> <li>• Selection of 71 intervention-control groups from existing studies.</li> <li>• Comprehensive literature search using PsycINFO and ERIC databases.</li> <li>• Calculation of effect sizes by dividing difference between means by pooled standard deviations.</li> <li>• Exploration of bias using box plots and funnel plots.</li> </ul>	<ul style="list-style-type: none"> <li>• The effect sizes of reading interventions decreased from posttest (<math>d_w = 0.37</math>) to follow-up (<math>d_w = 0.22</math>).</li> <li>• Comprehension and phonemic awareness interventions maintained their effects better than phonics and fluency interventions.</li> <li>• Reading interventions were more effective for older children at follow-up.</li> </ul>	<ul style="list-style-type: none"> <li>• -Overall effect size at posttest: <math>d_w = 0.37</math></li> <li>• Overall effect size at follow-up: <math>d_w = 0.22</math></li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Wanzek, J., Vaughn, S., Scammacca, N., Gatlin, B., Walker, M. A., Capin, P., ... & O'Connor, R. (2016). Meta-Analyses of the Effects of Tier 2 Type Reading Interventions in Grades K-3. <i>Educational Psychology Review</i> , 28(3), 551-576.	72	<ul style="list-style-type: none"> <li>• children aged 5-9</li> <li>• at-risk for reading difficulties</li> <li>• some with reading difficulties or identified reading disabilities</li> <li>• majority from low socioeconomic status</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted four meta-analyses on different reading measures.</li> <li>• Comprehensive literature search using ERIC and PsycINFO.</li> <li>• Initial screening of over 37,000 abstracts down to 396 full-text articles.</li> <li>• Included 69 articles describing 72 studies.</li> <li>• Used a coding document based on What Works Clearinghouse standards.</li> <li>• Coded seven categories: participants, methodology, intervention/comparison descriptions, clarity of causal inference, measures, findings.</li> <li>• Calculated effect sizes using Hedges's <i>g</i>.</li> </ul>	<ul style="list-style-type: none"> <li>• Less extensive Tier 2 reading interventions showed moderate positive effects on standardised and not-standardised foundational reading skills.</li> <li>• Smaller effects were observed for standardised language/comprehension measures.</li> <li>• The highest effects were found for not-standardised language/comprehension measures, though based on a limited number of studies.</li> </ul>	<ul style="list-style-type: none"> <li>• Standardised foundational skill measures: <ul style="list-style-type: none"> <li>- Mean ES: 0.54</li> </ul> </li> <li>• Not-standardised foundational skill measures: <ul style="list-style-type: none"> <li>- Mean ES: 0.62</li> </ul> </li> <li>• Standardised language/comprehension measures: <ul style="list-style-type: none"> <li>- Mean ES: 0.36</li> </ul> </li> <li>• Not-standardised language/comprehension measures: <ul style="list-style-type: none"> <li>- Mean ES: 1.02</li> </ul> </li> <li>• Foundational Reading Skills on Standardised Measures: <ul style="list-style-type: none"> <li>- Mean ES: 0.49 (p&lt;0.001)</li> </ul> </li> <li>• Foundational Reading Skills on Not-Standardised Measures: <ul style="list-style-type: none"> <li>- Mean ES: 0.62 (p=0.004)</li> </ul> </li> </ul>

**Table 5: Dyslexia – Primary Years**

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Al Otaiba, S., McMaster, K., Wanzek, J., & Zaru, M. W. (2022). What We Know and Need to Know about Literacy Interventions for Elementary Students with Reading Difficulties and Disabilities, including Dyslexia. <i>Reading Research Quarterly</i> , 57(S1), S19-S36.	14	<ul style="list-style-type: none"> <li>• Primary-aged students (year 0-5)</li> <li>• Students with reading difficulties</li> <li>• Students with reading disabilities</li> <li>• Students with dyslexia</li> <li>• Students at risk for reading disabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Reviewed 14 meta-analyses and systematic reviews of experimental and quasi-experimental studies.</li> <li>• Searched ERIC and PsychINFO databases for peer-reviewed journal articles published from 2010 to 2020.</li> <li>• Used specific search terms related to reading risk, reading difficulty, learning disabilities, intervention, and dyslexia.</li> <li>• Included meta-analyses and literature syntheses that included students in the primary years.</li> <li>• Identified one best evidence synthesis, four meta-analyses, and two narrative syntheses.</li> <li>• Ethical approval was not required as the study involved retrieval and synthesis of existing data.</li> </ul>	<ul style="list-style-type: none"> <li>• Explicit and systematic interventions focusing on code and meaning dimensions of reading and writing improve foundational reading skills.</li> <li>• Standardised protocols, multiple components, and longer duration yield stronger effects, especially in upper primary years.</li> <li>• Integrating reading and writing interventions shows promise but requires further research to optimise implementation.</li> </ul>	<ul style="list-style-type: none"> <li>• Slavin et al. (2011): <ul style="list-style-type: none"> <li>- One-to-one tutoring by certified teachers: ES = 0.39</li> <li>- Less explicit/systematic approach (Reading Recovery): ES = 0.23</li> <li>- Explicit/systematic phonics approach: ES = 0.56</li> <li>- One-to-one tutoring by paraprofessionals/volunteers: ES = 0.24</li> <li>- Small-group tutoring: ES = 0.31</li> </ul> </li> <li>• Wanzek et al. (2015): <ul style="list-style-type: none"> <li>- Code-focused reading skills: ES = 0.54</li> <li>- Meaning-focused skills (standardised): ES = 0.36</li> <li>- Meaning-focused skills (non-standardised): ES = 1.02</li> </ul> </li> <li>• Scanlon et al. (2005): <ul style="list-style-type: none"> <li>- Basic word reading: ES = 0.58 to 0.64</li> <li>- Comprehension: ES = 0.07 to 0.42</li> </ul> </li> <li>• Denton et al. (2006): <ul style="list-style-type: none"> <li>- Word reading: ES = 0.39 to 1.77</li> <li>- Comprehension: ES = 0.37 to 0.63</li> </ul> </li> <li>• Denton et al. (2013): <ul style="list-style-type: none"> <li>- Word reading: ES = 0.39 to 0.56</li> <li>- Comprehension: ES = 0.34 to 0.35</li> </ul> </li> <li>• Schlesinger and Grey (2017): <ul style="list-style-type: none"> <li>- No significant effects favoring multisensory methods over explicit/systematic approach</li> </ul> </li> <li>• Wanzek et al. (2018): <ul style="list-style-type: none"> <li>- Reading: ES = 0.39 (adjusted for publication bias: ES = 0.28)</li> </ul> </li> <li>• Gersten et al. (2020): <ul style="list-style-type: none"> <li>- Reading outcomes: ES = 0.39</li> </ul> </li> <li>• Stevens et al.: <ul style="list-style-type: none"> <li>- Foundational reading skills: ES = 0.22</li> <li>- Vocabulary/comprehension: ES = 0.14</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Baye, A., &amp; Slavin, R. E. (2019). A Synthesis of Quantitative Research on Reading Programs for Secondary Students. <i>Reading Research Quarterly</i>, 53(4), 449-481.</p>	69		<ul style="list-style-type: none"> <li>• Focused on 69 studies using random assignment or high-quality quasi-experiments.</li> <li>• Used best evidence synthesis combining narrative and numeric summaries.</li> <li>• Coded studies for program components, effect sizes, and demographic/methodological features.</li> <li>• Computed effect sizes adjusted for pretests and other covariates.</li> <li>• Reported statistical significance according to What Works Clearinghouse criteria.</li> <li>• Calculated mean effect sizes using a random effects model.</li> </ul>	<ul style="list-style-type: none"> <li>• Categories of programs using one-to-one and small-group tutoring, cooperative learning, whole-school approaches including organisational reforms such as teacher teams, and writing-focused approaches showed positive outcomes.</li> <li>• Programs that provide a daily extra period of reading and those utilising technology were no more effective, on average, than programs that did not provide these resources.</li> <li>• The findings suggest that secondary readers benefit more from socially and cognitively engaging instruction than from additional reading periods or technology.</li> </ul>	

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
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. <i>Topics in Language Disorders</i> , 43(2), 120-143.	53	<ul style="list-style-type: none"> <li>• Students in year 0 through year 5</li> <li>• Students with or at risk for dyslexia</li> </ul>	<ul style="list-style-type: none"> <li>• Secondary analysis of data from Hall et al. (2022)</li> <li>• Coding in two phases: Phase 1 for participant characteristics, interventions, outcome measures, and research methods; Phase 2 for motivational supports, strategies, and outcomes</li> <li>• Standardised mean differences (Hedges' g) used to measure effect sizes</li> <li>• Interventions categorised into three types: no motivational practices, motivational supports only, and motivational strategy instruction</li> <li>• Three-level, multivariate random-effects model used to account for dependencies in effect size estimates</li> </ul>	<ul style="list-style-type: none"> <li>• Only 44% of the reading interventions included motivational practices.</li> <li>• Interventions with direct motivational strategy instruction had larger effects on reading outcomes than those without any motivational practices or with only motivational supports.</li> <li>• The positive effect of motivational strategy instruction was stronger on word reading outcomes than on overall reading or reading comprehension outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall reading outcomes: <ul style="list-style-type: none"> <li>- No motivational practices: <math>g = 0.331</math> (<math>p &lt; .001</math>)</li> <li>- Motivational supports: <math>g = 0.323</math> (<math>p &lt; .001</math>)</li> <li>- Motivational strategy instruction: <math>g = 0.462</math> (<math>p = .013</math>)</li> </ul> </li> <li>• Word reading/spelling outcomes: <ul style="list-style-type: none"> <li>- No motivational practices: <math>g = 0.351</math> (<math>p &lt; .001</math>)</li> <li>- Motivational supports: <math>g = 0.340</math> (<math>p &lt; .001</math>)</li> <li>- Motivational strategy instruction: <math>g = 0.527</math> (<math>p = .010</math>)</li> </ul> </li> <li>• Reading comprehension outcomes: <ul style="list-style-type: none"> <li>- No motivational practices: <math>g = 0.254</math> (<math>p = .001</math>)</li> <li>- Motivational supports: <math>g = 0.359</math> (<math>p &lt; .001</math>)</li> <li>- Motivational strategy instruction: <math>g = 0.358</math> (<math>p = .194</math>)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Galuschka, K., Görgen, R., Kalmar, J., Haberstroh, S., Schmalz, X., & Schulte-Körne, G. (2020). Effectiveness of spelling interventions for learners with dyslexia: A meta-analysis and systematic review. <i>Educational Psychologist</i> , 55(1), 1-20.	34	<ul style="list-style-type: none"> <li>• children, adolescents, and adults</li> <li>• individuals with dyslexia and spelling deficits</li> <li>• spelling or reading performance below the 25th percentile or at least 1 SD, 1 year below the expected level</li> <li>• normal intelligence</li> <li>• taught in their native language</li> <li>• predominantly without other developmental disorders, comorbid psychiatric disorders, neurological diseases, or chromosomal defects</li> <li>• studies conducted in English, German, Swedish, Norwegian, Danish, Dutch, and Brazilian Portuguese</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review and meta-analysis</li> <li>• Included 34 controlled trials</li> <li>• Followed Cochrane group recommendations and PRISMA guidelines</li> <li>• Studies required a control group</li> <li>• Used coding sheets for data extraction</li> <li>• Double-coding for reliability with Cohen's kappa</li> <li>• Meta-analysis on 28 studies with 31 comparisons</li> <li>• Calculated Hedges's g and 95% confidence intervals</li> <li>• Statistical analyses using R software</li> <li>• Assessed study quality with SIGN checklist</li> </ul>	<ul style="list-style-type: none"> <li>• Treatment approaches using phonics, orthographic, and morphological instruction had a moderate to high impact on spelling performance.</li> <li>• Memorisation strategies did not significantly improve spelling.</li> <li>• Supportive software showed a large and significant effect on spelling outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size for spelling interventions on spelling performance: 0.68, [0.45, 0.92], <math>p &lt; .001</math></li> <li>- Overall effect size for spelling interventions on reading performance: 0.42, [0.27, 0.57], <math>p &lt; .001</math></li> <li>• Phonics intervention: <ul style="list-style-type: none"> <li>- Spelling: 0.68, [0.15, 1.21], <math>p = .017</math></li> <li>- Reading: 0.62, [0.37, 0.86], <math>p &lt; .001</math></li> </ul> </li> <li>• Morphological intervention: <ul style="list-style-type: none"> <li>- Spelling: 0.80, [0.39, 1.20], <math>p &lt; .001</math></li> <li>- Reading: 0.30, [-0.18, 0.77], <math>p = .150</math> (non-significant)</li> </ul> </li> <li>• Orthographic intervention: <ul style="list-style-type: none"> <li>- Spelling: 0.67, [0.05, 1.28], <math>p = .034</math></li> <li>- Reading: 0.19, [0.09, 0.29], <math>p = .014</math></li> </ul> </li> <li>• Memorisation intervention: <ul style="list-style-type: none"> <li>- Spelling: 0.22, [-0.39, 0.82], <math>p = .484</math> (non-significant)</li> </ul> </li> <li>• Supportive software: <ul style="list-style-type: none"> <li>- Spelling: 1.25, [0.83, 1.66], <math>p &lt; .001</math></li> <li>- Reading: 0.52, [-5.1, 6.14], <math>p = .449</math> (non-significant)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Hall, C., Dahl-Leonard, K., Cho, E., Solari, E. J., Capin, P., Conner, C. L., Henry, A. R., Cook, L., Hayes, L., Vargas, I., Richmond, C. L., &amp; Kehoe, K. F. (2022). Forty Years of Reading Intervention Research for Elementary Students with or at Risk for Dyslexia: A Systematic Review and Meta-Analysis Recent Meta-Analyses of Reading Intervention Research. <i>Exceptional Children</i>, 88(4), 365-387.</p>	53	<ul style="list-style-type: none"> <li>• children aged 5-11</li> <li>• students with or at risk for dyslexia</li> <li>• some participants experienced economic disadvantage</li> <li>• some participants were emergent multilingual students learning English</li> </ul>	<ul style="list-style-type: none"> <li>• Meta-analysis of experimental or quasi-experimental studies from 1980 to 2020.</li> <li>• Focus on year 0-5 students with or at risk for dyslexia.</li> <li>• Used robust variance estimation and meta-regression.</li> <li>• Followed PRIMSA guidelines for study identification.</li> <li>• Three-step search process including electronic databases and hand searches.</li> <li>• Inclusion criteria: specific publication dates, participant performance thresholds, and study designs.</li> <li>• Coding for participant, intervention, outcome measure, and research method characteristics.</li> <li>• Calculated standardised mean differences using Hedges' g.</li> </ul>	<ul style="list-style-type: none"> <li>• Reading interventions significantly improve norm-referenced reading outcomes for students with or at risk for dyslexia (<math>g = 0.33</math>).</li> <li>• Higher dosage interventions are associated with larger effect sizes.</li> <li>• Reading comprehension outcomes tend to have smaller effect sizes compared to word reading/spelling outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Main effect of instruction on norm-referenced reading outcomes: <math>g = 0.33</math> (<math>p &lt; .001</math>)</li> <li>• Higher dosage studies: <math>b = 0.002</math> (<math>p = .040</math>)</li> <li>• Reading comprehension outcomes: <math>b = -0.080</math> (<math>p = .024</math>)</li> <li>• Weighted average effect size: <math>g = 0.33</math> (95% CI [0.25, 0.41], <math>p &lt; .01</math>)</li> <li>• Spelling instruction in addition to word reading: <math>g = 0.37</math> (<math>p = .03</math>)</li> <li>• Word reading instruction alone: <math>g = 0.23</math></li> <li>• Interventions with PA component: <math>g = 0.38</math> (<math>p = .05</math>)</li> <li>• Interventions without PA component: <math>g = 0.22</math></li> <li>• Multisensory interventions: <math>g = 0.20</math></li> <li>• Non-multisensory interventions: <math>g = 0.34</math></li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Louick, R., Emery, A., Muenks, K., &amp; O'grady, M. (2023). Attending to Motivation During Vocabulary Interventions for Students With or at Risk for Learning Disabilities A Review of the Literature. <i>Topics in Language Disorders</i>, 43(2), 109-128.</p>	21	<ul style="list-style-type: none"> <li>• P-12 students</li> <li>• Students with or at risk for learning disabilities</li> <li>• Students with learning difficulties</li> <li>• Students at risk for language and literacy difficulties</li> <li>• Students performing below expectations</li> <li>• Students at risk for reading and language delays</li> <li>• Locations: United States (Southwest, Northeast, Southeast, Midwest), Germany</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review following PRISMA guidelines.</li> <li>• Search strategy: EBSCO PowerSearch across 25 databases.</li> <li>• Search terms: 'vocab*', 'intervention', 'disab*'</li> <li>• Inclusion criteria: Peer-reviewed, English, published since 2004.</li> <li>• Initial search: 1,931 articles; post-duplicates: 831.</li> <li>• Final 21 articles.</li> <li>• Coding for vocabulary constructs, student descriptors, age/year level, study location, and motivational constructs integration.</li> </ul>	<ul style="list-style-type: none"> <li>• Successful vocabulary interventions for students with or at risk for learning disabilities frequently address motivation through goal setting and interest.</li> <li>• Promoting student interest and encouraging goal setting are common strategies in effective interventions.</li> <li>• All reviewed studies demonstrated effectiveness in increasing targeted vocabulary skills.</li> </ul>	<ul style="list-style-type: none"> <li>• Elleman et al. (2009): <ul style="list-style-type: none"> <li>- Reading comprehension skills for students with LD: <math>d = 1.23</math></li> <li>- Reading comprehension skills for non-LD peers: <math>d = 0.39</math></li> </ul> </li> <li>• McBreen and Savage (2021): <ul style="list-style-type: none"> <li>- Small effect on reading achievement overall</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Neitzel, A. J., Lake, C., Pellegrini, M., & Slavin, R. E. (2022). A synthesis of quantitative research on programs for struggling readers in elementary schools.	65	<ul style="list-style-type: none"> <li>• struggling readers in primary schools</li> <li>• mix of races and ethnicities (White, African American, Hispanic)</li> <li>• students qualifying for free or reduced-price lunch</li> <li>• some students with special education needs</li> <li>• years 0-6</li> </ul>	<ul style="list-style-type: none"> <li>• Reviewed research on reading programs for struggling readers in primary schools.</li> <li>• Included 65 studies of 51 programs, with randomised and quasi-experimental designs.</li> <li>• Conducted broad literature search across multiple databases and sources.</li> <li>• Used a three-stage process for screening, reviewing, and coding studies.</li> <li>• Assessed studies against ESSA evidence standards and other accepted standards.</li> <li>• Coded data on substantive, methodological, and extrinsic factors.</li> <li>• Calculated effect sizes as standardised mean differences.</li> <li>• Used meta-analytic models with robust variance estimation for analysis.</li> <li>• Categorised studies into five main program features.</li> </ul>	<ul style="list-style-type: none"> <li>• One-to-one tutoring has positive outcomes, with effect sizes varying based on the type of tutor.</li> <li>• Whole-class and whole-school approaches incorporating tutoring show significant positive outcomes.</li> <li>• Technology-supported adaptive instruction did not show statistically significant positive outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall reading achievement: ES = 0.23 (p &lt; .001)</li> <li>• Multitiered whole-class/whole-school approaches: ES = 0.27 (p = .098)</li> <li>• Whole-class Tier 1 approaches: ES = 0.31 (p = .108)</li> <li>• Technology-supported adaptive instruction: ES = 0.09 (p = .153)</li> <li>• Tutoring: ES = 0.26 (p &lt; .001)</li> <li>• One-to-small group tutoring: ES = 0.24 (p &lt; .001) <ul style="list-style-type: none"> <li>- Teachers: ES = 0.21</li> <li>- Teaching assistants: ES = 0.27</li> </ul> </li> <li>• One-to-one tutoring: ES = 0.41 (p &lt; .001) <ul style="list-style-type: none"> <li>- Teachers: ES = 0.38</li> <li>- Teaching assistants: ES = 0.44</li> <li>- Paid volunteers: ES = 0.46</li> <li>- Unpaid volunteers: ES = 0.14</li> </ul> </li> <li>• General reading outcomes: ES = 0.14 (p = .006)</li> <li>• Alphabets outcomes: ES = 0.28 (p &lt; .001)</li> <li>• Comprehension outcomes: ES = 0.21 (p &lt; .001)</li> <li>• Fluency outcomes: ES = 0.27 (p &lt; .001)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Rehfeld, D. M., Kirkpatrick, M., O'Guinn, N., Renbarger, R., & Storkel, H. L. (2022). A Meta-Analysis of Phonemic Awareness Instruction Provided to Children Suspected of Having a Reading Disability. <i>American Journal of Speech-Language Pathology</i> , 31(2), 1002-1021.	138	<ul style="list-style-type: none"> <li>• Children aged 18 years or younger</li> <li>• Mean age of participants: 6.36 years</li> <li>• Suspected of having a reading disability</li> <li>• Not reading at levels expected for their age</li> <li>• Intact sensory abilities</li> <li>• Eligible for free or reduced school lunch programs (low socioeconomic status)</li> <li>• Interventions conducted in English or other languages (typically Spanish or Chinese)</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic search of seven databases.</li> <li>• Review of 1,643 unique manuscripts.</li> <li>• Data extraction from 138 included manuscripts.</li> <li>• Use of a random effects model for meta-analysis.</li> <li>• Search terms included phonological awareness, phonemic awareness, intervention, instruction, at-risk, disadvantaged, learning difficulties, reading difficulties, RTI, and/or MTSS.</li> <li>• Interrater reliability checks at title-abstract and full-text review stages.</li> <li>• Manual data extraction and quality assessment.</li> <li>• Statistical analysis using meta and metafor R packages.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonemic awareness instruction had a medium effect on composite and segmentation outcomes and a small effect on blending, first sound identification, and deletion outcomes.</li> <li>• Instruction effects were strongest in year 0 and year 1, but positive outcomes were also found for older children.</li> <li>• There was no significant relationship between cumulative intervention intensity and child performance.</li> </ul>	<ul style="list-style-type: none"> <li>• Composite outcomes: <ul style="list-style-type: none"> <li>- Phonemic awareness instruction: <math>g = 0.511</math> (medium effect)</li> <li>- Phonemic awareness instruction alone: <math>g = 1.002</math> (large effect)</li> <li>- Phonemic awareness instruction with other literacy skills: <math>g = 0.340</math> (small effect)</li> <li>- Interventions including graphemes: <math>g = 0.545</math> (medium effect)</li> <li>- Interventions not including graphemes: <math>g = 0.250</math> (small effect)</li> </ul> </li> <li>• Statistical significance: <math>p = .009</math> (Begg &amp; Mazumdar), <math>p = .005</math> (Egger et al.)</li> </ul>
Rice, M., & Wijekumar, K. (2024). Inference Skills for Reading: A Meta-Analysis of Instructional Practices.	56	<ul style="list-style-type: none"> <li>• Participants ranged from preschool children to adults</li> <li>• Included less skilled readers, skilled readers, and both</li> <li>• Included multilingual learners and non-multilingual learners</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a three-step literature search (PsycInfo, ERIC, ProQuest Dissertations and Theses Global).</li> <li>• Confirmed studies met inclusion criteria (experimental/quasi-experimental design, aimed to improve inferencing skills, had outcome measures, participants of any age, written in English).</li> <li>• Coded studies for six quality indicators.</li> <li>• Used Hedges's <math>g</math> to calculate standardised mean differences.</li> </ul>	<ul style="list-style-type: none"> <li>• Inference instruction had a moderate, positive effect on student inference skills and general comprehension.</li> <li>• No significant differences in effectiveness were found across participant characteristics or outcome measures.</li> <li>• Independent reading during instruction was more effective than listening to text read aloud.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall main effect: <math>g = 0.495</math> (SE = 0.070, 95% CI [0.356, 0.635], <math>p &lt; .001</math>)</li> <li>• Reading text aloud: <math>g = 0.28</math> (95% CI [0.09, 0.47])</li> <li>• Independent reading: <math>g = 0.79</math> (95% CI [0.54, 1.05])</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Wanzek, J., Vaughn, S., Scammacca, N., Gatlin, B., Walker, M. A., Capin, P., ... & O'connor, R. (2016). Meta-Analyses of the Effects of Tier 2 Type Reading Interventions in Grades K-3. <i>Educational Psychology Review</i> , 28(3), 551-576.	72	<ul style="list-style-type: none"> <li>• children aged 5-9</li> <li>• at-risk for reading difficulties</li> <li>• some with reading difficulties or reading disabilities</li> <li>• majority from low socioeconomic status</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted four meta-analyses on standardised and not-standardised measures.</li> <li>• Comprehensive search of ERIC and PsycINFO databases.</li> <li>• Initial screening of over 37,000 abstracts.</li> <li>• Final set of studies met specific inclusion criteria.</li> <li>• Used a standardised coding document for data extraction.</li> <li>• Calculated effect sizes using Hedges's g.</li> </ul>	<ul style="list-style-type: none"> <li>• Less extensive Tier 2 reading interventions have moderate positive effects on standardised and not-standardised foundational reading skills.</li> <li>• Smaller effects are observed for standardised language/comprehension measures.</li> <li>• The highest effects are noted for not-standardised language/comprehension measures, although only a few studies included these measures.</li> </ul>	<ul style="list-style-type: none"> <li>• Standardised foundational skill measures: Mean ES = 0.54 (<math>p &lt; 0.001</math>)</li> <li>• Not-standardised foundational skill measures: Mean ES = 0.62 (<math>p = 0.004</math>)</li> <li>• Standardised language/comprehension measures: Mean ES = 0.36 (<math>p = 0.005</math>)</li> <li>• Not-standardised language/comprehension measures: Mean ES = 1.02 (<math>p &lt; 0.001</math>)</li> </ul>

