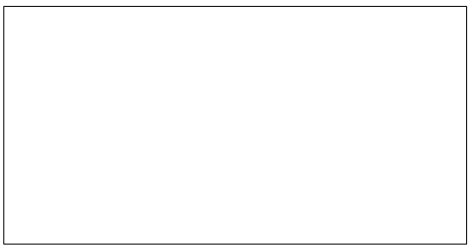

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ANNUAL REVIEWS

Annual Review of Developmental Psychology

The Reading Is Language Model: A Theoretical Framework for Language and Reading Development and Intervention

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Keywords

language, reading, intervention, model of reading, simple view of reading, randomized controlled trial, RCT

Abstract

Language is at the heart of learning and education, and children who enter school with language weaknesses are at high risk of educational failure. We review interventions for reading and language that have been rigorously evaluated and highlight issues of implementation beyond research trials. Our review confirms that interventions to promote language and reading skills can be effective. We propose the reading is language (RIL) model, a developmental extension of the simple view of reading. The RIL model views language as a critical foundation for all aspects of literacy development, initially for learning to read words and subsequently for developing reading comprehension and written expression. Identifying and intervening to ameliorate language and reading difficulties are feasible and have important implications for improving educational and psychosocial well-being.

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INTRODUCTION

The science of reading is mature and has had a positive effect on reading instruction (Petscher et al. 2020). The simple view of reading (Gough & Tunmer 1986) has framed much of this research. According to the simple view, reading for meaning (the goal of literacy) is the product of decoding and listening comprehension. Although it is not a developmental model, the simple view has rightly had a huge influence on the field (Hoover & Tunmer 2022). However, it forces an uneasy separation between language and reading, one that is compounded by an earlier highly influential view that reading is "parasitic on speech" (Mattingly 1972) rather than dependent on broader language skills. Our central argument here is that it is time to recognize that language is at the heart of learning to read and a critical foundation for literacy—writing, after all, is simply the visual representation of spoken language (Dickinson et al. 2010). All aspects of literacy (including word reading, reading comprehension, and written expression) are parasitic on language. Without language, none of these skills would have evolved or would develop in the individual.

Here we propose the reading is language (RIL) model, which views language and literacy as inherently interconnected and interdependent. The model can be seen as a development of the simple view of reading (Gough & Tunmer 1986) and Scarborough's reading rope (Scarborough 2001). The RIL model is explicitly developmental and emphasizes that early language skills (measured before reading has begun) form the foundation for the later development of both decoding and language comprehension (Hulme et al. 2015). Language and decoding skills, in turn, make the development of reading comprehension possible, as postulated by the simple view of reading. These ideas are shown in **Figure 1**, which outlines a causal model of how different skills influence one another over the course of development. There are four overlapping phases: prereading and beginning, intermediate, and proficient reading.

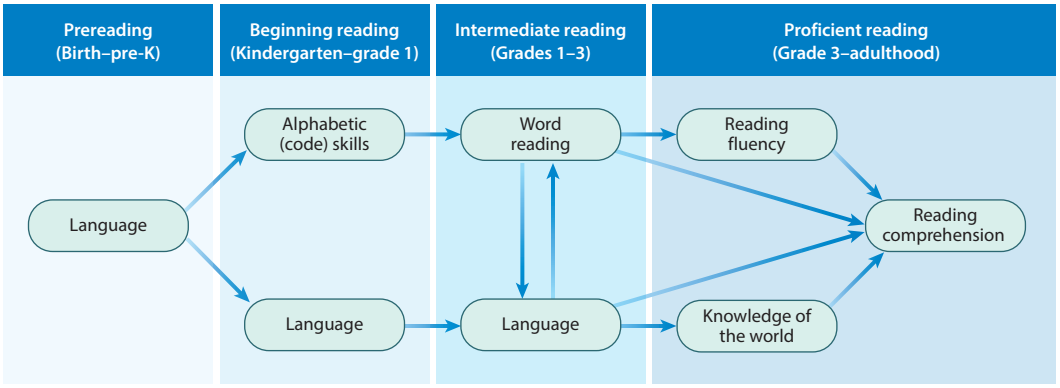

Figure 1

The reading is language (RIL) model, showing the developmental phases of reading from preschool through adulthood with approximate ages and grades. Ellipses represent postulated latent variables. One-headed arrows represent proposed causal relationships between these latent variables. According to the model, early language skills form the foundation for the development of decoding and word-reading skills and later reading comprehension. The postulated causal relationships in the model lead directly to predictions about how interventions to improve key skills at certain stages should have downstream effects on later skills.