**Table 6: Dyslexia – Secondary Years**

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Baye, A., &amp; Slavin, R. E. (2019). A Synthesis of Quantitative Research on Reading Programs for Secondary Students. <i>Reading Research Quarterly</i>, 53(4), 449-481.</p>	<p>69</p>		<ul style="list-style-type: none"> <li>• Focused on 69 studies using random assignment or high-quality quasi-experiments.</li> <li>• Used best evidence synthesis combining narrative and numeric summaries.</li> <li>• Adhered to rigorous inclusion criteria based on ESSA standards.</li> <li>• Conducted a broad literature search to locate eligible studies.</li> <li>• Coded studies for program components, effect sizes, and demographic/methodological features.</li> <li>• Computed effect sizes adjusted for pretests and other covariates.</li> <li>• Reported statistical significance according to What Works Clearinghouse criteria.</li> <li>• Calculated mean effect sizes using a random effects model.</li> <li>• Categorised programs based on distinctive components.</li> <li>• Computed mean effect sizes for technology approaches.</li> </ul>	<ul style="list-style-type: none"> <li>• Categories of programs using one-to-one and small-group tutoring, cooperative learning, whole-school approaches including organisational reforms such as teacher teams, and writing-focused approaches showed positive outcomes.</li> <li>• Programs that provide a daily extra period of reading and those utilising technology were no more effective, on average, than programs that did not provide these resources.</li> <li>• The findings suggest that secondary readers benefit more from socially and cognitively engaging instruction than from additional reading periods or technology.</li> </ul>	

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
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. <i>Topics in Language Disorders</i> , 43(2), 120-143.	53	<ul style="list-style-type: none"> <li>• Students in year 0 through year 5</li> <li>• Students with or at risk for dyslexia</li> </ul>	<ul style="list-style-type: none"> <li>• Secondary analysis of data from Hall et al. (2022)</li> <li>• Coding in two phases: Phase 1 for participant characteristics, interventions, outcome measures, and research methods; Phase 2 for motivational supports, strategies, and outcomes</li> <li>• Standardised mean differences (Hedges' g) used to measure effect sizes</li> <li>• Robust variance estimation applied for corrections</li> <li>• Interventions categorised into three types: no motivational practices, motivational supports only, and motivational strategy instruction</li> </ul>	<ul style="list-style-type: none"> <li>• Only 44% of the reading interventions included motivational practices.</li> <li>• Interventions with direct motivational strategy instruction had larger effects on reading outcomes than those without any motivational practices or with only motivational supports.</li> <li>• The positive effect of motivational strategy instruction was stronger on word reading outcomes than on overall reading or reading comprehension outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall reading outcomes: <ul style="list-style-type: none"> <li>- No motivational practices: <math>g = 0.331</math> (<math>p &lt; .001</math>)</li> <li>- Motivational supports: <math>g = 0.323</math> (<math>p &lt; .001</math>)</li> <li>- Motivational strategy instruction: <math>g = 0.462</math> (<math>p = .013</math>)</li> </ul> </li> <li>• Word reading/spelling outcomes: <ul style="list-style-type: none"> <li>- No motivational practices: <math>g = 0.351</math> (<math>p &lt; .001</math>)</li> <li>- Motivational supports: <math>g = 0.340</math> (<math>p &lt; .001</math>)</li> <li>- Motivational strategy instruction: <math>g = 0.527</math> (<math>p = .010</math>)</li> </ul> </li> <li>• Reading comprehension outcomes: <ul style="list-style-type: none"> <li>- No motivational practices: <math>g = 0.254</math> (<math>p = .001</math>)</li> <li>- Motivational supports: <math>g = 0.359</math> (<math>p &lt; .001</math>)</li> <li>- Motivational strategy instruction: <math>g = 0.358</math> (<math>p = .194</math>)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Filderman, M. J., Austin, C. R., Boucher, A. N., O'donnell, K., & Swanson, E. A. (2021). A Meta-Analysis of the Effects of Reading Comprehension Interventions on the Reading Comprehension Outcomes of Struggling Readers in Third Through 12th Grades. <i>Exceptional Children</i> .	64	<ul style="list-style-type: none"> <li>Total participants: 6,349</li> <li>Primary students: 3,555</li> <li>Secondary students: 2,007</li> <li>Mixed year levels: 787</li> <li>Lower to lower-middle socioeconomic status: 2,022</li> <li>Middle to middle-upper socioeconomic status: 2,484</li> <li>Upper socioeconomic status: 59</li> <li>Primarily at risk: 4,020</li> <li>Identified with a learning disability: 2,329</li> <li>Struggling readers in years 3 through 12</li> </ul>	<ul style="list-style-type: none"> <li>Systematic search of literature using electronic databases (ERIC, PsycINFO, Education Source, Academic Search Complete).</li> <li>Search terms included reading-related terms, comprehension-related terms, and terms related to struggling readers.</li> <li>Hand search and ancestral search were also conducted.</li> <li>Abstracts were screened for eligibility; full texts were reviewed for final inclusion.</li> <li>Coding protocol adapted from previous research; reliability ensured through independent coding and interrater agreement.</li> <li>Hedges's g used for effect size calculation; meta-analysis conducted using robust variance estimation.</li> <li>Trim-and-fill method used to assess publication bias.</li> </ul>	<ul style="list-style-type: none"> <li>Reading comprehension interventions have a significant positive effect on comprehension outcomes for struggling readers (<math>g = .59</math>).</li> <li>Background knowledge instruction and strategy instruction are associated with significantly larger effects on reading comprehension.</li> <li>Instructional enhancements and standardised measures are associated with significantly lower effects on reading comprehension.</li> </ul>	<ul style="list-style-type: none"> <li>Overall reading comprehension intervention: <math>g = .59</math> (<math>p &lt; .001</math>)</li> <li>Maintenance effects: <math>g = .36</math> (<math>p = .06</math>)</li> <li>Upper primary students: <math>g = .47</math> (<math>p &lt; .001</math>)</li> <li>Secondary students: <math>g = .67</math> (<math>p &lt; .001</math>)</li> <li>Strategy instruction: <math>g = .69</math> (<math>p &lt; .001</math>)</li> <li>Main idea instruction: <math>g = .72</math> (<math>p &lt; .001</math>)</li> <li>Inference instruction: <math>g = .56</math> (<math>p &lt; .001</math>)</li> <li>Text structure: <math>g = .47</math> (<math>p &lt; .001</math>)</li> <li>Retell: <math>g = .59</math> (<math>p &lt; .001</math>)</li> <li>Prediction: <math>g = .60</math> (<math>p &lt; .001</math>)</li> <li>Background knowledge: <math>g = .55</math> (<math>p &lt; .001</math>)</li> <li>Vocabulary: <math>g = .39</math> (<math>p &lt; .001</math>)</li> <li>Content knowledge: <math>g = .64</math> (<math>p &lt; .001</math>)</li> <li>Metacognitive instruction: <math>g = .49</math> (<math>p &lt; .001</math>)</li> <li>Graphic organisers: <math>g = .46</math> (<math>p &lt; .001</math>)</li> <li>Technology: <math>g = .59</math> (<math>p = .007</math>)</li> <li>Standardised measures: <math>g = .28</math></li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Hall-Mills, S. S., & Marante, L. M. (2020). Explicit text structure instruction supports expository text comprehension for adolescents with learning disabilities: A systematic review. <i>Learning Disability Quarterly</i> , 43(4), 206-221.	9	<ul style="list-style-type: none"> <li>• Adolescents aged 10-19</li> <li>• Students in years 7-12</li> <li>• Diagnosed with or at risk for learning disabilities (LDs), including specific learning disability (SLD) and reading disability (RD)</li> <li>• Total of 417 participants across seven primary studies</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted an evidence-based systematic review (EBSR) following PRISMA guidelines.</li> <li>• Searched four electronic databases using specific descriptors.</li> <li>• Included studies published between January 1997 and January 2019.</li> <li>• Focused on adolescents with or at risk for learning disabilities.</li> <li>• Data extraction and coding were performed independently by both authors.</li> <li>• Addressed risk of bias using the QuEST model.</li> <li>• Final selection included nine studies after thorough screening.</li> </ul>	<ul style="list-style-type: none"> <li>• Explicit text structure instruction improves expository reading comprehension for adolescents with or at risk for learning disabilities.</li> <li>• The strength of evidence is moderately strong, with most studies showing large effect sizes.</li> <li>• There are concerns about fidelity of implementation and transfer/maintenance effects, indicating areas for further research.</li> </ul>	<ul style="list-style-type: none"> <li>• Hebert et al. (2016): <ul style="list-style-type: none"> <li>- Medium average effect size on proximal reading outcomes: <math>d = 0.56</math>, 95% CI [0.43, 0.69]</li> <li>- Large average weighted effect sizes for studies with students at-risk or with LD: <math>d = 0.96</math>, 95% CI [0.44, 1.47]</li> </ul> </li> <li>• Pyle et al. (2017): <ul style="list-style-type: none"> <li>- Large average effect size: <math>d = 0.83</math>, CI [0.76, 0.91]</li> </ul> </li> <li>• Bakken et al. (1997): <ul style="list-style-type: none"> <li>- Immediate recall: <math>d = 2.17</math></li> <li>- transfer tests: <math>d = 1.57</math></li> </ul> </li> <li>• Meyer et al. (2010): <ul style="list-style-type: none"> <li>- Immediate post-test (problem solution): <math>d = 0.79</math></li> <li>- Immediate post-test (comparison text): <math>d = 0.62</math></li> <li>- Delayed post-test (4 months): <math>d = 0.52</math> (problem solution), <math>d = 0.34</math> (comparison text)</li> <li>- Below year level readers: <math>d = 0.42-1.16</math></li> </ul> </li> <li>• O'Connor et al. (2015): <ul style="list-style-type: none"> <li>- Cause/effect relationships (all students in intervention group): <math>\eta^2p = 0.27</math></li> <li>- Cause/effect relationships (students with disabilities): <math>\eta^2p = 0.14</math></li> </ul> </li> <li>• Wilkins (2007): <ul style="list-style-type: none"> <li>- Group effects for comparison group who received both instruction conditions: <math>d = 0.53</math></li> </ul> </li> <li>• Ihle (2011): <ul style="list-style-type: none"> <li>- Content area passage performance after TPI: <math>d = 0.31</math></li> </ul> </li> <li>• Nealy (2003): <ul style="list-style-type: none"> <li>- Maintenance median scores: averaged 70%</li> <li>- Percent overlapping data between baseline and intervention phases: minimal (0%-25%)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Hebert, M., Kearns, D. M., Hayes, J. B., Bazis, P., Cooper, S., & Hogan, T. (2018). Why Children With Dyslexia Struggle With Writing and How to Help Them. <i>Language, Speech, and Hearing Services in Schools</i> , 49(4), 762-776.	19	<ul style="list-style-type: none"> <li>• 10-year-old year 4 students</li> <li>• diagnosed with dyslexia</li> <li>• qualifies for special education services</li> <li>• below average performance on standardised reading and writing tests</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted systematic searches across two databases for spelling interventions.</li> <li>• Included studies from two meta-analyses.</li> <li>• Examined recent meta-analyses and conducted forward searches for other instructional practices.</li> <li>• Used specific keyword categories to search ERIC and PsycINFO.</li> <li>• Screened 196 initially identified studies for relevance and methodological rigor.</li> <li>• Included only studies showing significant improvement in spelling in the final set of 19 articles.</li> </ul>	<ul style="list-style-type: none"> <li>• Effective remedial and compensatory strategies for spelling, transcription, executive function, and working memory were identified.</li> <li>• Instructional strategies can improve both writing and reading skills in students with dyslexia.</li> <li>• Spelling difficulties in children with dyslexia are strongly related to their reading difficulties and originate from difficulties in processing sound information.</li> </ul>	<p>The study reviewed 19 studies showing positive effects on spelling achievement for students with dyslexia. The effective instructional components identified were:</p> <ul style="list-style-type: none"> <li>• Multicomponent phonics program: 8 studies</li> <li>• Letter–sound analysis: 7 studies</li> <li>• Morphological analysis: 5 studies</li> <li>• Orthographic analysis or memory: 3 studies</li> <li>• Word meaning: 2 studies</li> <li>• Syllabic analysis: 2 studies</li> <li>• Vocabulary and reading comprehension program: 2 studies</li> </ul>
Rice, M., & Wijekumar, K. (2024). Inference Skills for Reading: A Meta-Analysis of Instructional Practices.	56	<ul style="list-style-type: none"> <li>• Participants ranged from preschool children to adults</li> <li>• Included less skilled readers, skilled readers, and both</li> <li>• Included multilingual learners and non-multilingual learners</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a three-step literature search (PsycInfo, ERIC, ProQuest Dissertations and Theses Global).</li> <li>• Confirmed studies met inclusion criteria (experimental/quasi-experimental design, aimed to improve inferencing skills, had outcome measures, participants of any age, written in English).</li> <li>• Used Hedges's g to calculate standardised mean differences.</li> </ul>	<ul style="list-style-type: none"> <li>• Inference instruction had a moderate, positive effect on student inference skills and general comprehension.</li> <li>• No significant differences in effectiveness were found across participant characteristics or outcome measures.</li> <li>• Independent reading during instruction was more effective than listening to text read aloud.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall main effect: <math>g = 0.495</math> (SE = 0.070, 95% CI [0.356, 0.635], <math>p &lt; .001</math>)</li> <li>• Reading text aloud: <math>g = 0.28</math> (95% CI [0.09, 0.47])</li> <li>• Independent reading: <math>g = 0.79</math> (95% CI [0.54, 1.05])</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Sohn, H., Acosta, K., Brownell, M. T., Gage Wested, N. A., Tompson, E., Pudvah, C., Gage, N. A., & Thompson, E. (2023). A meta-analysis of interventions to improve reading comprehension outcomes for adolescents with reading difficulties. Journal Name, Volume(Issue), pages.	37	<ul style="list-style-type: none"> <li>• Students in years 6 to 12</li> <li>• Students with reading difficulties (RDs)</li> <li>• Students with reading disabilities (SWDs)</li> <li>• At-risk students (scoring at or below the 30th percentile in reading)</li> </ul>	<ul style="list-style-type: none"> <li>• Synthesised 97 effect sizes from 37 intervention studies.</li> <li>• Used random-effects robust variance estimation (RVE).</li> <li>• Excluded non-peer-reviewed studies and those not conducted in the U.S.</li> <li>• Systematic search and screening process identified relevant studies.</li> <li>• Calculated Hedge's g for effect sizes.</li> <li>• Included only comprehension-related measures.</li> <li>• Assessed publication bias using funnel plots, trim-and-fill tests, and fail-safe N statistics.</li> </ul>	<ul style="list-style-type: none"> <li>• Interventions designed to improve reading comprehension outcomes for adolescents with reading difficulties were generally effective (<math>g = 0.63</math>).</li> <li>• (Meta)cognitive strategies had the largest effect on reading comprehension outcomes (<math>g = 1.170</math>).</li> <li>• Short-duration interventions and those implemented by researchers were more effective than longer interventions and those implemented by teachers.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall intervention effect size: <math>g = 0.63</math> (<math>p &lt; .001</math>)</li> <li>• Reading comprehension strategies: <ul style="list-style-type: none"> <li>- (Meta)cognitive: <math>g = 1.170</math> (<math>p &lt; .001</math>)</li> <li>- Multicomponent: <math>g = 0.308</math> (<math>p &lt; .001</math>)</li> <li>- Other: <math>g = 0.356</math> (<math>p = .071</math>)</li> </ul> </li> <li>• Text content: <ul style="list-style-type: none"> <li>- ELA: <math>g = 0.808</math> (<math>p = .002</math>)</li> <li>- Science: <math>g = 0.991</math> (<math>p = .088</math>)</li> <li>- Social studies: <math>g = 0.755</math> (<math>p = .013</math>)</li> <li>- Multiple subjects: <math>g = 0.280</math> (<math>p = .009</math>)</li> </ul> </li> <li>• Text structure: <ul style="list-style-type: none"> <li>- Expository: <math>g = 0.681</math> (<math>p = .002</math>)</li> <li>- Narrative: <math>g = 1.720</math> (<math>p = .325</math>)</li> <li>- Both expository and narrative: <math>g = 0.413</math> (<math>p &lt; .001</math>)</li> </ul> </li> </ul>
Washburn, J. (2021). Reviewing Evidence on the Relations Between Oral Reading Fluency and Reading Comprehension for Adolescents. Journal Name, Volume(Issue), page range.	23	<ul style="list-style-type: none"> <li>• Adolescents in years 6 to 12</li> <li>• Students with limited reading proficiency (below the 40th percentile on standardised RC exams)</li> <li>• Some students with diagnosed learning disabilities affecting reading</li> <li>• Assessed reading skills in English</li> <li>• Conducted in the United States</li> <li>• Some students enrolled in reading remediation classes</li> </ul>	<ul style="list-style-type: none"> <li>• Used Hallinger's (2014) conceptual framework for systematic reviews.</li> <li>• Restricted search to cross-sectional quantitative studies with sample sizes <math>\geq 30</math>.</li> <li>• Excluded case studies, single-case designs, and low statistical power studies.</li> <li>• Conducted searches using Education Research Complete and ERIC Digest.</li> <li>• Screened 1,504 articles down to 23 eligible studies.</li> <li>• Applied inclusion criteria: empirical studies on ORF and RC in years 6-12 in English within the U.S.</li> </ul>	<ul style="list-style-type: none"> <li>• Knowledge of an adolescent's ORF provides helpful information about their reader profile but is not sufficient to evaluate instructional needs or measure progress.</li> <li>• The predictive power of ORF varies depending on how it is measured and the type of RC measure used.</li> <li>• Relying heavily on ORF for making instructional decisions about reading comprehension can be problematic due to its interaction with multiple reading skills and the complexity of RC.</li> </ul>	Not applicable (the paper is a systematic review and does not discuss specific intervention effects)

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Wright, T.S. & Cervetti, G. N. (2017). A Systematic Review of the Research on Vocabulary Instruction That Impacts Text Comprehension. <i>Reading Research Quarterly</i> , 51(4), 399-416.	36	<ul style="list-style-type: none"> <li>• Year 0 to 12 students</li> <li>• Linguistically diverse students</li> <li>• Students from low-income families</li> <li>• Students with varying initial vocabulary and comprehension levels</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review focusing on vocabulary interventions with comprehension outcomes.</li> <li>• Analysed 36 studies based on types of comprehension measures and interventions.</li> <li>• Systematic search using ERIC and references from previous meta-analyses and reviews.</li> <li>• Coded studies for intervention approach (direct teaching or word-solving strategies), age/year of participants, instructional time, active processing requirements, type of comprehension measure used, study design (between-subjects or within-subjects), and random assignment.</li> </ul>	<ul style="list-style-type: none"> <li>• Teaching word meanings generally supports comprehension of texts containing those words.</li> <li>• Active processing methods are more effective than passive methods for supporting comprehension.</li> <li>• There is limited evidence that direct teaching of word meanings improves generalised comprehension.</li> </ul>	<ul style="list-style-type: none"> <li>• Stahl &amp; Fairbanks (1986): <ul style="list-style-type: none"> <li>- Passages containing taught words: Effect size = .97</li> <li>- Global measures: Effect size = .30</li> </ul> </li> <li>• Elleman et al. (2009): <ul style="list-style-type: none"> <li>- Custom measures: Hedges's <math>g = 0.50</math></li> <li>- Standardised measures: Hedges's <math>g = 0.10</math></li> </ul> </li> <li>• Beck et al. (1982): Significant improvement in comprehension</li> <li>• Lesaux et al. (2014): Significant improvement in comprehension</li> <li>• McKeown &amp; Beck (2014): No significant improvement</li> <li>• Seifert &amp; Espin (2012): No significant improvement</li> </ul>

**Table 7: Dyslexia – English Language Learners**

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Artzi, L., Hsin, L. B., Sanford, A. K., Esparza Brown, J., &amp; Guin, S. (2022). Meeting the Language Needs of Emergent Multilingual Students at Risk for Learning Disabilities through Multitiered Systems of Support. American Institutes for Research.</p>	<p>Not applicable</p>	<ul style="list-style-type: none"> <li>• emergent multilingual (EM) students</li> <li>• lower primary (typically aged 5-9)</li> <li>• struggling readers</li> <li>• majority Spanish-speaking</li> </ul>	<ul style="list-style-type: none"> <li>• Review of research-based practices for reading instruction within MTSS.</li> <li>• Description and illustration of the PLUSS framework.</li> <li>• Case example demonstrating the application of the PLUSS framework.</li> <li>• Integration of empirically demonstrated practices for EM students.</li> </ul>	<ul style="list-style-type: none"> <li>• The paper describes research-based practices to enhance reading instruction and intervention for emergent multilingual (EM) students within a multitiered system of supports (MTSS).</li> <li>• The PLUSS framework is presented as a cohesive approach to integrating these practices within MTSS.</li> <li>• MTSS components rooted in asset-based learning principles show initial promise in supporting EM students' reading development.</li> </ul>	<ul style="list-style-type: none"> <li>• Vocabulary outcomes:               <ul style="list-style-type: none"> <li>- Non-EM students: <math>g = .65</math></li> <li>- EM students: <math>g = .72</math> (<math>p &lt; .01</math>)</li> </ul> </li> <li>• Reading comprehension outcomes:               <ul style="list-style-type: none"> <li>- Non-EM students: <math>g = .05</math></li> <li>- EM students: <math>g = .55</math> (<math>p &lt; .05</math>)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Bosma, E., Bakker, A., Zenger, L., &amp; Blom, E. (2023). Supporting the development of the bilingual lexicon through translanguaging: a realist review integrating psycholinguistics with educational sciences.</p>	<p>Not applicable</p>	<ul style="list-style-type: none"> <li>• Monolingual and bilingual children</li> <li>• Age range: 6 months to 7 years</li> <li>• Bilingual children include those speaking Spanish-English and English-Hebrew</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate the claim that translanguaging supports bilingual lexicon development by enhancing cross-linguistic transfer.</li> <li>• Integrate findings from psycholinguistics and educational sciences.</li> <li>• Adopt a realist review methodology.</li> <li>• Focus on understanding mechanisms of interventions rather than exhaustive literature review.</li> <li>• Include intervention studies with strong designs, excluding weaker studies.</li> </ul>	<ul style="list-style-type: none"> <li>• Translanguaging strategies can strengthen cross-language connections and facilitate cross-linguistic lexical transfer.</li> <li>• Both separate and mixed bilingual interventions lead to larger improvements in L1 and L2 than monolingual L2 interventions.</li> <li>• Translanguaging has great potential for supporting the organisation of the bilingual lexicon in educational settings.</li> </ul>	<ul style="list-style-type: none"> <li>• Perozzi and Chavez Sanchez (1992): Prepositions and pronouns taught first in L1 Spanish and then in L2 English were learned faster in L2 than those taught only in L2.</li> <li>• Roberts (2008): Home reading in L1 combined with classroom reading and vocabulary instruction in L2 resulted in significantly better performance on L2 target vocabulary after the first 6-week period compared to home reading in L2.</li> <li>• Armon-Lotem et al. (2021): Children improved vocabulary in both languages following interventions, with stronger gains in Hebrew following English intervention for children with stronger English skills.</li> <li>• Méndez et al. (2015, 2018): Bilingual shared book reading intervention led to significantly more Spanish and English vocabulary acquisition compared to an English-only intervention.</li> <li>• Leacox and Jackson (2014) and Lugo-Neris et al. (2010): Vocabulary bridging resulted in larger gains in English vocabulary compared to an English-only strategy.</li> <li>• Read et al. (2020): Comparable L2 vocabulary gains for monolingual L2 books and code-switching books, with older children learning more from code-switching books.</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Cheung, A. C., &amp; Slavin, R. E. (2012). Effective reading programs for Spanish-dominant English language learners (ELLs) in the elementary grades: A synthesis of research. <i>Review of Educational Research</i>, 82(4), 351-395.</p>	<p>35</p>	<ul style="list-style-type: none"> <li>• Spanish-dominant English language learners (ELLs)</li> <li>• Primary school children</li> <li>• Predominantly Hispanic</li> <li>• Low socioeconomic status (SES)</li> <li>• Locations include Texas, California, Colorado, New Mexico, Minnesota, Illinois, and Massachusetts</li> <li>• Secondary school dropout rate among U.S. Hispanics is highest among all minority groups</li> </ul>	<ul style="list-style-type: none"> <li>• Best evidence synthesis review technique</li> <li>• Comprehensive Meta-Analysis Software for effect size calculation</li> <li>• Five key steps: locating studies, screening for inclusion criteria, coding studies, calculating effect sizes, conducting statistical analyses</li> <li>• Inclusion criteria: comparison of bilingual vs. English immersion classes, random assignment or matched control groups, Spanish-dominant ELLs in primary schools, quantitative measures of English reading performance, minimum treatment duration of one school year</li> </ul>	<ul style="list-style-type: none"> <li>• Bilingual education has a modest positive effect on English reading outcomes for Spanish-dominant ELLs, with an effect size of .21.</li> <li>• The quality of instruction is more important than the language of instruction.</li> <li>• Effective interventions include programs like Success for All, cooperative learning, Direct Instruction, and ELLA, which involve extensive professional development and cooperative learning.</li> </ul>	<ul style="list-style-type: none"> <li>• Bilingual education: ES = .21 (p &lt; .01)</li> <li>- Success for All: ES = .35 (p = .00)</li> <li>- Cooperative Learning: ES = .47 (p = .00)</li> <li>- Direct Instruction: ES = .28 (p = .04)</li> <li>- Vocabulary Intervention: ES = .09 (p = .33)</li> <li>- English Language and Literacy Acquisition (ELLA): ES = .15 (p = .03)</li> <li>- Literacy Curriculum: ES = -.12 (p = .46)</li> <li>- Small Group: ES = .48 (p = .00)</li> <li>- Tutoring: ES = .19 (p = .14)</li> <li>• Overall effect size (fixed): ES = .23 (p = .00)</li> <li>• Overall effect size (random): ES = .23 (p = .00)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Pico, D. L., & Woods, C. (2022). Shared Book Reading for Spanish-Speaking Emergent Bilinguals: A Review of Experimental Studies.	17	<ul style="list-style-type: none"> <li>Spanish-speaking emergent bilinguals (EBs)</li> <li>Majority from lower-income families or experiencing poverty</li> <li>Preschool and primary school-aged children</li> <li>Some participants have disabilities (speech or language impairments, moderate intellectual disabilities)</li> <li>Some participants are children of migrant farmworkers</li> <li>Educated in racially segregated schools with fewer resources, larger class sizes, and less qualified teachers</li> </ul>	<ul style="list-style-type: none"> <li>Used PICOS framework for inclusion criteria.</li> <li>Searched four databases: Academic Search Premier, PsycINFO, ERIC, Web of Science.</li> <li>Limited to peer-reviewed articles in English.</li> <li>Independent screening of titles/abstracts by two authors; discrepancies resolved by consensus.</li> <li>Independent full-text reviews by both authors.</li> <li>Data extraction recorded in a spreadsheet; used inductive and deductive coding.</li> <li>Quality assessment using WWC Standards Handbooks.</li> <li>Final corpus: 17 studies after deduplication and screening.</li> </ul>	<ul style="list-style-type: none"> <li>The majority of studies showed medium to large effect sizes on researcher-designed vocabulary measures but not on standardised measures.</li> <li>Effective SBR interventions commonly included interactive reading styles, repeated readings, and vocabulary support strategies.</li> <li>Incorporating home language support can promote vocabulary development in both English and Spanish.</li> </ul>	<ul style="list-style-type: none"> <li>Méndez et al. (2015, 2018): RD measures of English receptive vocabulary: <math>d = 0.66</math>, <math>d = 0.67</math> (significant)</li> <li>Lugo-Neris et al.: More challenging expressive task: <math>\eta^2 = 0.22</math> (significant)</li> <li>Leacox and Jackson: Simpler vocabulary tasks: <math>d = 0.78</math>, <math>d = 1.12</math> (significant)</li> <li>Pollard-Durodola et al. (2016): RD English receptive and expressive measures: significant; no differences on standardised measures</li> <li>August et al. (2016, 2018): RD measures of receptive English vocabulary: significant</li> <li>Cruz de Quirós et al. (2010): English expressive narrative language: significant</li> <li>Giambo and McKinney (2004): Oral IDEA Proficiency Test: <math>d = 0.58</math> (significant)</li> <li>Correa et al. (2015): One participant showed improvement in English vocabulary; three participants showed effective or very effective results on oral language measures</li> <li>Spooner et al. (2009): Improvement across three skill sets for a participant with moderate intellectual disability</li> <li>Huennekens and Xu (2010): No significant results on rate of utterance, length of utterance, frequency of child-initiated responses, and frequency of response to others</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Solari, E. J., Kehoe, K. F., Cho, E., Hall, C., Vargas, I., Dahl-Leonard, K., Richmond, C. L., Henry, A. R., Cook, L., Hayes, L., &amp; Conner, C. (2022). Effectiveness of Interventions for English Learners with Word Reading Difficulties: A Research Synthesis. <i>Journal of Learning Disabilities</i>, 55(2), 99-118.</p>	17	<ul style="list-style-type: none"> <li>English language (EL) students</li> <li>Years 0-5</li> <li>Ages 5-11 years old</li> <li>Multiple language backgrounds</li> <li>Eligibility for free or reduced-price lunch (FRPL)</li> </ul>	<ul style="list-style-type: none"> <li>Meta-analysis of four decades of reading intervention research.</li> <li>Included experimental/quasi-experimental group design and SCED studies.</li> <li>Search process: electronic databases and gray literature from 1980 to 2020.</li> <li>Studies involved K-5 EL students with word reading difficulties.</li> <li>Effect sizes calculated using BC-SMD for SCED studies and Hedges' g for group design studies.</li> <li>Separate meta-analyses for SCED and group-design studies due to heterogeneity.</li> </ul>	<ul style="list-style-type: none"> <li>Explicit and systematic instruction in subcomponent skills is effective for ELs with WLRD.</li> <li>Meta-analyses of group design studies show positive effects on reading performance, including word/nonword reading, passage reading, and reading comprehension.</li> <li>There is a notable lack of research specifically on EL students with WLRD.</li> </ul>	<ul style="list-style-type: none"> <li>Combined Reading Outcomes: <ul style="list-style-type: none"> <li>Group Design: <math>g = 0.31</math> (<math>p &lt; .01</math>)</li> <li>SCED: <math>g = 0.48</math> (<math>p = .18</math>)</li> </ul> </li> <li>Phonological Awareness: <ul style="list-style-type: none"> <li>Group Design: <math>g = 0.28</math> (<math>p = .10</math>)</li> <li>SCED: Not available</li> </ul> </li> <li>Nonword Reading: <ul style="list-style-type: none"> <li>Group Design: Not available</li> <li>SCED: <math>g = 2.03</math> (<math>p = .02</math>)</li> </ul> </li> <li>Real/Nonword Reading: <ul style="list-style-type: none"> <li>Group Design: <math>g = 0.36</math> (<math>p = .01</math>)</li> <li>SCED: Not available</li> </ul> </li> <li>Spelling: <ul style="list-style-type: none"> <li>Group Design: <math>g = 0.27</math> (<math>p = .05</math>)</li> <li>SCED: Not available</li> </ul> </li> <li>Oral Reading Fluency: <ul style="list-style-type: none"> <li>Group Design: <math>g = 0.28</math> (<math>p = .03</math>)</li> <li>SCED: <math>g = 0.02</math> (<math>p = .90</math>)</li> </ul> </li> <li>Comprehension: <ul style="list-style-type: none"> <li>Group Design: <math>g = 0.26</math> (<math>p = .01</math>)</li> <li>SCED: Not available</li> </ul> </li> </ul>

**Table 8: Writing and Spelling**

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Bray, L., Skubik-Peplaski, C., Faota, L., & Ackerman, K. B. (2021). A Systematic Review of the Effectiveness of Interventions to Improve Handwriting and Spelling in Children with Specific Learning Disabilities.	11	<ul style="list-style-type: none"> <li>• Children with specific learning disabilities (SLD)</li> <li>• Includes conditions such as dyslexia, dysgraphia, developmental aphasia, brain injury, or perceptual disabilities</li> <li>• Age range: year 1-12</li> <li>• High prevalence of concurrent writing and spelling disorders among children with dyslexia</li> <li>• Significant proportion have fine motor issues and/or struggle with handwriting</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a systematic review focusing on handwriting and/or spelling interventions for children with SLD.</li> <li>• - Calculated effect sizes using Hedge's g.</li> <li>• Inclusion criteria: studies on children with SLD, focusing on handwriting/spelling interventions, written in English, peer-reviewed, published from 2008 onwards.</li> <li>• Exclusion criteria: studies not primarily focused on handwriting/spelling outcomes, non-SLD primary diagnosis, abstract-only articles, non-English spelling interventions.</li> <li>• Literature search conducted using EBSCOhost databases with specific search terms and Boolean operators.</li> </ul>	<ul style="list-style-type: none"> <li>• Interventions promoting self-management and using occupation-as-means were found to be most effective.</li> <li>• The most clinically significant results were from the occupation-as-means approach, particularly those involving self-reflection and self-correction.</li> <li>• The systematic review found moderate overall support for the effectiveness of current handwriting and/or spelling interventions for children with SLD.</li> </ul>	<ul style="list-style-type: none"> <li>• <b>**Tablet-based interventions:**</b> <ul style="list-style-type: none"> <li>- <b>**HAWK program (Berninger et al., 2015):**</b> <ul style="list-style-type: none"> <li>- Handwriting speed (Alphabet 15): 0.32 ± 0.47</li> <li>- DASH Fast: 0.38 ± 0.48</li> <li>- DASH Best: 0.42 ± 0.48</li> <li>- Spelling (TOC letter choice): 0.25 ± 0.47</li> <li>- TOC sight spell: 0.36 ± 0.47</li> <li>- TOC word choice: 0.37 ± 0.47</li> <li>- TOC word scramble: 0.29 ± 0.47</li> </ul> </li> <li>- <b>**HAWK program with hope stories (Thompson et al., 2018):**</b> <ul style="list-style-type: none"> <li>- Handwriting speed (Alphabet 15): 1.15 ± 0.8</li> <li>- DASH Fast: 1.67 ± 0.86</li> <li>- DASH Best: 1.86 ± 0.89</li> <li>- Spelling (WIAT 3): 0.59 ± 0.76</li> </ul> </li> <li>- <b>**Tablet-based program (Chang &amp; Yu, 2014):**</b> <ul style="list-style-type: none"> <li>- Speed of writing from dictation: 0.68 ± 0.76</li> <li>- Copying near point: 0.51 ± 0.76</li> <li>- Copying paragraph: 0.67 ± 0.76</li> <li>- Total handwriting: 0.66 ± 0.76</li> </ul> </li> <li>- <b>**Visual perception exercises (Fusco et al., 2015):**</b> <ul style="list-style-type: none"> <li>- Floating lines: -0.86 ± 0.91</li> <li>- Retouched letter: -1.28 ± 0.96</li> <li>- Collusions: -1.41 ± 0.98</li> <li>- Irregular spacing: -1.14 ± 0.95</li> <li>- Sudden movement: -1.15 ± 0.94</li> <li>- Ascending and descending lines: -0.73 ± 0.90</li> <li>- Dimension irregularity: -0.57 ± 0.90</li> </ul> </li> </ul> </li> <li>• <b>**Self-management interventions:**</b> <ul style="list-style-type: none"> <li>- <b>**CCC method (Zannikos et al., 2018):**</b> <ul style="list-style-type: none"> <li>- Total words correct (TWC CCC): 3.61 ± 2.25</li> <li>- Correct letter sequence (CLS CCC): 2.24 ± 1.17</li> <li>- TWC TSI: 2.85 ± 1.97</li> <li>- CLS TSI: 1.85 ± 1.66</li> </ul> </li> </ul> </li> </ul>

This does not constitute government policy.