The RIL model emphasizes that language skills develop before learning to read has begun and initially serve as purely means of spoken communication. However, this same language system provides the foundation for alphabetic or code skills that form the basis for learning to read words, as well as being the precursor of more advanced language skills that are the foundation for reading comprehension. The RIL model postulates that early language skills are a causal factor in the development of both word reading and later language and reading comprehension. According to the model, we should think of emergent code-related skills [phoneme awareness, letter-sound knowledge, and rapid automatized naming (RAN)] as developing through a differentiation process as the phonological components of language go through rapid development and become explicit at around the time that reading instruction begins. With regard to code-related skills, 3-year-old children are typically not skilled in identifying phonemes in spoken words or relating those phonemes to the letters used to represent them in writing. These skills are taught in school. But the ability to learn these skills depends critically on the state of the language system before, or around the time of, entry into school. Children with poor language skills (Bishop & Adams 1990) and those with articulation or speech difficulties at school entry (Hayiou-Thomas et al. 2017) will find these prereading skills difficult to learn. In the intermediate-reading phase, there is a rapid growth of word recognition skills, children have effectively mastered code-related skills, and word reading is becoming securely established. During this intermediate phase language also continues to develop, and there will be reciprocal causal effects between word reading and language development (each process facilitates development of the other).

In the proficient-reading phase of the RIL model, reading comprehension becomes securely established. The two primary causal influences on reading comprehension in this phase are word reading and language skills. However, we identify two possible additional causal influences on reading comprehension: reading fluency and world knowledge. Reading fluency (the ability to recognize printed words accurately and rapidly) takes time to develop and depends on practice, building on earlier, less efficient word-reading skills. It is reasonable to expect that poor reading fluency is an obstacle to reading comprehension since slow and effortful reading may drain attentional resources and limit the ability to process a text for its meaning. World knowledge (or background knowledge; Catts 2022) refers to our knowledge from outside of a text that has a

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bearing on our comprehension of the text. When reading a passage about the genetics of plants, for example, our earlier knowledge of both genes and plants will clearly be relevant to how well we understand it. We have represented knowledge here as separable from language, although we believe it is debatable to what extent these constructs can be meaningfully separated. Much world knowledge has been acquired through language and may be represented linguistically. The nuances of the distinction between language and knowledge in relation to reading comprehension deserve further study. However, this lies outside the scope of this review; we mention it here for completeness.

The RIL model makes it natural to think of interventions for reading difficulties as inextricably linked to interventions to improve language. According to the model, any child with language difficulties in preschool will be at risk of later reading problems—problems with both learning to read words and understanding what can be read aloud. Therefore, interventions to improve oral language in the preschool and early school years can be expected to improve later language, word-reading, and reading comprehension skills. However, the timing of these different effects will vary. A language intervention may have immediate benefits for language, but effects on word decoding will arise only later (by providing a secure foundation for the development of foundational reading skills). Any benefits from language intervention for reading comprehension would be expected to arise later still (via two causal pathways, one being early language → prereading skills → word reading → reading comprehension, and the other being a more direct pathway, early language → later language → reading comprehension).

There is a wave-like quality to the RIL model (see **Figure 2**). Language development is a necessary prerequisite for alphabetic (code) skills, which in turn allow for the development of word reading, which in turn is necessary for the development of reading comprehension. The waves here represent the idea that the different skills postulated in the model show different periods of rapid development, with each succeeding wave being dependent on earlier waves for its development.