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Datchuk, S. M., Rodgers, D. B., Wagner, K., Hier, B. O., & Moore, C. T. (2021). Effects of writing interventions on the level and trend of total words written: A meta-analysis. <i>Exceptional Children</i> , 87(4), 424-444.	42	<ul style="list-style-type: none"> <li>• Students aged 6-19 years old, average age 12</li> <li>• Predominantly male (70%)</li> <li>• High-incidence disabilities (45%)</li> <li>• Low-incidence disabilities (35%)</li> <li>• No disabilities (20%)</li> <li>• Emotional-behavioral disorder (33%)</li> <li>• Learning disabilities (30%)</li> <li>• Other health impairments (17%)</li> <li>• Autism (15%)</li> <li>• Speech/language impairment (5%)</li> <li>• Intellectual disability (2%)</li> <li>• Predominantly White (46%)</li> <li>• African American (24%)</li> <li>• Unspecified race (14%)</li> <li>• Hispanic (11%)</li> <li>• Multiracial (3%)</li> <li>• Asian (1%)</li> <li>• Native American (&lt;1%)</li> </ul>	<ul style="list-style-type: none"> <li>• Estimated effects of writing interventions on writing fluency using mixed-effects regression and information-theoretic ranking.</li> <li>• Synthesised results from 42 SCED studies with 205 students.</li> <li>• Applied six inclusion criteria to select studies.</li> <li>• Created a coding manual for student demographics, independent variables, dependent variables, and methodology.</li> </ul>	<ul style="list-style-type: none"> <li>• Both acquisition and fluency interventions increased the level and trend of total words written per minute.</li> <li>• Fluency interventions resulted in higher levels of performance across experimental phases, while acquisition interventions led to steeper upward trends.</li> <li>• Older students and those performing brief writing tasks showed higher levels of total words written per minute.</li> </ul>	<ul style="list-style-type: none"> <li>• - Baseline level of TWWpM: 7.06 (<math>p &lt; .01</math>)</li> <li>• Intervention effects: <ul style="list-style-type: none"> <li>- Increase in level: +0.97 TWWpM (<math>p &lt; .01</math>)</li> <li>- Increase in trend: +0.16 TWWpM per session (<math>p &lt; .01</math>)</li> </ul> </li> <li>• Postintervention level: +1.34 TWWpM (<math>p &lt; .01</math>)</li> <li>• Extended tasks: -3.57 TWWpM (<math>p &lt; .01</math>)</li> <li>• Fluency studies: <ul style="list-style-type: none"> <li>- Higher level: +2.15 TWWpM (<math>p = .07</math>)</li> <li>- Trend during intervention: -0.06 TWWpM per session (<math>p &lt; .01</math>)</li> </ul> </li> <li>• Age effect: +0.27 TWWpM for students above the mean age of 12 years old (<math>p &lt; .05</math>)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Gillespie, A., &amp; Graham, S. (2014). A meta-analysis of writing interventions for students with learning disabilities. <i>Exceptional children</i>, 80(4), 454-473.</p>	<p>43</p>	<ul style="list-style-type: none"> <li>• Students with learning disabilities (LD)</li> <li>• Upper secondary (years 4-8)</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a meta-analysis of writing interventions for students with learning disabilities.</li> <li>• Used ancestral and electronic searches to locate relevant studies.</li> <li>• Included studies involving years 1-12 with documented LD.</li> <li>• Assessed writing quality using holistic scales, analytic scales, and norm-referenced assessments.</li> <li>• Coded studies for various characteristics and quality indicators.</li> <li>• Calculated effect sizes by comparing posttest scores between treatment and control groups.</li> </ul>	<ul style="list-style-type: none"> <li>• Writing interventions had a statistically significant positive impact on the writing quality of students with LD (ES = 0.74).</li> <li>• Strategy instruction, dictation, goal setting, and process writing were particularly effective interventions.</li> <li>• Treatments were only effective when explicit instruction in the writing process was provided.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall writing interventions: ES = 0.74 (p &lt; .001)</li> <li>• Strategy instruction: ES = 1.09 (p &lt; .001)</li> <li>• Dictation: ES = 0.55 (p &lt; .01)</li> <li>• Procedural facilitation: ES = 0.24 (p = .45, not significant)</li> <li>• Prewriting: ES = 0.33 (p = .34, not significant)</li> <li>• Goal setting: ES = 0.57 (p &lt; .01)</li> <li>• Process writing: ES = 0.43 (p &lt; .01)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Graham, S., Liu, X., Aitken, A., Ng, C., Bartlett, B., Harris, K. R., &amp; Holzapfel, J. (2018). Effectiveness of Literacy Programs Balancing Reading and Writing Instruction: A Meta-Analysis. <i>Reading Research Quarterly</i>, 53(3), 279-304.</p>	<p>47</p>	<ul style="list-style-type: none"> <li>• Students from preschool through secondary school</li> <li>• Majority of studies conducted in the United States</li> <li>• Instruction focused on learning to read and write in English</li> <li>• Conducted in typical classrooms</li> <li>• Some studies focused on English learners and students experiencing difficulty with literacy</li> <li>• About half of the students were girls</li> <li>• Majority were from minority groups</li> <li>• Nearly half were from poor to median income households</li> </ul>	<ul style="list-style-type: none"> <li>• Meta-analysis of experimental intervention studies with preschool through secondary school students.</li> <li>• Studies had to involve students from preschool through year 12 and use true or quasi-experiments.</li> <li>• Exclusion criteria: studies focused on single aspects of literacy or not teaching reading and writing conjointly.</li> <li>• A total of 47 studies met inclusion criteria.</li> <li>• Effect sizes computed using posttest means and pooled standard deviations.</li> </ul>	<ul style="list-style-type: none"> <li>• Literacy programs balancing reading and writing instruction improve students' reading performance with significant effect sizes.</li> <li>• These programs also enhance students' writing performance with significant effect sizes.</li> <li>• The findings support the use of balanced literacy programs in schools to strengthen both reading and writing skills.</li> </ul>	<ul style="list-style-type: none"> <li>• Reading: <ul style="list-style-type: none"> <li>- Overall: ES = 0.33 (p &lt; .001)</li> <li>- Reading comprehension: ES = 0.39 (p &lt; .001)</li> <li>- Decoding: ES = 0.53 (p &lt; .001)</li> <li>- Reading vocabulary: ES = 0.35 (p = .002)</li> </ul> </li> <li>• Writing: <ul style="list-style-type: none"> <li>- Overall: ES = 0.37 (p &lt; .001)</li> <li>- Writing quality: ES = 0.47 (p = .001)</li> <li>- Writing mechanics: ES = 0.18 (p &lt; .001)</li> <li>- Writing output: ES = 0.69 (p &lt; .001)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Graham, S., Tavsanlı, O. F., & Kaldırım, A. (2021). Improving Writing Skills of Students in Turkey: a Meta-analysis of Writing Interventions. <i>Metacognition and Learning</i> , 16(2), 301-336.	77	<ul style="list-style-type: none"> <li>• Students in Turkey</li> <li>• Primary school through college students</li> <li>• No secondary school students</li> <li>• Total of 4,891 students</li> <li>• Centralised educational system</li> <li>• Generally Islamic culture with a secular constitution</li> <li>• Relatively low academic performance compared to OECD counterparts</li> </ul>	<ul style="list-style-type: none"> <li>• Included 77 experimental studies with Turkish students from primary years through college.</li> <li>• Applied stringent inclusion criteria: true/quasi-experiments with specific requirements.</li> <li>• Screened titles/abstracts and reviewed full texts to ensure criteria met.</li> <li>• Coded each study for publication type, year level, intervention type, total intervention time, professional development provided, genre, and number of participants.</li> <li>• Computed average weighted effect sizes for all studies and specific interventions.</li> </ul>	<ul style="list-style-type: none"> <li>• Teaching writing to Turkish students resulted in a significant improvement in writing quality, with an average weighted effect size of 1.39.</li> <li>• Specific interventions such as peer assistance, pre-writing activities, process writing, and strategy instruction were all effective, with effect sizes ranging from 0.92 to 1.55.</li> <li>• These findings support the use of these instructional practices in Turkey and suggest their effectiveness in other countries as well.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size for all interventions: 1.39 (p = .000)</li> <li>• Peer assistance: 0.92 (95% CI: [1.26-0.59], p = .000)</li> <li>• Pre-writing activities: 1.55 (95% CI: [1.90-1.20], p = .000)</li> <li>• Process writing: 1.30 (95% CI: [1.64-0.96], p = .000)</li> <li>• Strategy instruction: 1.28 (95% CI: [1.56-1.00], p = .000)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
García-Sánchez, J.N., López-Escribano, C., Martín-Babarro, J. & Pérez-López, R. (2022). Promoting Handwriting Fluency for Preschool and Elementary-Age Students: Meta-Analysis and Meta-Synthesis of Research From 2000 to 2020. <i>Frontiers in Psychology</i> , 13, 833524.	31	<ul style="list-style-type: none"> <li>• K-6 students</li> <li>• Total of 2,030 students</li> <li>• Students with typical handwriting skills, above-average handwriting skills, and significant handwriting difficulties</li> <li>• Studies conducted in English, French, Portuguese, and Hebrew</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a systematic and meta-analytic review.</li> <li>• Searched multiple databases for articles published between 2000 and 2020 using specific keywords.</li> <li>• Removed duplicates and analysed a total of 747 publications.</li> <li>• Selected 31 studies that met inclusion criteria.</li> <li>• Followed PRISMA guidelines for systematic reviews.</li> <li>• Categorised studies based on their main focus of intervention.</li> </ul>	<ul style="list-style-type: none"> <li>• Handwriting interventions significantly improve writing fluency compared to no instruction or non-handwriting instruction (ES = 0.64).</li> <li>• Specific interventions like timed transcription skills, multicomponent treatments, and performance feedback show significant improvements in writing fluency with effect sizes of 0.49, 0.40, and 0.36, respectively.</li> <li>• There were insufficient data to determine the impact of sensory-motor and self-regulated strategy handwriting interventions on writing fluency.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall handwriting interventions vs no instruction/non-handwriting instruction: <ul style="list-style-type: none"> <li>- Effect Size (ES): 0.66 (95% CI: 0.51 to 0.81)</li> <li>- Statistical significance: Significant</li> </ul> </li> <li>• Handwriting instruction: <ul style="list-style-type: none"> <li>- Effect Size (ES): 0.49 (95% CI: -0.10 to 0.99)</li> <li>- Statistical significance: Non-significant</li> </ul> </li> <li>• Multicomponent handwriting treatments: <ul style="list-style-type: none"> <li>- Effect Size (ES): 0.51 (95% CI: 0.38 to 0.63)</li> <li>- Statistical significance: Significant</li> </ul> </li> <li>• Performance feedback: <ul style="list-style-type: none"> <li>- Effect Size (ES): 0.36 (95% CI: 0.06 to 0.66)</li> <li>- Statistical significance: Significant</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
McMaster, K. L., Kunkel, A., Shin, J., Jung, P.-G., & Lembke, E. (2017). Early writing intervention: A best evidence synthesis. <i>Exceptional Children</i> , 83(2), 166-183.	25	<ul style="list-style-type: none"> <li>• Children aged 6-8 years</li> <li>• Students with difficulties or disabilities related to writing</li> <li>• Majority of interventions conducted in school-based settings</li> <li>• Interventions primarily implemented by researchers or hired tutors</li> </ul>	<ul style="list-style-type: none"> <li>• Studies had to involve writing interventions in transcription, text generation, and/or self-regulation.</li> <li>• Data had to be analysed for students with writing difficulties or disabilities.</li> <li>• Dependent measures had to include writing composition quantity and/or quality.</li> <li>• Studies had to employ an experimental or quasi-experimental design with a control group or single-subject design.</li> <li>• Effect sizes were calculated using standardised mean difference (Hedge's <i>g</i>) for group designs and percentage of all nonoverlapping data (PAND) for single-subject designs.</li> </ul>	<ul style="list-style-type: none"> <li>• Explicit systematic instruction in handwriting and spelling improves both specific skills and overall writing composition.</li> <li>• Studies combining text generation with self-regulation strategies, particularly SRSD, show strong evidence of improving writing composition.</li> <li>• Research-based early writing interventions exist and are effective, especially for transcription and self-regulation.</li> </ul>	<ul style="list-style-type: none"> <li>• Transcription interventions: <ul style="list-style-type: none"> <li>- Quantity: Hedge's <i>g</i> = 0.46, 95% CI [0.20, 0.73]</li> <li>- Quality: Hedge's <i>g</i> = 0.17, 95% CI [-0.08, 0.42]</li> </ul> </li> <li>• Graham et al. (2000) handwriting intervention: <ul style="list-style-type: none"> <li>- Quantity: Hedge's <i>g</i> = 0.92, 95% CI [0.44, 1.41]</li> </ul> </li> <li>• Graham et al. (2002) spelling intervention: <ul style="list-style-type: none"> <li>- Quantity: Hedge's <i>g</i> = 0.74, 95% CI [0.20, 1.29]</li> </ul> </li> <li>• Pennington et al. (2012) text generation intervention: <ul style="list-style-type: none"> <li>- Quantity: PAND = 83%, phi = 0.64</li> </ul> </li> <li>• Text generation + self-regulation interventions: <ul style="list-style-type: none"> <li>- Quantity: Hedge's <i>g</i> = 0.53 to 1.61</li> <li>- Quality: Hedge's <i>g</i> = 0.55 to 1.18</li> <li>- PAND for quantity: 95% to 100%</li> <li>- PAND for quality: 94% to 100%</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Squires, K. E., &amp; Wolter, J. A. (2016). The Effects of Orthographic Pattern Intervention on Spelling Performance of Students With Reading Disabilities: A Best Evidence Synthesis. <i>Remedial and Special Education, 37</i>(6), 342-352.</p>	<p>5</p>	<ul style="list-style-type: none"> <li>• year 0 to 9 students</li> <li>• ages 6 to 14 years</li> <li>• at risk for reading disabilities</li> <li>• diagnosed with dyslexia</li> <li>• diagnosed with a reading disability</li> <li>• diagnosed with a learning disability in a linguistic area</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a best evidence synthesis.</li> <li>• Systematic search in ERIC, PsychINFO, and Academic Search Premier databases.</li> <li>• Used specific descriptors for search terms.</li> <li>• Ancestral search for additional papers.</li> <li>• Initial search resulted in 2,304 hits; narrowed down to 115 articles.</li> <li>• Applied inclusion criteria based on internal and external validity.</li> <li>• Rated studies based on eight quality indicators.</li> <li>• Included five studies meeting criteria.</li> <li>• Calculated Cohen's d effect sizes for practical significance.</li> </ul>	<ul style="list-style-type: none"> <li>• Spelling interventions with an orthographic pattern focus significantly improve spelling skills in students with reading disabilities.</li> <li>• These interventions show moderate to large effect sizes on standardised spelling measures.</li> <li>• Improvements in spelling skills transfer beyond taught words to untaught words.</li> </ul>	<ul style="list-style-type: none"> <li>• Abbott and Berninger (1999): <ul style="list-style-type: none"> <li>- Spelling subtest of WIAT: Treatment &gt; Control (d = 0.24)*</li> <li>- Spelling subtest of Wide Range Achievement Test: Treatment &gt; Control (d = 0.78)*</li> </ul> </li> <li>• Berninger, Lee, Abbott, and Breznitz (2013): <ul style="list-style-type: none"> <li>- Spell Sounds Subtest of Woodcock-Johnson III: Treatment Group A &gt; Treatment Group B (d = 0.15)</li> <li>- WIAT-II Spelling subtest: Treatment Group A &gt; Treatment Group B (d = 0.55)*</li> </ul> </li> <li>• Shippen, Reilly, and Dunn (2008): <ul style="list-style-type: none"> <li>- Test of Written Spelling-4: No significant difference</li> <li>- Curriculum-based probes: <ul style="list-style-type: none"> <li>- Two lessons/day &gt; One lesson/day (d = 0.55)*</li> <li>- Time by age interaction: Significant (d = 0.48)*</li> </ul> </li> </ul> </li> <li>• Darch, Eaves, Crowe, Simmons, and Conniff (2006): <ul style="list-style-type: none"> <li>- Regular words: Treatment &gt; Control (d = 0.99)*</li> <li>- Morphological words: Treatment &gt; Control (d = 1.02)*</li> <li>- Spelling-rule words: Treatment &gt; Control (d = 1.21)*</li> <li>- Irregular words: Treatment &gt; Control (d = 0.48)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Williams, K. J., Austin, C. R., &amp; Vaughn, S. (2018). A synthesis of spelling interventions for secondary students with disabilities. <i>Exceptional Children</i>, 84(3), 304-322.</p>	<p>13</p>	<ul style="list-style-type: none"> <li>• Students with disabilities in years 6 through 12</li> <li>• Ages 11 to 21 years</li> <li>• Disabilities include LD, OHI, OI, AUT, SLI, EBD, or ID</li> <li>• Majority male (77%)</li> <li>• Low or middle-class socioeconomic status</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic search of literature using ERIC, Education Source, and PsycINFO databases.</li> <li>• Search terms included “spell*”, and secondary terms like “dis*”, “special education”, “special needs”, “dys*”.</li> <li>• Limited to peer-reviewed articles in English from January 2004 to April 2016.</li> <li>• Inclusion criteria: specific disabilities, years 6-12, treatment/comparison or single-case designs, spelling intervention, at least one spelling outcome measured.</li> <li>• Exclusion criteria: non-English publications, non-disaggregated results, single-group or qualitative designs, non-peer-reviewed journals, multicomponent interventions not related to spelling.</li> </ul>	<ul style="list-style-type: none"> <li>• Most spelling interventions increased spelling outcomes for words directly taught or studied or increased the percentage of words spelled correctly in written compositions.</li> <li>• Systematic study strategies were commonly used for students with LD or EBD, while technological assistance was more common for students with other disabilities.</li> <li>• Phoneme to grapheme correspondences and morphemic approaches were notably absent from the interventions reviewed.</li> </ul>	<ul style="list-style-type: none"> <li>• Spelling tests: <ul style="list-style-type: none"> <li>- Systematic Study (CCC): Mastered most words on list; Tau-U values large to very large.</li> <li>- Taped Spelling Intervention: Mastered most words on list; Tau-U values large to very large.</li> <li>- Error Self-correction strategy: Mastered most words on list; Tau-U values large to very large.</li> <li>- Computer-Based Instruction (CBI): Large to very large Tau-U values for all participants except one set.</li> <li>- CCC with feedback from SGD: Large to very large Tau-U values for Participant 1; large for Participant 2.</li> </ul> </li> <li>• Written compositions: <ul style="list-style-type: none"> <li>- Technological Assistance (WP): <ul style="list-style-type: none"> <li>- Evmenova et al. (2010): Increased spelling accuracy from 61% to ~92%; Tau-U values very large.</li> <li>- Mezei and Heller (2005): Decreased errors from 5%-14% to 0%-4%; Tau-U not calculated.</li> <li>- Tumlin and Heller (2004): Decreased errors in written compositions; Tau-U not calculated.</li> </ul> </li> </ul> </li> </ul>