However, to make things even more complicated, the different waves typically overlap, and there may be reciprocal interactions between the processes. The waves are designed to convey

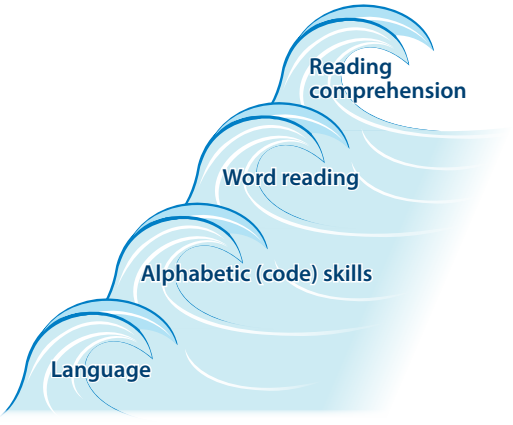

Figure 2

The reading is language model postulates overlapping waves of development (language, alphabetic, word reading, reading comprehension), with each wave forming a foundation for later waves. The waves represent phases of rapid development after which development continues more slowly. Language, for example, shows a very prolonged period of development that may continue into adulthood. The language wave should be interpreted as representing a period of particularly rapid development that needs to reach a threshold before later waves can develop.

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the idea of particularly rapid phases of development for particular skills. To give approximate ages associated with these waves, language development starts around birth, shows particularly rapid development in the preschool years (2–5 years), and continues throughout an extended period into late adolescence or adulthood (Nippold 2000). Code-related skills typically start to develop following direct instruction at school entry (rising 5-year-olds in the United Kingdom, somewhat later in many other countries) and reaches a sufficient level of development to support word-reading development after 1 or 2 years. Like oral language development, the development of rapid automated word recognition may show an extended period of development, lasting well into secondary education. The timing of the wave representing reading comprehension development depends on when the earlier waves reach sufficient levels—typically this wave will be in ascendency during the second to third years of formal reading instruction. These timings are deliberately approximate and refer to a typically developing child. In many children, development may be delayed, to varying degrees, and it is those children who will benefit from the interventions we discuss here.

THE TRIPLE FOUNDATION OF WORD-LEVEL READING

Learning to decode print depends critically on phoneme awareness, letter knowledge, and the rapid retrieval of the names of symbols or objects (i.e., RAN) (e.g., Caravolas et al. 2012, Lervåg & Hulme 2009). Recommendations for how best to teach word reading, enshrined in the report of the National Reading Panel (2000), have built on this evidence.

To investigate the relationship between oral language skills and learning to read, Hulme et al. (2015) conducted a longitudinal study of children at risk of poor reading (either at family risk of dyslexia or with a preschool language difficulty) together with typically developing controls ($N = 260$). The children were assessed on a broad range of language- and reading-related measures annually from age 3.5 years (before reading instruction had begun) to 8 years. Contrary to the prediction that early speech-based skills would predict word reading, preschool language (a latent factor defined by measures at 3.5 years) predicted phoneme awareness, letter knowledge, and RAN shortly after school entry (age 5.5), and between 5.5 and 6.5 years, phoneme awareness and letter knowledge predicted the development of word reading. In turn, in line with the RIL and simple view models, word reading together with preschool language predicted reading comprehension at 8 years. In short, oral language had both a direct and indirect effect on the development of reading comprehension and its effects on word reading were fully mediated by phoneme awareness and letter knowledge (the alphabetic foundation).

The findings of Hulme et al. (2015) accord with a large-scale study by the NICHD Early Child Care Research Network (2005), who reported a direct effect of preschool oral language on reading accuracy in grade 1 (see also Babayğit et al. 2021), but they contrast with others that have reported effects of preschool language only on reading comprehension (Language and Reading Research Consortium & Chiu 2018, Kendeou et al. 2009, Storch & Whitehurst 2002). There are several plausible reasons for these discrepancies: the age of the children at initial test, the range of oral language measures used (see Schatschneider et al. 2004), and the high-risk nature of the sample of children with language-related difficulties (see Catts et al. 1999). Addressing the first two of these, Hjetland et al. (2019) conducted a longitudinal study of Norwegian children followed from age 4 to 9 years. Consistent with Hulme et al. (2015), preschool language predicted three key code-related skills (phoneme awareness, letter knowledge, and RAN) and predicted decoding indirectly through this pathway. In addition, both decoding and language had a direct effect on initial reading comprehension at age 7, and language also predicted the rate of growth in reading comprehension between ages 7 and 9.