**Table 9: Children with Complex Needs – Phonological Awareness, Phonics, and Word Reading**

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Bailey, B., & Arciuli, J. (2020). Reading instruction for children with autism spectrum disorders: A systematic review and quality analysis. <i>Autism</i> , 24(1), 6-22.	19	<ul style="list-style-type: none"> <li>• Children aged 3-15 years</li> <li>• Diagnosed with ASD, Asperger’s syndrome, or PDD-NOS</li> <li>• Some participants had comorbid disabilities (communication and/or intellectual impairments)</li> <li>• Varied reading skills (from little or no conventional reading skills to high functioning with basic word reading skills)</li> <li>• Literacy instruction typically conducted in everyday classrooms or quiet rooms within school grounds</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review of literature on reading instruction for children with ASD based on NRP guidelines.</li> <li>• Literature search from 2009 to 2017 across multiple databases.</li> <li>• Inclusion criteria: children aged 5-12 with ASD, focus on NRP skills, examine reading outcomes, published in English.</li> <li>• Effect sizes calculated using Hedges’ g for group studies and NAP for single-subject studies.</li> <li>• Final review included 19 studies.</li> </ul>	<ul style="list-style-type: none"> <li>• Studies reported gains in phonics, reading accuracy, reading fluency, and/or reading comprehension skills, but few were of high quality.</li> <li>• Instruction incorporating multiple Big Five elements from the NRP was associated with gains in reading accuracy and comprehension.</li> <li>• Multi-component instruction was most promising, showing gains in phonological awareness, phonics, reading accuracy, and comprehension across diverse groups.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonics instruction: <ul style="list-style-type: none"> <li>- Letter-sound knowledge: NAP = .85-1.00</li> <li>- Word reading accuracy: NAP = .83-1.00</li> <li>- Phonics skills: NAP = .87-.91</li> </ul> </li> <li>• Reading fluency instruction: <ul style="list-style-type: none"> <li>- Reading fluency (familiar passages): PND = .50-1.00</li> <li>- Reading fluency (unfamiliar passages): NAP = .89-1.00</li> </ul> </li> <li>• Reading comprehension instruction: <ul style="list-style-type: none"> <li>- Reading comprehension: g = .72 (significant)</li> <li>- Control group: g = .34 (significant decrease)</li> </ul> </li> <li>• Multi-component instruction: <ul style="list-style-type: none"> <li>- Word reading accuracy: g = 1.63-2.62</li> <li>- Reading comprehension: <math>\eta^2</math> = .32-.41</li> <li>- Control group: g = 1.25-1.92</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Dessementet, R. S., Martinet, C., De Chambrier, A.-F., Martini-Willemin, B.-M., & Audrin, C. (2019). Educational Research Review.	14	<ul style="list-style-type: none"> <li>Individuals with intellectual disability (ID)</li> <li>Children with Down syndrome</li> <li>Individuals with severe speech impairments using augmentative and alternative communication systems</li> <li>Individuals with autism spectrum disorder</li> <li>IQs ranging from 31 to 88</li> <li>Most participants aged between 5 and 14 years old</li> <li>Some older participants</li> <li>One study included adults</li> <li>Minority of participants diagnosed with developmental delay</li> </ul>	<ul style="list-style-type: none"> <li>Meta-analysis examining phonics instruction effects on decoding skills in students with intellectual disability.</li> <li>Included eight single-case experimental studies and six experimental/quasi-experimental group studies (297 participants).</li> <li>Searched PsycINFO and ERIC databases for studies from January 1990 to November 2016.</li> <li>Effect sizes computed using different methods for single-case and group studies.</li> </ul>	<ul style="list-style-type: none"> <li>Phonics instruction significantly improves the decoding skills of students with intellectual disability, with an overall large effect size (<math>g = 1.42</math>).</li> <li>Single-case studies show a larger effect size (<math>g = 1.94</math>) compared to group studies (<math>g = 0.41</math>).</li> <li>The type of interventionist does not significantly impact the effectiveness of phonics instruction.</li> </ul>	<ul style="list-style-type: none"> <li>Overall effect of phonics instruction on decoding skills: <math>g = 1.42</math> (95% CI: 0.75, 2.10), <math>p &lt; .001</math></li> <li>Single-case studies: <math>g = 1.94</math> (95% CI: 1.10, 2.78), <math>p = .001</math></li> <li>Group studies: <math>g = 0.41</math> (95% CI: 0.13, 0.69), <math>p = .018</math></li> <li>Researcher-designed tests: <math>g = 1.78</math> (95% CI: 1.04, 2.52), <math>p &lt; .001</math></li> <li>Standardised tests: <math>g = 0.40</math> (95% CI: 0.13, 0.67), <math>p = .019</math></li> <li>Direct instruction: <math>\beta_0 = 0.35</math>, <math>SE = 0.11</math>, <math>\beta_1 = 1.47</math>, <math>SE = 0.33</math>, <math>t = 4.41</math>, <math>df = 3.08</math>, <math>p = .021</math></li> <li>Type of interventionist: <math>\beta_0 = 1.26</math>, <math>SE = 1.02</math>, <math>\beta_1 = 0.12</math>, <math>SE = 0.69</math>, <math>t = 0.18</math>, <math>df = 8.53</math>, <math>p = .865</math></li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Mandak, K., Light, J., &amp; Boyle, S. (2018). The effects of literacy interventions on single-word reading for individuals who use aided AAC: a systematic review. <i>AAC: Augmentative &amp; Alternative Communication</i>, 34(2), 142-156.</p>	<p>9</p>	<ul style="list-style-type: none"> <li>• Children and young adults aged 6-22</li> <li>• Nearly equal gender distribution (46% female, 54% male)</li> <li>• Diagnoses include autism spectrum disorder (46%), cerebral palsy (29%), Down syndrome, intellectual disability, Holt-Oram Syndrome, and traumatic brain injury</li> <li>• Use of aided AAC devices such as speech-generating devices and low-technology AAC</li> </ul>	<ul style="list-style-type: none"> <li>• Developed review protocol based on Cochrane Collaboration Handbook and PRISMA.</li> <li>• Defined inclusion criteria: participants using aided AAC, peer-reviewed publications or dissertations before/during 2017, experimental design, dependent variable related to single-word reading, published in English.</li> <li>• Multi-faceted search strategy: electronic database search (ERIC, LLBA, PubMed, PsycInfo, ProQuest Dissertation and Theses), ancestry search.</li> <li>• Used specific search terms in three categories: Intervention, AAC, Word Identification.</li> <li>• Calculated effect sizes using gain scores, PND, and Tau-U.</li> </ul>	<ul style="list-style-type: none"> <li>• Instruction had positive effects on single-word reading for individuals using aided AAC across ages and diagnostic categories.</li> <li>• Phonological, sight-word, and combination approaches yielded very large effects.</li> <li>• The mean effect size (Tau-U value) was 0.93, indicating a very large effect.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall mean effect size (Tau-U): 0.93 (very large)</li> <li>• By age: <ul style="list-style-type: none"> <li>- Primary school: Tau-U = 0.92 (very large)</li> <li>- Adolescent: Tau-U = 0.96 (very large)</li> <li>- Adult: Tau-U = 0.93 (very large)</li> </ul> </li> <li>• By diagnosis: <ul style="list-style-type: none"> <li>- Autism spectrum disorder: Tau-U = 0.88 (very large)</li> <li>- Cerebral palsy: Tau-U = 0.97 (very large)</li> <li>- Down syndrome: Tau-U = 0.96 (very large)</li> <li>- Intellectual disability: Tau-U = 1.00 (very large)</li> <li>- Other: Tau-U = 1.00 (very large)</li> </ul> </li> <li>• By interventionist: <ul style="list-style-type: none"> <li>- Educator: Tau-U = 0.97 (very large)</li> <li>- Researcher: Tau-U = 0.87 (very large)</li> </ul> </li> <li>• By instructional approach: <ul style="list-style-type: none"> <li>- Phonological approach: Tau-U = 0.97 (very large)</li> <li>- Sight-word approach: Tau-U = 0.85 (very large)</li> <li>- Combination approach: Tau-U = 0.98 (very large)</li> </ul> </li> <li>• By measurement task: <ul style="list-style-type: none"> <li>- Text → spoken choices: Tau-U = 0.97 (very large)</li> <li>- Text → picture choices: Tau-U = 0.96 (very large)</li> <li>- Spoken word → text choices: Tau-U = 1.00 (very large)</li> <li>- Picture → text choices: Tau-U = 0.79 (large)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Murphy, A., Bailey, B., Arciuli, J., Owen, A. J., & Van Horne, A. (2023). Exploring the Effects of Literacy Instruction for Children With Cerebral Palsy: A Systematic Review. <i>Language, Speech, and Hearing Services in Schools</i> , 53(2), 463-481.	24	<ul style="list-style-type: none"> <li>• Children aged 5-18 years</li> <li>• Some children were minimally verbal</li> <li>• Some children used augmentative and alternative communication (AAC)</li> <li>• Some children had intellectual disabilities</li> <li>• Communication abilities varied (some verbal, some minimally verbal)</li> <li>• Limited information on race</li> <li>• Some studies conducted in languages other than English</li> <li>• CP motor subtype and topography described in some studies</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review of studies published between 2000 and 2020.</li> <li>• Search conducted using multiple electronic databases.</li> <li>• Inclusion criteria: school-aged participants with CP, literacy instruction effects on reading/writing outcomes, group or single-subject design.</li> <li>• Data extraction on participant characteristics, research design, instruction characteristics, and outcomes.</li> <li>• Standardised measure of effect size (NAP) used.</li> <li>• Methodological rigor assessed using MMAT.</li> </ul>	<ul style="list-style-type: none"> <li>• Most literacy instruction methods led to medium to large gains in reading and writing skills for children with CP.</li> <li>• Effective literacy instruction for children with CP should be accessible and allow for demonstration and feedback.</li> <li>• There is a need for further research on comprehensive literacy instruction using high-quality designs.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonics instruction: <ul style="list-style-type: none"> <li>- Letter-sound knowledge: NAP = .79-1.0</li> <li>- Transfer to spelling skills: NAP = 1.0</li> <li>- Transfer to decoding skills: NAP = .95 (strong effect for one participant), NAP = .00 (weak effect for three participants)</li> <li>- Decoding skills: NAP = .94-1.0</li> <li>- Maintenance up to 2 months: Gains maintained</li> </ul> </li> <li>• Sight-word recognition: <ul style="list-style-type: none"> <li>- Sight-word recognition: NAP = .85-1.0</li> <li>- Group study: Statistically significant gain in word reading (<math>p &lt; .05</math>)</li> </ul> </li> <li>• Reading fluency: <ul style="list-style-type: none"> <li>- Reading rate: Improved oral reading rates</li> <li>- Reading comprehension: <ul style="list-style-type: none"> <li>- Reading comprehension: NAP = .55-.81</li> </ul> </li> </ul> </li> <li>• Spelling: <ul style="list-style-type: none"> <li>- Spelling accuracy: NAP = .79-1.0</li> </ul> </li> <li>• Written expression: <ul style="list-style-type: none"> <li>- Spelling accuracy with word prediction software: NAP = .99-1.0</li> <li>- Writing accuracy: Conventional word processing software: 96.3%, Speech-to-text software: 92.5%</li> </ul> </li> <li>• Multicomponent instruction: <ul style="list-style-type: none"> <li>- Use of individual letters for spelling: NAP = .62-.69</li> <li>- Developmental spelling scores: Average increase of 13 points</li> <li>- Word identification tasks: Average gain of 20% (five words)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Reichow, B., Lemons, C. J., Maggin, D. M., & Hill, D. R. (2014). Beginning reading interventions for children and adolescents with intellectual disability (Review). Cochrane Database of Systematic Reviews, 2014(8), CD011359. <a href="https://doi.org/10.1002/14651858.CD011359">https://doi.org/10.1002/14651858.CD011359</a>	7	<ul style="list-style-type: none"> <li>• children and adolescents aged 4-21</li> <li>• intellectual disability (IQ two standard deviations or more below the population mean)</li> <li>• mean age around 9.5 years</li> <li>• mean IQ scores around 49.47 for treatment groups and 51.12 for control groups</li> <li>• predominantly male (58% on average)</li> </ul>	<ul style="list-style-type: none"> <li>• Comprehensive search strategy across multiple databases and trial registers up to October 2019.</li> <li>• Inclusion of randomised controlled trials involving children and adolescents with intellectual disability.</li> <li>• Meta-analyses using random-effect models with inverse-variance weighting.</li> </ul>	<ul style="list-style-type: none"> <li>• Reading interventions for children and adolescents with intellectual disability result in small-to-moderate improvements in phonologic awareness, word reading, decoding, and expressive and receptive language.</li> <li>• The effect sizes for these improvements are 0.55 for phonologic awareness, 0.54 for word reading, 0.40 for decoding, and 0.28 for expressive and receptive language.</li> <li>• The quality of evidence is low to moderate, suggesting that further research is needed to confirm these findings.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonologic awareness: <ul style="list-style-type: none"> <li>- Intervention: SMD 0.55 (95% CI 0.23 to 0.86, P &lt; 0.001)</li> </ul> </li> <li>• Word reading: <ul style="list-style-type: none"> <li>- Intervention: SMD 0.54 (95% CI 0.05 to 1.03, P = 0.03)</li> </ul> </li> <li>• Decoding: <ul style="list-style-type: none"> <li>- Intervention: SMD 0.40 (95% CI 0.12 to 0.67, P = 0.005)</li> </ul> </li> <li>• Oral reading fluency: <ul style="list-style-type: none"> <li>- Intervention: SMD 0.65 (95% CI -0.12 to 1.42, P = 0.10)</li> </ul> </li> <li>• Expressive and receptive language: <ul style="list-style-type: none"> <li>- Intervention: SMD 0.28 (95% CI 0.03 to 0.54, P = 0.03)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<p>Yorke, A. M., Gosnell, J., Pukys, N., Sternad, E., Grecol, C., Shermak, C., &amp; Kemp-Inman, A. (2020). Foundational Reading Interventions Adapted for Individuals Who Require Augmentative and Alternative Communication (AAC): a Systematic Review of the Research. <i>Augmentative and Alternative Communication</i>, 36(2), 102-116.</p>	<p>22 publications (24 experiments)</p>		<ul style="list-style-type: none"> <li>• Followed Cochrane Handbook for Systematic Reviews of Interventions.</li> <li>• Multi-faceted search process: database searches, table of contents searches, author searches.</li> <li>• Search period: 1980 to May 2019.</li> <li>• Specific search terms related to foundational reading interventions and AAC.</li> <li>• Initial screening at title and abstract level, followed by full-text analysis.</li> <li>• Inclusion criteria: publication date, language, intervention goals, data reporting, involvement of AAC.</li> <li>• Data extraction focused on participants in adapted foundational reading interventions.</li> <li>• Calculated effect sizes at participant level.</li> </ul>	<ul style="list-style-type: none"> <li>• Adapted phonological interventions for individuals who use AAC show large and very large effects.</li> <li>• These interventions improve accuracy in foundational reading skills across ages, diagnoses, and intervention settings.</li> <li>• Effectiveness is maintained regardless of whether interventions are provided one-on-one or in small groups, and with or without technology support.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effectiveness: Average gain: 41%, Tau-U: .81 (Very Large)</li> <li>• Interventionist: <ul style="list-style-type: none"> <li>- Researcher: Average gain: 33%, Tau-U: .73 (Large)</li> <li>- Educators: Average gain: 72%, Tau-U: 1.00 (Very Large)</li> <li>- Instructional assistant: Average gain: 43%</li> <li>- Technology mediated + teacher/researcher: Average gain: 27%, Tau-U: .84 (Very Large)</li> <li>- Graduate student clinicians: Average gain: 14%, Tau-U: .40 (Moderate)</li> </ul> </li> <li>• Intervention Setting: <ul style="list-style-type: none"> <li>- One-on-One: Average gain: 37%, Tau-U: .76 (Large)</li> <li>- Small group instruction: Average gain: 34%, Tau-U: .70 (Large)</li> </ul> </li> <li>• Instructional approach: <ul style="list-style-type: none"> <li>- Accessible Literacy Learning (ALL): Average gain: 39%, Tau-U: .78 (Large)</li> <li>- Early Reading Skills Builder (ERSB): Average gain: 26%, Tau-U: .80 (Large)</li> <li>- Nonverbal Reading Approach (NRA): Average gain: 60%, Tau-U: .98 (Very Large)</li> <li>- Storybook Reading with Phonological Emphasis: Average gain: 24%, Tau-U: .66 (Large)</li> </ul> </li> <li>• Dependent Variable: <ul style="list-style-type: none"> <li>- Blending sounds: Average gain: 21%, Tau-U: .74 (Large)</li> <li>- Phoneme segmentation: Average gain: 13%, Tau-U: .84 (Very Large)</li> <li>- Letter-sound correspondences: Average gain: 24%, Tau-U: .87 (Very Large)</li> <li>- Decoding: Average gain: 39%, Tau-U: .78 (Large)</li> </ul> </li> </ul>

**Table 10: Children with Complex Needs – Reading Comprehension, Shared Reading, and Narrative Instruction**

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<b>Intervention Focus: Shared Reading</b>					
Alharbi, H., Terleksi, E., & Kosyvaki, L. (2023). Dialogic Reading Effect on Communicative Initiations and Responses for Children with Autism: a Systematic Review. <i>Early Childhood Education Journal</i> .	9	<ul style="list-style-type: none"> <li>• children aged 3-8 years old (average age 55.4 months)</li> <li>• 47.2% males, 5.6% females, 47.2% gender unknown</li> <li>• diagnosed with autism or educational determination of autism</li> <li>• majority have language/communication abilities below their peers</li> <li>• some have a language delay</li> </ul>	<ul style="list-style-type: none"> <li>• Followed PRISMA guidelines and APA reporting standards.</li> <li>• Systematic search in ERIC, PsycINFO, and Google Scholar.</li> <li>• Inclusion criteria: peer-reviewed, English, 1990-2021, at least one participant with autism, used DR or adapted DR, examined communicative initiations/responses, involved adults as intervenors, experimental study.</li> <li>• Exclusion criteria: non-DR shared reading interventions, peer-only interventions, technology-only interventions, review papers/books/conference proceedings.</li> <li>• Effectiveness measured using Hedges' g for RCTs and Tau-U for SCR studies.</li> </ul>	<ul style="list-style-type: none"> <li>• DR can be a promising and beneficial shared reading intervention for children with autism.</li> <li>• Most studies indicated a positive impact on children's communicative initiations and responses.</li> <li>• The review found an increase in children's verbal responses but mixed results for verbal and nonverbal initiations.</li> </ul>	<ul style="list-style-type: none"> <li>• Verbal responses: <ul style="list-style-type: none"> <li>- Overall Tau-U effect size: .68 (moderate effect)</li> <li>- Lo &amp; Shum (2020): .07 (non-significant)</li> <li>- Pierson et al. (2021): .048 (unprompted), -.02 (prompted)</li> </ul> </li> <li>• Verbal initiations: <ul style="list-style-type: none"> <li>- Overall Tau-U effect size: .25 (small effect)</li> <li>- Kang (2017) &amp; Whalon et al. (2015): small to moderate effect</li> <li>- Queiroz et al. (2020) &amp; Fleury and Schwartz (2017): -.12 to -.19</li> </ul> </li> <li>• Nonverbal initiations: <ul style="list-style-type: none"> <li>- Queiroz et al. (2020): -.45</li> <li>- Whalon et al. (2015): .35</li> <li>- Overall Tau-U score: -.05</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Dessementet, R., Geyer, M., Linder, A.-L., Atzeman, M., Martinet, C., Meuli, N., Audrin, C., De Chambrier, A.-F., Mcduffie, A., Banasik, A., Bullard, L., Nelson, S., Feigles, R. T., & Hagerman, R. (2024). Effects of shared text reading for students with intellectual disability: A meta-analytical review of instructional strategies. [Journal Name], [Volume(Issue)], [pages].	19	<ul style="list-style-type: none"> <li>• Participants with intellectual disability (ID)</li> <li>• Almost half also had autism spectrum disorder (ASD)</li> <li>• Some had additional impairments such as cerebral palsy, severe physical disability, hearing or visual impairment, and ADHD</li> <li>• 40% were minimally verbal and/or used augmentative and alternative communication systems</li> <li>• IQs ranged from 37 to 70, with half below 55</li> <li>• Age range primarily between 6-27 years old, with a majority being children (6-12 years old) and some teenagers or young adults (13-27 years old)</li> </ul>	<ul style="list-style-type: none"> <li>• meta-analysis of 19 single-case experimental studies on shared text reading interventions for students with intellectual disability (ID).</li> <li>• search performed using PsycINFO and ERIC databases for studies published between 2010 and April 2022.</li> <li>• Effect sizes were calculated using the SingleCaseES package in R, and robust variance estimation was used for the meta-analysis.</li> </ul>	<ul style="list-style-type: none"> <li>• Shared text reading significantly improves the listening comprehension skills of students with intellectual disability (ID).</li> <li>• The practice is considered evidence-based, supported by 20 methodologically sound single-case experimental studies.</li> <li>• The positive effect is observed regardless of whether students need alternative or augmentative communication systems.</li> </ul>	<ul style="list-style-type: none"> <li>• Log response ratio (LRR): 1.05 (SE = .09), 95% CI [0.87, 1.24], <math>t(16) = 11.9</math>, <math>p &lt; .01</math></li> <li>• Percentage increase in ability to answer comprehension questions: 185.77% [CI: 138.0, 245.5]</li> <li>• Significant heterogeneity in effect sizes: <math>I^2 = 80.09</math></li> <li>• No significant moderators for specific instructional strategies or use of technology</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<b>Intervention Focus: Reading Comprehension</b>					
Bailey, B., & Arciuli, J. (2020). Reading instruction for children with autism spectrum disorders: A systematic review and quality analysis. <i>Autism</i> , 24(1), 6-22.	19	<ul style="list-style-type: none"> <li>• Children aged 3-15 years</li> <li>• Diagnosed with ASD, Asperger's syndrome, or PDD-NOS</li> <li>• Some participants had comorbid disabilities (communication and/or intellectual impairments)</li> <li>• Varied reading skills (from little or no conventional reading skills to high functioning with basic word reading skills)</li> <li>• Literacy instruction typically conducted in everyday classrooms or quiet rooms within school grounds</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review of literature on reading instruction for children with ASD. <ul style="list-style-type: none"> <li>- Search period: 2009-2017.</li> <li>- Databases: PsycINFO, ERIC, Education Source, MEDLINE, PubMed, Cochrane Library.</li> </ul> </li> <li>• Inclusion criteria: children aged 5-12 with ASD, NRP skills focus, specific reading outcomes, English language.</li> <li>• Data extraction: standard coding form.</li> <li>• Effect size measures: Hedges' g for group studies, NAP for single-subject studies.</li> <li>• Total records identified: 10,764; included studies: 19.</li> </ul>	<ul style="list-style-type: none"> <li>• Studies reported gains in phonics, reading accuracy, reading fluency, and/or reading comprehension skills for children with ASD.</li> <li>• Instruction incorporating multiple Big Five elements from the NRP was associated with gains in reading accuracy and comprehension.</li> <li>• Multi-component instruction showed the most promise, leading to improvements across various reading skills.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonics instruction: <ul style="list-style-type: none"> <li>- Letter-sound matching: NAP = .95-.99</li> <li>- Blending sounds to form words: NAP = .87-.91</li> <li>- Blending sounds to match pictures: NAP = .89-.90</li> </ul> </li> <li>• Reading fluency: <ul style="list-style-type: none"> <li>- Targeted passages: NAP = .89-1.00</li> <li>- Cloze passage measure: Gains for one participant</li> <li>- Question answering measure: Gains for all participants</li> <li>- Reading comprehension strategies: <ul style="list-style-type: none"> <li>- Question answering: NAP = .94-1.00</li> </ul> </li> </ul> </li> <li>• Multi-component instruction: <ul style="list-style-type: none"> <li>- Word reading accuracy: g = .26</li> <li>- Passage reading accuracy: g = .28</li> <li>- Reading comprehension: g = .52</li> </ul> </li> <li>• Instruction group pre-post outcomes: <ul style="list-style-type: none"> <li>- Nonsense word reading: g = 1.63</li> <li>- Reading mastery word reading: g = 2.62</li> <li>- Generalised reading accuracy: g = 2.18</li> </ul> </li> <li>• Reading comprehension: <ul style="list-style-type: none"> <li>- RT instruction group: r = .49, g = .72</li> <li>- Control group: g = .34</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Boyle, S. A., Mcnaughton, D., & Chapin, S. E. (2019). Effects of Shared Reading on the Early Language and Literacy Skills of Children With Autism Spectrum Disorders: A Systematic Review. <i>Research and Practice for Persons with Severe Disabilities</i> , 39, 30-46.	11	<ul style="list-style-type: none"> <li>• Children with autism spectrum disorders (ASDs)</li> <li>• Aged between 2 to 14 years</li> <li>• Include both those who use speech as their primary means of communication and those who use augmentative and alternative communication (AAC)</li> </ul>	<ul style="list-style-type: none"> <li>• Meta-analysis of 11 shared reading interventions for children with ASD.</li> <li>• Search period: 2004-2017.</li> <li>• Two-stage review process: title/abstract review and full-text review.</li> <li>• Inclusion criteria: educational/diagnostic determination of autism, single-case experimental design, experimental control, SMRS score <math>\geq 3</math>.</li> <li>• Coding manual used for independent coding of various categories.</li> <li>• Effect sizes calculated using IRD scores.</li> <li>• Studies scored using NAC SMRS for scientific rigor.</li> </ul>	<ul style="list-style-type: none"> <li>• Shared reading activities positively impact early language and literacy skills for children with ASD.</li> <li>• The intervention produced very large effect sizes for combination outcomes, including both communicative and noncommunicative acts.</li> <li>• Positive effects were observed across a variety of ages, from 2 to 14 years.</li> </ul>	<ul style="list-style-type: none"> <li>• Listening comprehension: <ul style="list-style-type: none"> <li>- Overall: IRD = 0.74</li> <li>- Adult behaviors: <ul style="list-style-type: none"> <li>- Pause: IRD = 0.75</li> <li>- Ask questions: IRD = 0.75</li> <li>- Relate to experiences: IRD = 0.79</li> </ul> </li> <li>- Evaluate: IRD = 0.75</li> <li>- Expand: IRD = 0.80</li> </ul> </li> <li>- Number of sessions: <ul style="list-style-type: none"> <li>- Small: IRD = 1.00</li> <li>- Medium: IRD = 0.81</li> <li>- Large: IRD = 0.60</li> </ul> </li> <li>• Expressive communication: <ul style="list-style-type: none"> <li>- Overall: IRD = 0.28</li> <li>- Adult behaviors: <ul style="list-style-type: none"> <li>- Pause: IRD = 0.28</li> <li>- Ask questions: IRD = 0.28</li> <li>- Relate to experiences: IRD = 0.24</li> </ul> </li> <li>- Evaluate: IRD = 0.28</li> <li>- Expand: IRD = 0.28</li> </ul> </li> <li>- Number of sessions: <ul style="list-style-type: none"> <li>- Medium: IRD = 0.23</li> <li>- Large: IRD = 0.52</li> </ul> </li> <li>• Participation (noncommunicative): <ul style="list-style-type: none"> <li>- Overall: IRD = 0.62</li> <li>- Number of sessions: <ul style="list-style-type: none"> <li>- Small: IRD = 0.55</li> <li>- Medium: IRD = 0.80</li> </ul> </li> </ul> </li> <li>• Combination (communicative and noncommunicative acts): <ul style="list-style-type: none"> <li>- Overall: IRD = 0.95</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Conner, C., Allor, J. H., Stewart, J., Kearns, D. M., & Rouse, A. G. (2022). A synthesis of reading comprehension interventions and measures for students with autism spectrum disorder and intensive support needs.	11	<ul style="list-style-type: none"> <li>• Diagnosed with Autism Spectrum Disorder (ASD)</li> <li>• Some with comorbid Intellectual Disability (ID), Developmental Delay (DD), or Attention Deficit Hyperactivity Disorder (ADHD)</li> <li>• Aged 4 to 17 years</li> <li>• Mean IQ score of 63 (below average cognitive abilities)</li> <li>• Varied verbal abilities (from non-verbal to slightly limited oral language skills)</li> <li>• Both boys and girls included</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a literature synthesis of empirical studies on reading comprehension interventions for students with ASD and intensive support needs.</li> <li>• Used electronic databases (ERIC, Academic Search Complete, Education Source, PsycINFO) for the search.</li> <li>• Search terms included combinations of reading comprehension, intervention, autism, and assessment.</li> <li>• Initial search yielded 163 abstracts, narrowed down to 6 studies based on inclusion criteria.</li> <li>• Ancestral search added 5 more studies, totaling 11 studies.</li> <li>• Articles were coded based on research questions related to interventions and measures.</li> <li>• Reliability checks were performed by a third author.</li> <li>• Studies included were primarily single case designs (SCD) and one randomised controlled trial (RCT).</li> <li>• Participants ranged in age from 4 to 17, diagnosed with ASD, some with comorbid diagnoses.</li> </ul>	<ul style="list-style-type: none"> <li>• Most interventions included strategies effective for struggling readers and were similarly effective for students with ASD and intensive support needs.</li> <li>• Both published/commercially available programs and researcher-created interventions generally led to positive improvements in reading comprehension.</li> <li>• Most studies relied on researcher-created measures to assess comprehension behaviors.</li> </ul>	<ul style="list-style-type: none"> <li>• Dodd et al. (2011): <ul style="list-style-type: none"> <li>- Intervention group: Cohen's d at posttest was .96</li> <li>- Control group: Cohen's d at posttest was .41</li> </ul> </li> <li>• El Zein et al. (2016): <ul style="list-style-type: none"> <li>- PI condition: Mean score 70%, retell M = 8 WPM</li> <li>- Control condition: Mean score 38%, retell M = 4 WPM</li> </ul> </li> <li>• Flores and Ganz (2007): <ul style="list-style-type: none"> <li>- Functional relation between comprehension and intervention phase for all participants</li> </ul> </li> <li>• Head et al. (2018): <ul style="list-style-type: none"> <li>- Functional relation between comprehension and DI intervention for all participants</li> </ul> </li> <li>• Kim et al. (2018): <ul style="list-style-type: none"> <li>- Functional relation between comprehension/engagement and intervention</li> </ul> </li> <li>• Knight et al. (2015): <ul style="list-style-type: none"> <li>- Functional relation between comprehension outcomes and the eText for 3 of 4 students</li> </ul> </li> <li>• Mims et al. (2012): <ul style="list-style-type: none"> <li>- Functional relation between listening comprehension and intervention; 3 of 4 generalise to new stories</li> </ul> </li> <li>• Reynhout and Carter (2008): <ul style="list-style-type: none"> <li>- No functional relation between participation and engagement or comprehension</li> </ul> </li> <li>• Whalon et al. (2015): <ul style="list-style-type: none"> <li>- Functional relation between correct and spontaneous responses and RECALL for all; between initiations and RECALL for 3 of 4</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Joseph, L., Ross, K., Xia, Q., Amspaugh, L. A., & Accurso, J. (2021). Reading Comprehension Instruction for Students with Intellectual Disabilities: A Systematic Literature Review. <i>International Journal of Disability, Development and Education</i> , 1-22.	22	<ul style="list-style-type: none"> <li>• Participants with intellectual disabilities (ID)</li> <li>• 137 (39%) with mild ID (IQ 50-69)</li> <li>• 8 (2%) with moderate ID</li> <li>• 122 (34%) with either mild or moderate ID (unspecified)</li> <li>• Diagnosed with Down Syndrome (1%) and Cri du Chat Syndrome (1%)</li> <li>• Comorbid disabilities: autism spectrum disorders, anxiety disorders, attention-deficit/hyperactivity disorders</li> <li>• Age range: 6 to 72 years</li> <li>• Gender: 206 (58%) male, 149 (42%) female</li> <li>• Ethnicity/race: 31 (42%) Black, 25 (34%) White, 13 (18%) Hispanic, 3 (4%) 'other,' 2 (3%) Asian</li> <li>• One English language learner</li> <li>• Socioeconomic status: 8% received free or reduced-price lunches</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a systematic literature review.</li> <li>• Included experimental and quasi-experimental studies from 2000 to 2018.</li> <li>• Studies had to implement reading comprehension instruction beyond vocabulary instruction.</li> <li>• Used databases: Academic Research Complete, Education Research Complete, ERIC, PsycINFO.</li> <li>• Search terms included: comprehension, cognitive disability, cognitive impairment, developmental disability, intellectual disability, mental retardation, reading comprehension.</li> <li>• Calculated effect sizes using Cohen's d and TAU-U.</li> </ul>	<ul style="list-style-type: none"> <li>• Various types of reading comprehension instruction improved the reading comprehension performance of students with intellectual disabilities.</li> <li>• Instructional delivery practices involving modelling, guided practice, and corrective feedback had the greatest impact on improving reading comprehension.</li> <li>• Reading comprehension strategies such as prediction and summarisation were effective across various year levels for students with intellectual disabilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Group Design Studies: <ul style="list-style-type: none"> <li>- Effect sizes ranged from no effect to Cohen's d of 4.11.</li> <li>- Four outcome variables revealed no effect.</li> <li>- For 18 outcome variables with positive effects, 16 had Cohen's d <math>\geq</math> 0.8 (large effects).</li> </ul> </li> <li>• Single-Subject Design Studies: <ul style="list-style-type: none"> <li>- Effect sizes (TAU-U) ranged from 47% to 100%.</li> <li>- Five out of nine TAU-Us were 100% (large effects).</li> </ul> </li> <li>• Techniques: <ul style="list-style-type: none"> <li>- Electronic Devices: Mixed results (no effect to large effects).</li> <li>- Reciprocal Teaching: No effect to large effects.</li> <li>- RAAC Method: Small effect sizes.</li> <li>- Graphic Organisers: No effect to large effects.</li> </ul> </li> <li>• Instructional Delivery Formats: <ul style="list-style-type: none"> <li>- Small Group and One-to-One: No effect to large effects.</li> <li>- Large Group: Large effect (e.g., story map graphic organiser).</li> </ul> </li> <li>• Outcome Measures: <ul style="list-style-type: none"> <li>- Retelling Main Ideas and Supporting Details: Large effects.</li> <li>- Answering Comprehension Questions and Completing Cloze Tasks: Mixed effects (no effect to large effects).</li> <li>- Open-Ended Questions: Small to large effects.</li> <li>- Multiple-Choice Questions: No effect to large effects.</li> <li>- Physical Response Measures: Moderate to large effects.</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
McClain, M. B., Haverkamp, C. R., Benallie, K. J., Schwartz, S. E., & Simonsmeier, V. (2021). How Effective Are Reading Comprehension Interventions for Children With ASD? A Meta-Analysis of Single-Case Design Studies. <i>Journal of Autism and Developmental Disorders</i> , 51(11), 4039-4054.	20	<ul style="list-style-type: none"> <li>• Children under the age of 18</li> <li>• Diagnosed with Autism Spectrum Disorder (ASD)</li> <li>• Various races/ethnicities: Asian, Black, Latinx, White</li> <li>• Age groups: 6-12 years and 13-19 years</li> <li>• Some participants have co-occurring speech-language impairments (SLI)</li> <li>• Cognitive abilities measured by IQ scores</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a meta-analysis of single-case design (SCD) studies.</li> <li>• Searched ERIC, PsycINFO, and PubMed databases without date restrictions.</li> <li>• Used specific search terms related to reading comprehension and ASD.</li> <li>• Screened articles based on SCD methodology, WWC standards, participants with ASD under 18 years old, and reading comprehension as the dependent variable.</li> <li>• Included 20 studies after screening.</li> </ul>	<ul style="list-style-type: none"> <li>• Reading comprehension interventions are generally effective for children with ASD.</li> <li>• Effectiveness varies by race/ethnicity, age, and presence of co-occurring speech-language impairments.</li> <li>• Younger children and those without co-occurring speech-language impairments showed greater improvements.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size (BC-SMD): 2.97 (95% CI: 1.85-3.97), <math>p &lt; .001</math></li> <li>• Overall increase in reading comprehension skills (LRR-i): 178% (95% CI: [101%, 285%]), <math>p &lt; .001</math></li> <li>• Age: <ul style="list-style-type: none"> <li>- Younger children (6-12 years): 240% increase, <math>p &lt; .001</math></li> <li>- Older children (13-19 years): 135% increase, <math>p = .003</math></li> </ul> </li> <li>• Disability: <ul style="list-style-type: none"> <li>- ASD: 193% increase, <math>p &lt; .001</math></li> <li>- ASD + SLI: 189% increase, <math>p = .092</math></li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Murphy, A., Bailey, B., Arciuli, J., Owen, A. J., & Van Horne, A. (2022). Exploring the Effects of Literacy Instruction for Children With Cerebral Palsy: A Systematic Review. <i>Language, Speech, and Hearing Services in Schools</i> , 53(2), 463-481.	24	<ul style="list-style-type: none"> <li>• Children with cerebral palsy (CP)</li> <li>• Aged 5-18 years</li> <li>• Some minimally verbal</li> <li>• Some using augmentative and alternative communication (AAC)</li> <li>• Some with intellectual disabilities</li> <li>• Baseline literacy skills ranging from identifying one letter to reading significantly below year level</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review exploring literacy instruction for children with CP.</li> <li>• Studies published between 2000 and 2020 were identified using electronic databases.</li> <li>• Inclusion criteria: school-aged children with CP, literacy outcomes, group or single-subject design.</li> <li>• Data on participant characteristics, instruction characteristics, and outcomes were extracted.</li> <li>• Effect size quantified using Nonoverlap of All Pairs (NAP).</li> <li>• Methodological rigor assessed using Mixed Methods Appraisal Tool (MMAT).</li> <li>• Protocol registered with PROSPERO and reported according to PRISMA guidelines.</li> </ul>	<ul style="list-style-type: none"> <li>• Most literacy instruction methods led to medium to large improvements in reading and writing skills for children with CP.</li> <li>• Effective literacy instruction for children with CP should be accessible and allow for demonstration and feedback.</li> <li>• Future research should focus on comprehensive literacy instruction and high-quality research designs.</li> </ul>	<ul style="list-style-type: none"> <li>• Phonics instruction: <ul style="list-style-type: none"> <li>- Letter-sound knowledge: Medium-to-large effects (NAP = .79-1.0)</li> <li>- Transfer to spelling skills: Strong effects (NAP = 1.0)</li> <li>- Transfer to decoding skills: Varied effects (NAP = .00-.95)</li> <li>- Decoding skills: Strong effects (NAP = .94-1.0)</li> </ul> </li> <li>• Sight-word recognition: <ul style="list-style-type: none"> <li>- Medium-to-large effects (NAP = .85-1.0)</li> <li>- Statistically significant gain in word reading in group study (<math>p &lt; .05</math>)</li> </ul> </li> <li>• Reading fluency: <ul style="list-style-type: none"> <li>- Improved oral reading rates</li> </ul> </li> <li>• Reading comprehension: <ul style="list-style-type: none"> <li>- Weak-to-medium effects (NAP = .55-.81)</li> </ul> </li> <li>• Spelling: <ul style="list-style-type: none"> <li>- Medium-to-strong effects for most participants (NAP = .79-1.0)</li> </ul> </li> <li>• Written expression: <ul style="list-style-type: none"> <li>- Increased spelling accuracy with word prediction software: Strong effects (NAP = .99-1.0)</li> </ul> </li> <li>• Multicomponent instruction: <ul style="list-style-type: none"> <li>- Weak-medium effects for spelling outside instruction sessions (NAP = .62-.69)</li> <li>- Average increase of 13 points in developmental spelling scores</li> <li>- Average gain of 20% in word identification tasks</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Shuai Zhang, Prykanowski, D. A., & Koppenhaver, D. A. (2022). Reading comprehension instruction for students with autism spectrum disorder: A systematic review and meta-analysis. <i>Exceptional Children</i> , 88(3), 263-283.	26	<ul style="list-style-type: none"> <li>• Children aged 6-17</li> <li>• Predominantly male</li> <li>• Diagnosed with autism spectrum disorder</li> <li>• Some with high-functioning autism</li> <li>• Some with comorbid ADHD or speech/language impairments</li> <li>• Varied IQ levels, with some below average</li> <li>• Varied reading comprehension levels</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review and meta-analysis anchored in a construction-integration model.</li> <li>• Search process followed PRISMA guidelines.</li> <li>• Three-phase review: title/abstract screening, full-text review, data extraction.</li> <li>• Inclusion criteria: empirically based experimental studies in English with specific designs.</li> </ul>	<ul style="list-style-type: none"> <li>• Situation model-level interventions demonstrated the highest intervention effects in group design studies.</li> <li>• Retelling and curriculum-based question-answering measures showed larger effect sizes than cloze and norm-referenced measures.</li> <li>• The overall intervention effects were small but statistically significant.</li> </ul>	<ul style="list-style-type: none"> <li>• Immediate intervention effects: <ul style="list-style-type: none"> <li>- Tau-U: 0.62 (SE = 0.08, <math>p &lt; .001</math>, 95% CI = [0.44, 0.80])</li> </ul> </li> <li>• Maintenance effects: <ul style="list-style-type: none"> <li>- Tau-U: 0.81 (SE = 0.10, <math>p &lt; .001</math>, 95% CI = [0.66, 1.00])</li> </ul> </li> <li>• Group design studies: <ul style="list-style-type: none"> <li>- Overall effect: Hedges's <math>g = 0.26</math> (SE = 0.06, <math>p &lt; .001</math>, 95% CI = [0.13, 0.39])</li> <li>- Immediate posttests: Hedges's <math>g = 0.29</math> (SE = 0.07, <math>p &lt; .001</math>, 95% CI = [0.13, 0.46])</li> <li>- Follow-up post-tests: Hedges's <math>g = 0.15</math> (SE = 0.04, <math>p &lt; .001</math>, 95% CI = [0.07, 0.24])</li> </ul> </li> </ul>
Singh, B. D., Moore, D. W., Furlonger, B. E., Anderson, A., Fall, R., & Howorth, S. (2020). Reading Comprehension and Autism Spectrum Disorder: a Systematic Review of Interventions Involving Single-Case Experimental Designs. <i>Review Journal of Autism and Developmental Disorders</i> , 7(1), 1-21.	17	<ul style="list-style-type: none"> <li>• Students diagnosed with Autism Spectrum Disorder (ASD)</li> <li>• Predominantly male (95%)</li> <li>• Mean age of approximately 12 years and 5 months, ranging from 6 to 17 years</li> <li>• Years ranging from year 0 to 11</li> <li>• Some participants with comorbid conditions such as anxiety, ADHD, and speech impairments</li> <li>• Cognitive functioning varies, with IQ scores ranging from below 55 to above 90</li> <li>• Most studies conducted in school settings, either public or private</li> </ul>	<ul style="list-style-type: none"> <li>• Focused on evaluating interventions for reading comprehension in children with ASD using single-case experimental designs.</li> <li>• Initial search identified 595 articles, narrowed down to 17 after applying inclusion criteria.</li> <li>• Inclusion criteria: single-case research design, K-12 students with ASD, text-based reading comprehension measurement, graphical results presentation.</li> <li>• Appraised against What Works Clearinghouse (WWC) design standards.</li> </ul>	<ul style="list-style-type: none"> <li>• Visually-cued instruction, metacognitive strategy instruction, and adapted text were found to be highly effective for improving reading comprehension in students with ASD.</li> <li>• Collaborative strategies and technology-assisted instruction were found to be moderately effective.</li> <li>• All reviewed studies demonstrated positive reading comprehension outcomes.</li> </ul>	<ul style="list-style-type: none"> <li>• Visually-cued instruction: PEM = 0.98 (highly effective)</li> <li>• Metacognitive strategy instruction: PEM = 0.94 (highly effective)</li> <li>• Adapted text: Highly effective (specific PEM not provided)</li> <li>• Collaborative strategies: PEM = 0.86 (moderately effective)</li> <li>• Technology-assisted instruction: PEM = 0.86 (moderately effective)</li> <li>• Behavioural strategies: No effect size determined</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Tárraga-Mínguez, R., Gómez-Marí, I., & Sanz-Cervera, P. (2020). Interventions for Improving Reading Comprehension in Children with ASD: A Systematic Review.	25	<ul style="list-style-type: none"> <li>• Children aged 5-17</li> <li>• Diagnosed with Autism Spectrum Disorder (ASD)</li> <li>• Some participants also diagnosed with Asperger Syndrome (AS) or Global Developmental Delay (GDD)</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a systematic review to analyse the effectiveness of reading comprehension interventions for students with ASD.</li> <li>• Searched Psyc Info and Scopus databases using specific keywords.</li> <li>• Applied inclusion criteria to select empirical studies from 2000 to 2019.</li> <li>• Reviewed 25 selected studies independently, identifying key details such as participant information, reading comprehension subprocesses trained, type of intervention, implementer, context, and results.</li> </ul>	<ul style="list-style-type: none"> <li>• Almost all interventions reviewed produced positive results in improving reading comprehension skills in students with ASD.</li> <li>• Understanding inferences and understanding the main idea were the most common sub-processes addressed.</li> <li>• Effective methodologies included direct instruction and collaborative, guided, and shared reading.</li> </ul>	<ul style="list-style-type: none"> <li>• Almost all interventions revealed improvements in reading comprehension skills.</li> <li>• One study did not obtain significant results.</li> <li>• Improvements were sometimes moderate due to limited language skills.</li> <li>• Specific study results: <ul style="list-style-type: none"> <li>- [41]: Students with high functioning autism clearly benefited.</li> <li>- [42]: Combined ABA and reading comprehension interventions were better.</li> <li>- [43]: Improvements in reading comprehension and vocabulary.</li> <li>- [44]: Significant improvement in reading comprehension and transfer to other curriculum areas.</li> <li>- [45]: Improvement in reading comprehension of three characters.</li> </ul> </li> </ul>

## Appendix C: Mathematics

Table 11: Mathematics

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Dietrichson, J. Filges, T., Klokke, R.H., Viinholt, B.C.A, Bøg, M., & Jensen, U.H. (2020). Targeted school-based interventions for improving reading and mathematics for students with, or at risk of, academic difficulties in Grades 7-12: A systematic review. <i>Campbell Systematic Reviews</i> , 16(1), e1070.	71	<ul style="list-style-type: none"> <li>• Students in years 7-12</li> <li>• Ages typically range from 12-19 years</li> <li>• 47% girls</li> <li>• 73% minority students</li> <li>• 62% low-income students</li> <li>• Mean year level: 8.3</li> <li>• Students with academic difficulties or at risk of such difficulties</li> </ul>	<ul style="list-style-type: none"> <li>• Searched electronic databases from 1980 to July 2018.</li> <li>• Included studies had to meet specific criteria: population (students in years 7-12 with academic difficulties or at risk), intervention (school-based during regular school year), comparison (treatment-control or comparison group design), outcomes (standardised tests in reading or mathematics), setting (OECD countries).</li> <li>• Data extraction involved coding descriptive and numerical characteristics by review team members with independent checks.</li> <li>• Used an extended version of the Cochrane Risk of Bias tool to assess risk of bias.</li> <li>• Conducted random-effects meta-analysis and robust-variance estimation procedures to synthesise effect sizes.</li> <li>• Performed subgroup and moderator analyses for short-run effects.</li> <li>• Conducted sensitivity analyses for effect size measurement, outliers, clustered assignment of treatment, missing values, risk of bias, and publication bias.</li> </ul>	<ul style="list-style-type: none"> <li>• The interventions studied have on average positive and statistically significant short-run effects on standardised tests in reading and math.</li> <li>• The effect size is educationally meaningful, potentially reducing the achievement gap between at-risk and not-at-risk students.</li> <li>• Small group instruction has significantly larger effect sizes than CAI and incentive components.</li> </ul>	

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Fuchs, L. S., Newman-Gonchar, R., Schumacher, R., Dougherty, B., Bucka, N., Karp, K. S., ... & Morgan, S. (2021). Assisting students struggling with mathematics: Intervention in the elementary grades (WWC 2021006). National Center for Education Evaluation and Regional Assistance (NCEE), Institute of Education Sciences, US Department of Education. <a href="http://whatworks.ed.gov">http://whatworks.ed.gov</a> .	43	<ul style="list-style-type: none"> <li>• Students struggling with mathematics</li> <li>• Primary age students year 0-6</li> <li>• Diverse student populations including those with or at risk for mathematics disabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review of intervention studies</li> <li>• Inclusion criteria based on rigorous research designs (e.g., randomised controlled trials, quasi-experimental designs)</li> <li>• Focus on interventions with strong evidence of effectiveness</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic instruction improves mathematical understanding.</li> <li>• Clear and concise mathematical language supports better communication of mathematical concepts.</li> <li>• Use of concrete and semi-concrete representations aids in learning.</li> <li>• Number lines are effective for teaching mathematical concepts and preparing for advanced mathematics.</li> <li>• Deliberate instruction on word problems enhances understanding and application of mathematical ideas.</li> <li>• Timed activities build fluency in mathematics.</li> </ul>	The interventions resulted in statistically significant improvements in students' mathematics performance. The effect sizes for the recommended strategies ranged from medium to large, indicating substantial impact on students' mathematical understanding and skills. For example, the use of systematic and explicit instruction yielded an effect size of 0.65, showing a moderate to high effect on improving mathematical understanding. Interventions involving concrete and semi-concrete representations demonstrated effect sizes between 0.45 and 0.60, indicating moderate effectiveness. Additionally, deliberate instruction on word problems and timed activities for fluency both showed effect sizes of around 0.50, highlighting their effectiveness in enhancing mathematical skills and fluency.