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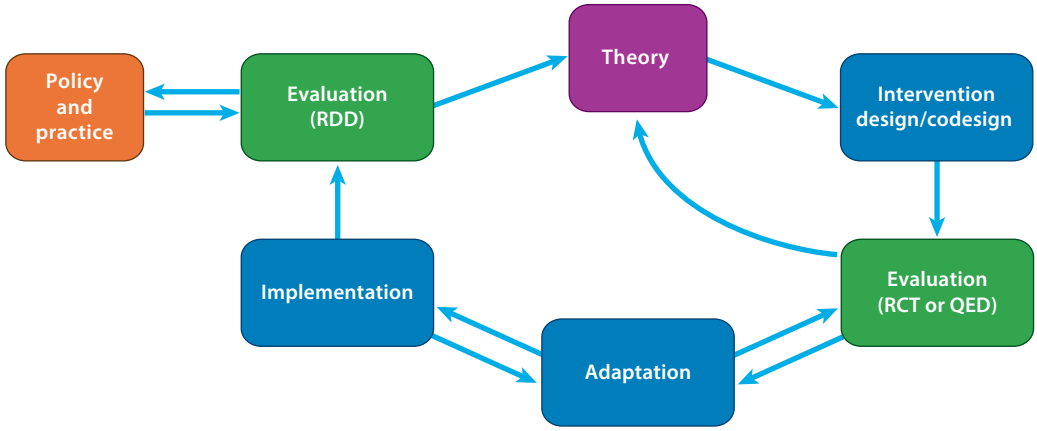

Figure 3

Interactive relationships between theory, intervention, evaluation, and policy. A virtuous circle begins with a causal theory that leads to the design and evaluation of a principled intervention, adapted with feedback from educators prior to large-scale implementation and further disseminated via policy and practice. Modifications are made as necessary to theory, intervention, and user experience. Abbreviations: QED, quasi-experimental design; RCT, randomized controlled trial; RDD, regression discontinuity design.

LINKING INTERVENTIONS TO THEORY

A fundamental principle is that any intervention should be based on a causal theory. Proposals about how to teach children with difficulties learning should address the nature of the learning problem and how a particular form of teaching is designed to address it. In turn, data on the efficacy of the intervention can be used to test the causal theory (e.g., Hulme et al. 2012). RIL provides a model for thinking about how language and reading development relate to each other and, because it is a causal theory, makes direct predictions about the expected effects of interventions at different stages of development. Translating theories into practical and useful interventions is a complex process, which is represented in **Figure 3**. The basic message from the figure is that there is a virtuous circle between theory and practice, with theory guiding the development of interventions, and evaluations of interventions leading potentially to both improvements in the interventions and feedback to the theories that generated them.

Taken together, the findings of the longitudinal studies described above provide a rationale for designing interventions that strengthen oral language skills because they provide the foundation for learning to read. In this view, early interventions to improve children's language should help to improve later reading. The RIL model is a causal model that guides the types of interventions that might be useful at different stages of development and makes predictions about the form and timing of the effects of interventions that can be expected (if the interventions are successful).

Methodological and Design Issues

Randomized controlled trials (RCTs) are the best way of evaluating treatments. In an RCT, children are randomly allocated to receive an intervention or a control treatment (typically, no specific treatment or business as usual). Random allocation of children, assuming sufficient group sizes, effectively eliminates pre-existing differences between groups as potential explanations for any effects. Studies that compare groups that are not assigned randomly are referred to as quasi-experiments and yield less convincing evidence of causal effects because pre-existing differences between groups are not effectively eliminated. This review focuses primarily on evidence from RCTs but also includes some quasi-experimental studies.

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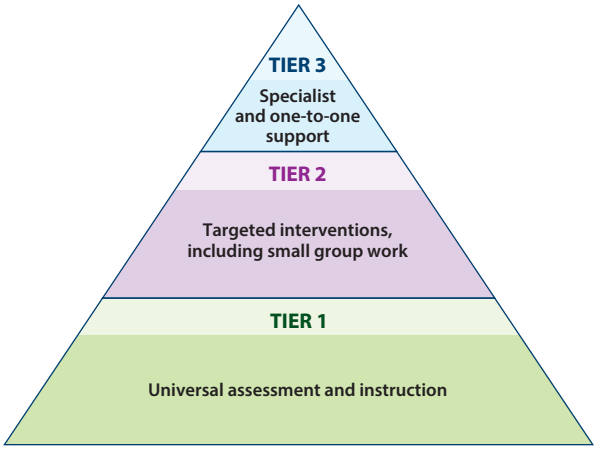

Figure 4

The different tiers of educational provision within the framework of a multitiered system of supports.

Space does not permit a detailed review of what is a vast literature; we therefore rely heavily on meta-analyses. Where appropriate, we include a summary of a key study. We cast the review within the framework of the multitiered system of supports (MTSS) in the United States (known as the three-tier model in the United Kingdom). Within these frameworks, tier 1 is mainstream instruction (universal), tier 2 is supplemental support for at-risk students, and tier 3 is specialist support (Fletcher & Vaughn 2009; see **Figure 4**). We refer only briefly to the efficacy of interventions within MTSS outside of trials (for an example of a reading intervention delivered at scale, see Coyne et al. 2018).

The most important information from an RCT is an estimate of the average treatment effect, that is, how much better off, on average, are people who received treatment than those who did not? These effects are typically expressed as the standardized mean difference (SMD) between groups after an intervention, that is, the difference between groups on a measure expressed in standard deviation units (a measure of variability on the measure). Using standard deviation units puts all effects on a common scale of measurement. In psychology, the SMD is typically referred to as Cohen's *d* or Hedge's *g*. These two measures are almost the same, but *g* contains a correction based on sample size.

An important issue is how to interpret effect sizes. Kraft (2020) reported a meta-analysis of 1,942 effect sizes from 747 RCTs evaluating educational interventions for reading and math. Based on this review, Kraft suggested that a small SMD was less than 0.05, a medium SMD was higher than 0.05 but less than 0.20, and a large SMD was 0.20 or higher. It should be noted that these benchmarks proposed by Kraft are considerably smaller than those elsewhere in the literature, and this difference should be taken account of when interpreting the effect sizes reported in the meta-analyses we cite.

Children at Risk of Poor Reading

In literate societies we typically assume that children will come to school proficient in the language of instruction. However, in increasingly diverse and multilingual societies, this assumption does not hold. Children who come to school at risk of reading difficulties include those who do not speak the language of instruction (often from minority backgrounds; Kuhfeld et al. 2018, Nag et al. 2019), who are socially disadvantaged (Dolean et al. 2019), or who have developmental language

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disorder (DLD) (Bishop & Snowling 2004) or intellectual disabilities (Lemmons et al. 2013). In the context of such diverse risks, Snow & Matthews (2016) suggest that there has been too much emphasis in the so-called early years (approximately pre-K to grade 2) on teaching constrained code-related skills and insufficient time spent on developing unconstrained skills such as grammar, vocabulary, discourse, and knowledge of the world. We agree and believe that a priority should be to strengthen language skills as a foundation for literacy development.

LANGUAGE INTERVENTIONS

Given that language is the key not only for reading but also for access to the curriculum, it is surprising that there are relatively few studies of language intervention in schools. Moreover, many studies have focused on relatively narrow and short-duration interventions, with teaching vocabulary being a common focus. Vocabulary is an important, but limited, aspect of language ability.

Marulis & Neuman (2010) reported a meta-analysis of some 67 studies of vocabulary interventions from birth to age 6, mostly quasi-experiments evaluating versions of storybook reading or dialogic teaching (discussion around topics being taught). The meta-analysis revealed a large mean effect size ($g = 0.88$) for improvements in knowledge of words directly taught, with some evidence that gains were maintained over time. Effect sizes were larger when the intervention was delivered by a more experienced (trained) instructor, when teaching was explicit, and when gains were measured using experimenter-designed bespoke measures. There was no evidence that individualized instruction was more effective than instruction in groups.

It should be emphasized that vocabulary knowledge is just one aspect of oral language; interventions focusing on broader skills such as grammatical and narrative skills, drawing on strategies such as scaffolding, cueing, and prompting within a linguistic framework, are also in use (e.g., Leonard & Kueser 2019). Cleave et al. (2015) examined the efficacy of conversational recasts on children's use of grammatical categories in a small meta-analysis of 14 studies. Recasting refers to building on a child's utterance by adding either semantic, syntactic, or phonological information. Crucially, recasts needed to be contingent on, and include, the child's own words. Although the evidence is limited, an SMD of 0.76 for distal measures in this meta-analysis suggests using recasts benefits the development of expressive language.