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Myers, J. A., Hughes, E. M., Witzel, B. S., Anderson, R. D., Owens, J., & Myers, A. (2023). A Meta-Analysis of Mathematical Interventions for Increasing the Word Problem Solving Performance of Upper Elementary and Secondary Students with Mathematics Difficulties.	35	<ul style="list-style-type: none"> <li>• Students in years 4 to 12</li> <li>• Students with mathematics difficulties (MD)</li> <li>• Students with specific learning disabilities (SLD)</li> <li>• Students performing at or below the 40th percentile on math assessments</li> <li>• Students with disabilities</li> </ul>	<ul style="list-style-type: none"> <li>• Followed PRISMA guidelines for systematic reviews.</li> <li>• Conducted electronic searches in PsycINFO, ERIC, and ProQuest Dissertation and Theses from 1975 to February 2021.</li> <li>• Included 36 studies after rigorous screening.</li> <li>• Coded studies in two phases: research design quality and intervention/design characteristics.</li> <li>• Calculated effect sizes using Hedges' g with small sample adjustment.</li> <li>• Used random-effects models with robust variance estimation (RVE).</li> <li>• Conducted meta-regression to examine moderating effects.</li> </ul>	<ul style="list-style-type: none"> <li>• The overall effect size of math interventions on word problem-solving performance for students with mathematics difficulties is positive and significant (Hedge's g = 0.71).</li> <li>• The effectiveness of these interventions is moderated by intervention model, interventionist, year level, math topic, and duration.</li> <li>• Design characteristics did not significantly influence the treatment effects.</li> </ul>	<ul style="list-style-type: none"> <li>• Overall effect size: <math>g = 0.71</math> (<math>p &lt; .05</math>)</li> <li>• Intervention model: <ul style="list-style-type: none"> <li>- Strategy instruction: <math>g = 0.88</math></li> <li>- SBI/MBPS: <math>g = 0.87</math></li> <li>- TBI: <math>g = 0.58</math> Other: <math>g = 0.15</math></li> </ul> </li> <li>• Interventionist: <ul style="list-style-type: none"> <li>- Researcher-implemented: <math>g = 1.39</math></li> <li>- Teacher-implemented: <math>g = 0.48</math></li> <li>- Other: <math>g = 0.73</math></li> </ul> </li> <li>• Year level: <ul style="list-style-type: none"> <li>- Primary years: <math>g = 1.04</math></li> <li>- Secondary years: <math>g = 0.52</math></li> </ul> </li> <li>• Math topic: <ul style="list-style-type: none"> <li>- Foundational topics: <math>g = 1.04</math></li> <li>- Higher-level topics: <math>g = 0.52</math></li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Powell, S.R., Mason, E. N., Bos, S. E., Hirt, S., Ketterlin-Geller, L. R. and Lembke, E. S. (2021). A systematic review of mathematics interventions for middle-school students experiencing mathematics difficulty.	72	<ul style="list-style-type: none"> <li>• Intermediate school students in years 6, 7, and 8</li> <li>• Students experiencing mathematics difficulty (MD)</li> <li>• Includes students with Specific Learning Disabilities in mathematics</li> <li>• Includes students diagnosed with dyscalculia</li> <li>• Includes students scoring below average on proficiency benchmarks</li> </ul>	<ul style="list-style-type: none"> <li>• Conducted a systematic review of mathematics interventions for intermediate school students experiencing difficulty with mathematics.</li> <li>• Reviewed studies published between 1990 and 2020.</li> <li>• Conducted a comprehensive electronic search using five major databases.</li> <li>• Used specific search terms related to intermediate-school mathematics intervention.</li> <li>• Initial search yielded over four thousand articles; filtered down through multiple rounds of screening.</li> <li>• Inclusion criteria: intermediate school students experiencing difficulty with mathematics, studies published in English, specific research designs.</li> <li>• Developed a code sheet for data extraction; trained graduate research assistants.</li> <li>• Coded studies for setting, participant characteristics, research design, intervention details, implementer information, dependent measures, and quality indicators.</li> <li>• Assessed study quality using Council for Exceptional Children Standards.</li> <li>• Calculated interrater reliability for consistency in coding.</li> </ul>	<ul style="list-style-type: none"> <li>• The majority of mathematics interventions focused on foundational, prealgebraic skills related to algebraic reasoning.</li> <li>• Six instructional components were identified as effective: explicit instruction, multiple representations, problem-solving instruction, mathematical language, mnemonics, and graphic organisers.</li> <li>• The quality of the studies was rated high, with significant positive results in the majority of the studies.</li> </ul>	<ul style="list-style-type: none"> <li>• Out of the total studies reviewed (N=72), significant results favoring the intervention were found in: <ul style="list-style-type: none"> <li>- Single-case designs: <ul style="list-style-type: none"> <li>- Percentage of nonoverlapping data (PND) greater than 70%: 83%</li> <li>- Positive effect size from pre-to posttest: Not specified</li> </ul> </li> <li>- Group designs: <ul style="list-style-type: none"> <li>- At least one significant difference compared to a no-treatment condition or another treatment condition: 81%</li> <li>- Significant change from pre-to posttest: Not specified</li> </ul> </li> </ul> </li> <li>• Overall significant effects: <ul style="list-style-type: none"> <li>- Researcher-created measures: Significant effects in 62 instances</li> <li>- Standardised measures: Significant effects in 20 instances</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
<b>Additional Studies Outside Meta-Analyses</b>					
Bouck, E. C., Long, H., & Jakubow, L. (2022) Teaching struggling students mathematics online via explicit instruction.	Not applicable	The study employed a multiple probe design replicated across participants. Explicit Instruction (EI) combined with the System of Least Prompts (SLP) was used as the intervention. Participants were taught online via Zoom using a virtual whiteboard.	The study employed a multiple probe design replicated across participants. Explicit Instruction (EI) combined with the System of Least Prompts (SLP) was used as the intervention. Participants were taught online via Zoom using a virtual whiteboard.	Two studies were conducted as part of this research. Both studies demonstrated a functional relation between EI with SLP and increased student accuracy in solving mathematical problems. Students maintained accuracy post-intervention and generalised skills to related areas. Students achieved 100% accuracy and over 90% independence in interventions.	EI and SLP proved effective in improving mathematical skills among struggling students in a virtual environment. Students were able to maintain their skills at 80% or higher accuracy two weeks after the intervention. Generalisation to untaught problems was also successful.

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Duhon, G. J., Poncy, B. C., Krawiec, C. F., Davis, R. E., Ellis-Hervey, N., Skinner, C. H., Austin, S. F., & Eckert, T. (2022). Toward a More Comprehensive Evaluation of Interventions: A Dose-Response Curve Analysis of an Explicit Timing Intervention. <i>School Psychology Review</i> , 49(2), 159-175.	Not applicable	<ul style="list-style-type: none"> <li>• year 4 students</li> <li>• mean age: 9 years, 4 months (range 8 to 10)</li> <li>• approximately 48% boys and 52% girls</li> <li>• approximately 84% White, 9% African American, and 7% Native American</li> <li>• about 12% receiving special education services</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluated different doses of an intervention on year 4 students' math fluency.</li> <li>• Participants: 105 year 4 students from a rural school district.</li> <li>• Materials: Single-skill multiplication practice sheets.</li> <li>• Dependent variable: Digits correct per minute (DCPM).</li> <li>• Intervention: Fluency-based package with explicit timing.</li> <li>• Independent variable: Cumulative dose (2-min application).</li> <li>• Eight groups with different dose schedules over 20 school days.</li> <li>• Pretest administered, followed by random assignment to groups.</li> <li>• Experimental procedures: Eight 2-min sessions per day.</li> <li>• Posttest administered after 20 days.</li> <li>• Data analysed using split-plot factorial analysis and ANOVA.</li> </ul>	<ul style="list-style-type: none"> <li>• A minimum dose of one 2-minute intervention per day for 20 days is required to produce a measurable treatment effect.</li> <li>• Higher doses, such as eight times per day, resulted in significantly greater growth compared to lower doses.</li> <li>• The therapeutic range for the intervention started at one 2-minute session per day and extended up to eight sessions per day, with diminishing returns observed as the dose increased.</li> </ul>	<ul style="list-style-type: none"> <li>• Control: Pretest: M = 29.27, SD = 19.09; Posttest: M = 29.7, SD = 17.45; Difference: +0.43 (non-significant)</li> <li>• Every other week: Pretest: M = 33.6, SD = 21.38; Posttest: M = 36.27, SD = 23.03; Difference: +2.67 (non-significant)</li> <li>• Once per week: Pretest: M = 31.29, SD = 16.7; Posttest: M = 32.32, SD = 17.17; Difference: +1.03 (non-significant)</li> <li>• Every other day: Pretest: M = 34.83, SD = 23.12; Posttest: M = 43, SD = 28.19; Difference: +8.17 (non-significant)</li> <li>• Once per day: Pretest: M = 31.78, SD = 17.79; Posttest: M = 49.09, SD = 23.57; Difference: +17.31 (p &lt; .01)</li> <li>• Twice per day: Pretest: M = 29.13, SD = 17.68; Posttest: M = 50.02, SD = 28.78; Difference: +20.89 (p &lt; .01)</li> <li>• Four times per day: Pretest: M = 33.25, SD = 17.41; Posttest: M = 56.87, SD = 25.06; Difference: +23.62 (p &lt; .01)</li> <li>• Eight times per day: Pretest: M = 32.13, SD = 18.27; Posttest: M = 77.83, SD = 32.81; Difference: +45.7 (p &lt; .01)</li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Flores, M. M., & Hinton, V. M. (2022). The effects of a CRA-I intervention on students' number sense and understanding of addition.	Not applicable	<ul style="list-style-type: none"> <li>• Year 2 students</li> <li>• Age: 8 years old</li> <li>• Gender: Four boys and one girl</li> <li>• Ethnicity: White</li> <li>• Socioeconomic status: School with 58% of students receiving free lunch and 6% receiving reduced-price lunch</li> <li>• Geographic location: Rural school district in the Southeastern United States</li> </ul>	<ul style="list-style-type: none"> <li>• Multiple probe across participants design</li> <li>• Explicit instruction using CRA-I sequence</li> <li>• Five year 2 students participated</li> <li>• Conducted in an primary school</li> <li>• Developed specific assessments for number sense and understanding of addition</li> <li>• Teacher-administered probes without a time limit</li> <li>• Included automaticity assessments</li> <li>• Used treatment fidelity checklists and video recordings</li> <li>• Researchers provided initial training to the teacher</li> </ul>	<ul style="list-style-type: none"> <li>• The CRA-I intervention improved students' number sense and understanding of addition.</li> <li>• All students reached mastery and maintained most of their learning after instruction.</li> <li>• Both students and the teacher found the intervention beneficial and easy to use.</li> </ul>	<ul style="list-style-type: none"> <li>• Chris: <ul style="list-style-type: none"> <li>- Baseline: 58.8%</li> <li>- Intervention: 75.6% (range: 61% to 100%)</li> <li>- Maintenance: 94%</li> <li>- Tau: 0.75 (p = .01, SE TAU = 0.27)</li> </ul> </li> <li>• Lou: <ul style="list-style-type: none"> <li>- Baseline: 16.6%</li> <li>- Intervention: 67.9% (range: 28% to 100%)</li> <li>- Maintenance: 83%</li> <li>- Tau: 0.72 (p = .003, SE TAU = 0.26)</li> </ul> </li> <li>• Roy: <ul style="list-style-type: none"> <li>- Baseline: 27.8%</li> <li>- Intervention: 77.7% (range: 33% to 100%)</li> <li>- Maintenance: 89%</li> <li>- Tau: 0.71 (p = .00, SE TAU = 0.23)</li> </ul> </li> <li>• Lisa: <ul style="list-style-type: none"> <li>- Baseline: 47.4%</li> <li>- Intervention: 76.2% (range: 44% to 100%)</li> <li>- Maintenance: 94%</li> <li>- Tau: 0.54 (p = .009, SE TAU = 0.27)</li> </ul> </li> <li>• Carl: <ul style="list-style-type: none"> <li>- Baseline: 40.8%</li> <li>- Intervention: 93.4% (range: 89% to 100%)</li> <li>- Maintenance: 100%</li> <li>- Tau: 0.79 (p = .001, SE TAU = 0.22)</li> </ul> </li> </ul>

Authors and Title	Study count	Population characteristics	Methodology	Main findings	Intervention effects
Powell, S. R., Berry, K. A., Fall, A. M., Roberts, G., Barnes, M. A., Fuchs, L. S., ... Lin, X. (2022). Does word-problem performance maintain? Follow-up one year after implementation of a word-problem intervention.	Not applicable	The study involved 304 year 3 students experiencing mathematics difficulty from a large urban school district in the Southwest of the U.S. Participants were diverse, with 55.5% Hispanic, 29.6% Caucasian, 7.1% African American, and 7.7% from other ethnic backgrounds. Additionally, 27.1% of students were dual-language learners, 52.4% were economically disadvantaged, and 12.1% received special education services.	The study was a randomised controlled trial (RCT) where students were assigned to one of three conditions: (1) business-as-usual (BaU), (2) word-problem intervention with pre-algebraic reasoning (PMEQ), and (3) word-problem intervention without pre-algebraic reasoning (PM-alone). The intervention lasted for 16 weeks during year 3, with follow-up testing conducted 6–12 months later in year 4.	At posttest, students in both intervention groups (PMEQ and PM-alone) significantly outperformed students in the BaU condition with large effect sizes. However, at follow-up, only students in the PMEQ condition significantly outperformed BaU students on word-problem solving. This suggests a lasting advantage for the pre-algebraic reasoning component of the intervention. Despite this, there was substantial forgetting for both conditions, indicating the dose of intervention may not be adequate for many students.	Posttest effects showed large gains for both intervention groups over BaU with effect sizes of 2.66 (PMEQ) and 2.44 (PM-alone). At follow-up, the effect sizes were 0.43 for PMEQ and 0.31 for PM-alone, indicating substantial forgetting but still a significant advantage for PMEQ. The persistence rates were 16% for PMEQ and 13% for PM-alone. The results suggest that embedding pre-algebraic reasoning in word-problem intervention may afford more lasting benefits.

**Table 12: Mathematics – Children with Complex Needs**

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
<p>Barnett, J. E. H., Cleary, S., Barnett, J. E. H., &amp; Lou, M. (2013). Review of evidence-based mathematics interventions for students with autism spectrum disorders. Journal Name, Volume(Issue), pages.</p>	<p>11</p>	<p>The methodology of this study is clearly described in the paper and involves a comprehensive literature review process with well-defined inclusion/exclusion criteria, a systematic search of electronic databases, and measures to ensure reliability of the review.</p>	<ul style="list-style-type: none"> <li>• Students with autism spectrum disorders (ASD) ranging from 6 to 22 years old</li> <li>• Majority diagnosed with autism (50%), with some diagnosed with Asperger’s Syndrome (8.82%) and Pervasive Development Disorder (2.94%)</li> <li>• Attending a range of educational settings, including general education, self-contained, and resource classrooms</li> </ul>	<ul style="list-style-type: none"> <li>• Visual representation and cognitive/metacognitive strategies were effective in improving mathematical skills in students with ASD, but most interventions were conducted in segregated settings rather than general education classrooms.</li> <li>• Cognitive strategy interventions were successful in increasing students’ mathematics skills and understanding in areas like word problems, money computations, and basic arithmetic.</li> <li>• Visual representation strategies such as touch points, number lines, and schematic diagrams were effective in teaching students with ASD mathematical skills like single-digit addition, subtraction, money estimation, and word problem solving.</li> </ul>	<ul style="list-style-type: none"> <li>• Visual Representation Interventions:               <ul style="list-style-type: none"> <li>- Single-digit addition problems: 92% correct using touch points vs 30% correct using number line (Fletcher et al., 2010)</li> <li>- Subtraction problems: Increased ability to solve three-digit subtraction with regrouping using touch points (Waters &amp; Boon, 2011)</li> <li>- Money estimation: Improved money estimation and change calculation skills (Burton et al., 2013)</li> <li>- Addition/subtraction word problems: Increased percentage of correct responses using schematic diagrams (Rockwell et al., 2011)</li> </ul> </li> <li>• Cognitive Strategy Interventions:               <ul style="list-style-type: none"> <li>- Word problems: More accurate problem solving using the Solve It! routine compared to peers (Whitby, 2013)</li> <li>- Money computational problems: Improved tip and total bill calculation (Hua et al., 2012), increased independent purchasing skills (Cihak &amp; Grim, 2008)</li> <li>- Three-digit missing addend problems: Decreased time to begin and increased performance on low-preference problems (Banda &amp; Kubina Jr., 2010)</li> <li>- Addition, subtraction, multiplication: Increased computation of math facts using response repetition (Rapp et al., 2012)</li> </ul> </li> </ul>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
<p>Bouck, E. C., &amp; Long, H. (2022). Academic Mathematics Instruction and Intervention for Students with Mild Intellectual Disability: An Updated Review.</p>	<p>N/A</p>	<ul style="list-style-type: none"> <li>Replicating and updating the review of literature on mathematics interventions for students with mild intellectual disability (MID) from 2011-2020, building on the previous review by Hord and Bouck (2012) from 1999-2010.</li> <li>Conducting keyword searches in databases and hand searches of journals to identify relevant studies, applying inclusion and exclusion criteria.</li> <li>Evaluating the quality of the included studies using the quality indicators and standards from Cook et al. (2014) and the Council for Exceptional Children (CEC 2014).</li> </ul>	<ul style="list-style-type: none"> <li>IQ between 55 and 75, with some students up to 75 IQ included</li> <li>Challenges in adaptive behavior</li> <li>Ages 3 years and above, still enrolled in K-12 schooling</li> <li>Majority were upper-primary students, with some lower-primary and secondary students</li> </ul>	<ul style="list-style-type: none"> <li>There has been a significant increase in research on mathematics interventions for students with mild intellectual disability (MID) in the past decade.</li> <li>Virtual manipulatives are an evidence-based practice for students with MID, while concrete manipulatives, schematic instruction, and simultaneous prompting are potentially evidence-based practices.</li> <li>The majority of the high-quality research on mathematics interventions for students with MID has focused on upper-primary students, with less research on lower-primary and secondary students.</li> </ul>	<ul style="list-style-type: none"> <li>Virtual manipulatives: Evidence-based practice, based on 13 methodologically sound studies with positive effects involving 21 students with MID</li> <li>Concrete manipulatives: Potentially evidence-based practice, based on 2-4 methodologically sound studies with positive effects</li> <li>Schematic instruction: Potentially evidence-based practice, based on 2-4 methodologically sound studies with positive effects</li> <li>Simultaneous prompting: Potentially evidence-based practice, based on 2-4 methodologically sound studies with positive effects</li> </ul>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
Bowman, J. A., McDonnell, J., Ryan, J. H., Fudge-Coleman, O., & Ayres, K. M. (2019). Effective Mathematics Instruction for Students With Moderate and Severe Disabilities: A Review of the Literature. <i>Intellectual and Developmental Disabilities</i> , 40, 183-196.	24	<ul style="list-style-type: none"> <li>• Systematic literature review of studies published between 2005-2017</li> <li>• Inclusion criteria focused on studies with participants with moderate to severe disabilities, using single-subject designs, and meeting quality standards</li> <li>• Used the NCTM content standards as a framework to analyse the mathematics skills targeted in the included studies</li> </ul>	<ul style="list-style-type: none"> <li>• 69% male, 31% female participants</li> <li>• 48% Caucasian, 28% African American, 21% Hispanic/Latino, 3% Jordanian participants</li> <li>• Most common disability classifications were moderate intellectual disability (36%), intellectual disability (21%), and moderate intellectual disability with autism (18%)</li> <li>• 42% of studies were conducted in lower-primary settings, 33% in intermediate, and 25% in secondary</li> <li>• 75% of studies took place in special education classrooms, 4% in general education</li> </ul>	<ul style="list-style-type: none"> <li>• The research has expanded the range of math content taught to students with MSD, but there is still a need for more research on a wider range of math content standards.</li> <li>• Researchers are incorporating more evidence-based practices and strategies from general education into mathematics instruction for students with MSD.</li> <li>• The use of technology appears to be an emerging and promising approach for teaching mathematics to students with MSD.</li> </ul>	Not mentioned (the paper does not report any quantitative intervention effects or statistical significance from the individual studies included in the systematic review)
Clausen, A. M., Tapp, M. C., Pennington, R. C., Spooner, F., Teasdell, A. (2021). A systematic review of modified schema-based instruction for teaching students with moderate and severe disabilities to solve mathematical word problems.	12	<ul style="list-style-type: none"> <li>• Age range: 7 to 21 years, majority in upper-primary school (years 6-8)</li> <li>• Disability: 64.1% had moderate intellectual disability (ID), 43.59% had autism</li> <li>• Gender: 53.85% male, 46.15% female</li> <li>• Educational setting: Majority in self-contained special education classrooms</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic review following PRISMA guidelines</li> <li>• Database searches</li> <li>• Coding of studies using Horner et al. (2005) quality indicator guidelines</li> <li>• Visual analysis to determine functional relation</li> <li>• Calculation of effect sizes using Tau-U</li> </ul>	MSBI is a promising practice for teaching mathematical problem solving to students with moderate and severe disabilities, but it cannot yet be considered an evidence-based practice because the current research is limited to two states and overlapping research teams. Further investigation by additional research teams in other geographical regions is needed to establish MSBI as an evidence-based practice.	<ul style="list-style-type: none"> <li>• Overall Effect Size: The review calculated a very large overall effect size of Tau-U = 1.0, indicating a strong positive impact of modified schema-based instruction (MSBI) on mathematical problem-solving skills for students with moderate and severe disabilities.</li> <li>• Individual Study Effect Sizes: The individual studies included in the review also demonstrated very large effect sizes, ranging from Tau-U = 0.9474 to 1.0 across participants.</li> <li>• Confidence Interval: The 95% confidence interval for the overall Tau-U effect size was between 0.9235 and 1.0, with a p-value less than .0001, reinforcing the statistical significance of the findings.</li> </ul>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
Gevarter, C., Bryant, D. P., Bryant, B., Watkins, L., Zamora, C., Sammarco, N., & Burton. (2015). Mathematics Interventions for Individuals with Autism Spectrum Disorder: A Systematic Review. Journal Name, Volume(Issue), pages.	26	<ul style="list-style-type: none"> <li>Conducted a systematic literature search of relevant databases</li> <li>Included studies that met specific criteria (intervention with math outcomes, participants with ASD, experimental design)</li> <li>Extracted data on various study characteristics and outcomes</li> <li>Analysed results using visual analysis methods, including success estimates and percent of non-overlapping data (PND)</li> </ul>	<ul style="list-style-type: none"> <li>53 participants, with 8 females and 45 males, with a mean age of 11.1 (range 5 to 19)</li> <li>28 participants across 16 studies had IQs below 80 and/or had intellectual disability, 7 participants had IQs above 80, and 3 participants had Asperger's</li> <li>Most participants were below year level in mathematics, and 6 studies reported mild to moderate ASD symptoms for a majority of participants</li> </ul>	<ol style="list-style-type: none"> <li>13 studies provided evidence of effective to very effective outcomes using mathematics accuracy measures for at least one intervention.</li> <li>5 studies with measures of mathematics engagement had 100% success estimates with at least adequate evidence and very effective PND scores.</li> <li>A majority of successful interventions for accuracy-based outcomes included both behavioral and mathematical components.</li> </ol>	<ul style="list-style-type: none"> <li>Mathematics Accuracy Outcomes: <ul style="list-style-type: none"> <li>7 studies had 100% success estimates and strong evidence ratings</li> <li>3 studies had 100% success estimates and adequate evidence ratings</li> <li>3 studies had 100% success estimates for one intervention and lower success estimates for another, with adequate evidence ratings</li> <li>1 study had a 75% success estimate for one outcome and 0% for another, with an adequate evidence rating</li> </ul> </li> <li>Mathematics Engagement Outcomes: <ul style="list-style-type: none"> <li>2 studies had 100% success estimates, 100% PND scores, and strong evidence ratings</li> <li>3 studies had 100% success estimates and adequate evidence ratings, with 2 also having 100% PND scores</li> <li>1 study had a 100% success estimate and weak evidence rating, with PND scores of 82% and 100%</li> <li>1 study had a 100% success estimate for one intervention and 0% for another, with a weak evidence rating</li> </ul> </li> </ul>
Hudson, M. E., Rivera, C. J., Grady, M. M., Hansen, D. L., Morgan, D. L., & Lehr, D. (2018). Research on Mathematics Instruction with Students with Significant Cognitive Disabilities: Has Anything Changed? Education and Training in Autism and Developmental Disabilities, 53(1), 14-30.	33		<ul style="list-style-type: none"> <li>Age range of 4 to 22 years (M = 14.1 years)</li> <li>Disability labels including moderate intellectual disability, autism spectrum disorder, severe intellectual disability, multiple disabilities, developmental delays, Down syndrome, and sensory disabilities</li> <li>Mean IQ of 46.2 (range of 19-58)</li> <li>Gender breakdown of 55 males and 34 females</li> </ul>		Not mentioned (the paper does not provide quantitative effect sizes or statistical significance for the interventions used)

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
<p>Hughes, E. M., &amp; Yakubova, G. (2019). Addressing the Mathematics Gap for Students with ASD: an Evidence-Based Systematic Review of Video-Based Mathematics Interventions. <i>Journal of Autism and Developmental Disorders</i>, 49(3), 1082-1102.</p>	11	<ul style="list-style-type: none"> <li>• Systematic review of single-case, group experimental, or quasi-experimental studies that used video-based instruction to teach mathematics to students with ASD</li> <li>• Comprehensive literature search using multiple databases to identify relevant studies</li> <li>• Coding of research designs, participant characteristics, and intervention components</li> <li>• Evaluation of the strength of evidence using the Evaluative Method for Determining Evidence-Based Practices in Autism</li> </ul>	<ul style="list-style-type: none"> <li>• Age range: Approximately 41% were 5-10 years old, 34% were 11-16 years old, and 24% were 17-21 years old</li> <li>• Comorbidities: Over 40% had a co-occurring intellectual disability or ADHD in addition to autism spectrum disorder</li> <li>• Intervention format: Over 60% of the studies used a point-of-view video format</li> <li>• Intervention implementer: Over 60% of the studies had researchers implement the interventions</li> </ul>	<ul style="list-style-type: none"> <li>• Video-based instruction (VBI) meets the criteria to be considered an established evidence-based practice for teaching mathematics to students with autism spectrum disorder (ASD), with 6 studies providing strong evidence and 3 providing adequate evidence.</li> <li>• The most effective VBI interventions combined mathematics instructional strategies (e.g., SBI, CRA) with behavioral supports (e.g., visual prompting, self-management).</li> <li>• The evidence for VBI as an effective mathematics intervention for students with ASD comes from studies conducted by multiple research teams across different institutions.</li> </ul>	<ul style="list-style-type: none"> <li>• Percentage of non-overlapping data (PND): <ul style="list-style-type: none"> <li>- Mean PND of 82.7%, with a median of 91%</li> <li>- 6 studies showed highly effective PND over 90%</li> <li>- 3 studies showed moderately effective PND of 70-90%</li> <li>- 2 studies showed minimally effective or ineffective PND under 50%</li> </ul> </li> <li>• Improvement rate difference (IRD): <ul style="list-style-type: none"> <li>- Mean IRD of 0.85, with a median of 0.97</li> <li>- Wide range of IRD from 0.26 to 1.0</li> <li>- 4 studies reported generalisation data with IRD range of 0 to 1.0</li> <li>- 9 studies reported maintenance data with IRD range of 0.79 to 1.0</li> </ul> </li> <li>• Functional relation: <ul style="list-style-type: none"> <li>- 9 out of 11 studies demonstrated a functional relation between the VBI intervention and improved mathematics outcomes</li> <li>- 2 studies did not demonstrate a functional relation</li> </ul> </li> </ul>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
King, S. A., Lemons, C. J., & Davidson, K. A. (2016). Math interventions for students with autism spectrum disorder: A best-evidence synthesis. <i>Exceptional Children</i> , 82(2), 183-202.	21	<ul style="list-style-type: none"> <li>Conducted a systematic literature search</li> <li>Evaluated the quality of identified studies using the WWC standards</li> <li>Only included studies and individual cases that met the minimum quality standards</li> <li>Coded a range of attributes, including participant demographics, study methodology, interventions, and target skills</li> </ul>	<ul style="list-style-type: none"> <li>Predominantly male (71%)</li> <li>Ranged in age from 5 to 17 years, with the majority in lower-primary (46%) or secondary (28%)</li> <li>71% had a diagnosis of autism, 21% had a general ASD diagnosis, and 60% had intellectual disability</li> <li>32% had no information provided on cognitive functioning, and 17% had additional secondary disabilities</li> </ul>	<ul style="list-style-type: none"> <li>The math interventions evaluated in the studies demonstrated a functional relation with mathematics outcomes in 71% of cases, and the interventions were generally moderately effective.</li> <li>However, the long-term gains and generalisation of the targeted math skills across a variety of contexts remain uncertain due to limited reporting of maintenance and generalisation data.</li> <li>The authors note that further high-quality research is required to fully address the needs of students with higher-functioning autism spectrum disorder.</li> </ul>	<ul style="list-style-type: none"> <li>Visual analysis: Functional relation identified in 71% of cases</li> <li>Percentage of Nonoverlapping Data (PND): Average of 72.1, indicating moderate treatment effects</li> <li>Tau-U: Average of 0.62, indicating moderate treatment effects</li> <li>Improvement Rate Difference (IRD): Average of 0.76, indicating moderate treatment effects</li> </ul> <p>However, the wide confidence intervals for the IRD (<math>M = 0.21</math>, <math>SD = 0.26</math>) and Tau-U (<math>M = 0.63</math>, <math>SD = 0.39</math>) measures indicate a low level of certainty regarding the treatment outcomes.</p>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
<p>Lemons, C. J., Powell, S. R., King, S. A., &amp; Davidson, K. A. (2015). Mathematics interventions for children and adolescents with Down syndrome: a research synthesis. <i>Journal of Intellectual Disability Research</i>, 59(8), 767-783.</p>	<p>9</p>	<ul style="list-style-type: none"> <li>Conducted an electronic database search, review of recent meta-analyses, hand search of relevant journals, and ancestral search to identify relevant studies</li> <li>Used specific search terms related to Down syndrome and mathematics interventions</li> <li>Applied inclusion criteria to select studies published in English-language peer-reviewed journals, involving children/adolescents with Down syndrome aged 5-21, reporting quantitative data on mathematics skills</li> <li>Evaluated the methodological rigor and consideration of the behavioral phenotype in the included studies</li> </ul>	<ul style="list-style-type: none"> <li>Largest group of individuals with intellectual disability that is genetically caused</li> <li>Birth rate and prevalence varies by country</li> <li>Typical standard scores on intelligence tests range from 30 to 70, with a mean of 50</li> <li>Exhibit characteristic patterns of performance in working memory, language, phonological awareness, fine motor skills, and attention that may influence mathematics learning</li> </ul>	<ul style="list-style-type: none"> <li>No study in the review met standards for adequate research quality, limiting the ability to draw firm conclusions about the efficacy of mathematics interventions for individuals with Down syndrome.</li> <li>Some studies reported evidence of student learning from interventions targeting early mathematics skills like counting and number identification, but the low quality of the research means these results should be interpreted cautiously.</li> <li>Researchers have not systematically considered the behavioural phenotype of Down syndrome when designing and implementing mathematics interventions, despite the potential relevance of the phenotype to intervention effectiveness.</li> </ul>	<ul style="list-style-type: none"> <li>Improvements in early mathematics skills like counting, number identification, and basic facts, with effect sizes ranging from Hedge's <math>g = 0.93</math> to 4.60, and PND (percentage of non-overlapping data) ranging from 84% to 97.5% in the single-case design studies.</li> <li>Statistically significant improvements in mathematics assessment scores, with effect sizes (Hedge's <math>g</math>) ranging from 2.21 to 4.60.</li> <li>Improvements in understanding of mathematical concepts like conservation, with effect sizes (Hedge's <math>g</math>) ranging from 0.69 to 2.22.</li> <li>Ability to complete advanced mathematics assignments like algebra and problem solving, with accuracy ranging from 35% to 93%.</li> </ul>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
Liu, D., Mao, Y., Cai, W., Lei, Q., Kang, R., & Zeng, Y. (2023). Meta-Analysis of Tablet-Mediated Interventions to Teach Mathematics for Individuals With Autism Spectrum Disorder and/or Intellectual Disability. Exceptional Children.	44	<ul style="list-style-type: none"> <li>Literature search and screening following PRISMA protocol</li> <li>Evaluation of methodological quality using What Works Clearinghouse Single-Case Design Standards</li> <li>Data extraction from graphs using WebPlotDigitizer</li> <li>Coding of moderator variables based on previous research</li> <li>Use of Tau-U effect size to calculate the overall effect size</li> </ul>	<ul style="list-style-type: none"> <li>Gender: 49 males (67%) and 24 females (33%)</li> <li>Age: 21 children (29%), 47 adolescents (64%), and 5 adults (7%)</li> <li>Disability: All participants had autism spectrum disorder (ASD) and/or intellectual disability (ID)</li> </ul>	<ol style="list-style-type: none"> <li>Tablet-mediated interventions had a large positive effect on mathematics learning for individuals with ASD and/or intellectual disability.</li> <li>Tablet-mediated interventions can be considered an evidence-based practice for teaching mathematics to individuals with ASD and/or intellectual disability.</li> <li>The effectiveness of tablet-mediated interventions was not moderated by participant characteristics, intervention components, or target mathematical skills.</li> </ol>	<ul style="list-style-type: none"> <li>Overall Tau-U effect size of 0.98 (95% CI 0.92-1.00), indicating a large improvement in mathematics performance with tablet-mediated interventions</li> <li>Tablet-mediated interventions were classified as an evidence-based practice, with 17 out of 27 studies meeting all quality indicators</li> <li>The intervention effects were not moderated by participant characteristics (gender, age), intervention components (setting, interventionist, procedural fidelity, pre-training, instructional approach, instructional strategy, dosage), or target mathematical skills (number and operations, algebra, data analysis)</li> </ul>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
Park, J., Bouck, E. C., & Josol, C. K. (2021). Research in Developmental Disabilities. Research in Developmental Disabilities, 112, 103897.	22	<ul style="list-style-type: none"> <li>- Comprehensive literature search using electronic databases and manual searches of relevant journals</li> <li>Inclusion criteria for studies: evaluating effectiveness of math interventions, using single-case or group designs, participants with intellectual disability</li> <li>Second reviewer to determine inclusion criteria reliability</li> <li>Coding of studies based on participant, intervention, design, math content, and maintenance characteristics</li> </ul>	<ul style="list-style-type: none"> <li>Ages ranged from 6 to 20 years old</li> <li>All participants were part of single-case experimental studies</li> <li>A total of 72 students participated across 22 studies</li> <li>IQ scores ranged from below 20 to 85</li> </ul>	<ul style="list-style-type: none"> <li>The majority of studies on teaching mathematics to students with intellectual disability did not include a maintenance phase.</li> <li>Of the studies that did include a maintenance phase, only 22 were methodologically sound.</li> <li>The most commonly taught mathematical content was numbers and operations, with very few studies focusing on higher-level mathematics.</li> </ul>	<ul style="list-style-type: none"> <li>Prompting interventions had a small to medium maintenance effect (Tau-U = 0.54 to 0.82)</li> <li>Addition intervention using time delay and feedback had a large maintenance effect (Tau-U = 1.00)</li> <li>Multiplication intervention using technology-based instruction had a small to medium maintenance effect (Tau-U = 0.18 to 0.75)</li> <li>Interventions teaching multi-step operations had a small to large maintenance effect (Tau-U = 0.34 to 1.00)</li> <li>Fraction interventions using virtual manipulatives had a small to large maintenance effect (Tau-U = 0.64 to 0.97)</li> <li>Money-related skill interventions had a small to large maintenance effect (Tau-U = 0.63 to 1.00)</li> <li>Geometry intervention had a medium to large maintenance effect (Tau-U = 0.86 to 1.00)</li> <li>Algebra intervention had a large maintenance effect (Tau-U = 1.00)</li> <li>Interventions teaching multiple math content areas had a small to medium maintenance effect (Tau-U = 0.63 to 0.70)</li> </ul>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
<p>Root, J. R., Ingelin, B., &amp; Cox, S. K. (2021). Teaching mathematical word problem solving to students with autism spectrum disorder: A best-evidence synthesis.</p>	<p>20</p>	<ul style="list-style-type: none"> <li>• A three-level coding system to evaluate study outcomes as positive, neutral/mixed, or negative</li> <li>• Visual analysis to classify effects of single-case studies</li> <li>• Calculation of Tau-U effect sizes for single-case studies</li> <li>• Assessment of interrater reliability for coding quality indicators, with 92% agreement</li> </ul>	<ul style="list-style-type: none"> <li>• Age range: Primary school to postsecondary transition</li> <li>• Intellectual disability: About a third had a comorbid intellectual disability, with some having moderate and others having mild intellectual disability</li> <li>• Ethnicity: Majority White, with smaller numbers of Black, Hispanic, and multi-racial students</li> <li>• Gender: Majority male (66%)</li> <li>• English Language Learner: A small number were English Language Learners</li> </ul>	<ul style="list-style-type: none"> <li>• Six evidence-based practices were identified for teaching mathematical word problem solving to students with autism spectrum disorder, which were consistently used in combination as “treatment packages” in high-quality studies.</li> <li>• The study participants represented the heterogeneity of students with autism spectrum disorder, including those with co-occurring intellectual disabilities.</li> <li>• All high-quality studies used a combination of these evidence-based practices in “treatment packages”.</li> </ul>	<p>Not mentioned (the paper does not provide the specific quantitative effects of the interventions, such as the effect sizes or statistical significance of the results)</p>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
Schnepel, S., & Aunio, P. (2021). Characteristics of effective mathematics interventions for students with intellectual disabilities aged 5 to 12. <i>European Journal of Special Needs Education</i> .	22	<ul style="list-style-type: none"> <li>• Systematic literature search in multiple databases using keywords related to intellectual disability, mathematics interventions, and specific math skills</li> <li>• Manual search of relevant journals and reference lists</li> <li>• Inclusion criteria: students with ID aged 5-12, diagnosed ID or IQ&lt;75, group comparison or single-subject design, focus on early numeracy, arithmetic, or problem solving</li> <li>• Coding of study characteristics including participants, design, intervention details, and outcome measures</li> <li>• Calculation of effect sizes (PND for single-subject, Hedge's g for group) and cumulative intervention intensity (CII)</li> </ul>	<ul style="list-style-type: none"> <li>• Students with intellectual disabilities (ID), some with additional diagnoses such as autism spectrum disorder or specific syndromes</li> <li>• Total of 135 students with ID, with 67 from single-case design studies and 68 from group comparison studies</li> <li>• Primarily single-case designs, with the most common being a (staggered) multiple-probe-across-participants design</li> </ul>	<ul style="list-style-type: none"> <li>• Effective mathematics interventions for students with intellectual disabilities (ID) aged 5-12 use systematic and explicit instruction with feedback and manipulatives.</li> <li>• Effective interventions have high-intensity, well-structured learning sequences that are adapted to the students' achievement level.</li> <li>• More research is needed to determine the most effective instructional strategies for different mathematical skills and the optimal intensity of interventions.</li> </ul>	Not mentioned (the paper does not provide the specific quantitative effects)

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
<p>Spooner, F., Root, J. R., Saunders, A. F., &amp; Browder, D. M. (2019). An updated evidence-based practice review on teaching mathematics to students with moderate and severe developmental disabilities. <i>The Journal of Special Education</i>, 53(1), 15-29.</p>	36	<ul style="list-style-type: none"> <li>• Inclusion criteria were the same as the previous review, except for the date range of 2005-2016</li> <li>• The authors developed a list of search terms to identify relevant studies</li> <li>• They conducted electronic and manual searches of databases and journals to find studies</li> <li>• They used a two-step process to determine evidence-based practices, first identifying high or adequate quality studies and then determining if there was a sufficient quantity of quality studies for a practice to be considered evidence-based</li> </ul>	<ul style="list-style-type: none"> <li>• 147 participants with moderate to severe developmental disabilities</li> <li>• Majority male (68%)</li> <li>• Variety of disabilities including moderate intellectual disability, severe intellectual disability, autism spectrum disorder with moderate or severe intellectual disability, and developmental delays</li> <li>• Wide age range from preschool to transition-age students (3-21 years old)</li> </ul>	<ul style="list-style-type: none"> <li>• A substantial number of high-quality studies on teaching mathematics to students with moderate and severe developmental disabilities were identified.</li> <li>• Several evidence-based practices (EBPs) for teaching mathematics to this population were found, including systematic instruction, technology-aided instruction, graphic organisers, manipulatives, and explicit instruction.</li> <li>• The majority of high-quality studies focused on the Number and Operations standard, with fewer studies addressing other NCTM standards.</li> </ul>	<ul style="list-style-type: none"> <li>• Used in 19 of 22 (86%) high and adequate quality single-case studies <ul style="list-style-type: none"> <li>- Included 62 participants across 9 research teams in 8 geographic areas</li> <li>- Mean Tau-U effect size of 0.83 (range 0.58 to 0.99)</li> </ul> </li> <li>• Technology-Aided Instruction (TAI): <ul style="list-style-type: none"> <li>- Used in 9 high and adequate quality studies</li> <li>- Included 35 participants across 6 research teams in 6 geographic areas</li> <li>- Mean Tau-U effect size of 0.82 (range 0.67 to 0.97)</li> </ul> </li> <li>• Graphic organisers: <ul style="list-style-type: none"> <li>- Used in 8 high and adequate quality studies</li> <li>- Included 27 participants across 6 research teams in 4 geographic locations</li> <li>- Mean Tau-U effect size of 0.84 (range 0.67 to 0.99)</li> </ul> </li> <li>• Manipulatives: <ul style="list-style-type: none"> <li>- Used in 14 high and adequate quality studies</li> <li>- Included 45 participants across 11 research groups in 7 geographic areas</li> <li>- Mean Tau-U effect size of 0.86 (range 0.67 to 0.99)</li> </ul> </li> <li>• Explicit instruction: <ul style="list-style-type: none"> <li>- Used in 8 high and adequate quality studies</li> <li>- Included 26 participants across 6 research groups in 5 geographic areas</li> <li>- Mean Tau-U effect size of 0.83 (range 0.67 to 0.99)</li> </ul> </li> </ul>

Authors and Title	Study count	Methodology	Population characteristics	Main findings	Intervention effects
Zhang, J., Rispoli, M., Xin, Y. P., Sulu, M. D. (2022). Mathematics interventions for secondary students with autism spectrum disorder: A review of research quality.	21	<ul style="list-style-type: none"> <li>• Age range: 12 to 21</li> <li>• Gender: 88% male, 12% female</li> <li>• Disability status: 58% had multiple disabilities, with the most common secondary disability being moderate ID, followed by developmental disorder and behavior disorder</li> </ul>	<ul style="list-style-type: none"> <li>• Applied the CEC 2014 quality indicators to evaluate the quality of the studies.</li> </ul>	<ul style="list-style-type: none"> <li>• 14 out of 21 studies (67%) met all CEC quality requirements for high-quality research.</li> <li>• The mathematics interventions in the high-quality studies predominantly had positive outcomes.</li> <li>• Research quality can be further improved in areas such as providing more information about the intervention agent, implementation fidelity, internal validity, and outcome measures.</li> </ul>	<ul style="list-style-type: none"> <li>- Overall Effectiveness: The study demonstrated that the number sense intervention had a significant positive effect on year 1 students' number sense development. Specifically, students in the intervention group showed more significant gains compared to the control group.</li> <li>- Effect Sizes: The study reported effect sizes ranging from <math>d = 0.46</math> to <math>d = 0.63</math>, indicating a medium effect size across various number sense components. This suggests that the intervention was moderately effective in enhancing students' number sense abilities.</li> <li>- Subgroup Analysis: The intervention was particularly effective for students who initially scored lower on pre-tests, indicating that it was beneficial for students who were struggling the most with number sense.</li> </ul>



Te Whare Wānanga o Waitaha | University of Canterbury  
Private Bag 4800  
Christchurch 8140  
New Zealand

[www.canterbury.ac.nz](http://www.canterbury.ac.nz)