Extending beyond teaching vocabulary and grammar, Gillam et al. (2024) developed a multicomponent intervention (called SKILL) for children in grades 1 to 4 to promote oral narrative skills using modeling, recasting, and scaffolding. The intervention had three phases: (*a*) teaching story structure and causal language, (*b*) using strategies for creating stories, and (*c*) engaging in consolidation strategies. Following screening of narrative skills, children selected to participate in SKILL were allocated at random to receive the intervention or business as usual. Children who received the intervention performed better on narrative comprehension ($d = 0.20$), narrative production ($d = 0.36$), and story structure ($d = 0.61$); effects were maintained at a 5-month follow-up. Importantly, the training generalized to written narrative production and, for children in grades 3 and 4, to reading comprehension, where the benefits were similar for monolingual children and English language learners (ELLs).

Similar strategies are embedded in the Nuffield Early Language Intervention (NELI) (Fricke et al. 2018), a 20-week, tier 2 supplementary intervention for children entering school with poor language skills. NELI comprises daily activities to promote vocabulary, narrative, and listening comprehension; in the second 10 weeks, training in letter knowledge and phoneme awareness is also included. NELI is delivered in small groups (three to five students) and to individuals by trained classroom assistants/teacher aides for children selected for low levels of language skill. A

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series of randomized trials of children receiving NELI have all reported positive effects on language ($d = 0.21$–0.80) and the intervention with the largest effect (Fricke et al. 2013) generalized to reading comprehension ($d = 0.52$) (for a review, see Snowling et al. 2022). Furthermore, a large effectiveness trial involving 193 schools (West et al. 2021) reported that NELI was as effective for ELLs as for monolinguals and for children of low socioeconomic status (SES), and it also had positive effects on children's behavior (West et al. 2022).

Rogde et al. (2019) reported a meta-analysis of 28 RCTs and 15 quasi-experiments evaluating language interventions. The studies differed markedly in quality, but overall, there was a significant effect of language intervention on oral language skills ($d = 0.16$), and studies with interventions involving small groups demonstrated larger effects than whole-class or larger group interventions ($d = 0.25$ and 0.10, respectively). Rogde et al. (2019) concluded that language interventions of good quality, especially when delivered to small groups, can have meaningful effects. This analysis identified 16 studies that had examined transfer from language interventions to reading comprehension. They found overall negligible effects. However, 9 out of 16 of these studies focused exclusively on vocabulary instruction rather than broader language skills, including narrative and grammatical skills. Other studies have found that interventions targeting broader oral language skills can benefit reading comprehension (Clarke et al. 2010, Fricke et al. 2013, Hulme et al. 2025) and written expression (Esposito et al. 2025).

A reasonable conclusion is that the oral language skills of at-risk children can be improved by supplementary tier 2 interventions. Transfer to reading comprehension has also been found, but whether such an effect emerges appears to depend upon the content and duration of the intervention, and, according to the RIL model, one would expect that transfer effects to reading comprehension would take time to emerge.

PRESCHOOL LANGUAGE ENRICHMENT AND INTERVENTION

It is now well-established that children who enter school with poorly developed language skills are at high risk of reading difficulties (Bishop & Adams 1990, Catts et al. 1999, Snowling & Melby-Lervåg 2016, Snowling et al. 2020). Therefore, arguably, every effort should be made in preschool to promote children's language development to facilitate their later reading development. Questions arise, however, as to whether this provision should be universal or targeted at those who are already at risk. In Australia, Wake et al. (2011) conducted an RCT to assess the efficacy of a parent-delivered program for late talkers aged 18–24 months. Although the parents were positive about the program, it had no significant effect on their toddlers' language or behavior at 3 years. Many children with slow language development catch up naturally, and so it is difficult to identify children who will be at risk of persistent difficulties before the age of 3 years.

Burgoyne et al. (2018) reported a trial of a 20-week, parent-delivered language enrichment program for at-risk children (of low SES) who attended Children's Centers (an initiative similar to Head Start in the United States). The program was designed to be delivered daily and was centered around storybook reading using dialogic reading principles; it also introduced new words and encouraged narrative production. In an active control condition, parents and children participated together in a set of activities to develop motor skills. The language intervention improved oral language ($d = 0.21$), narrative ($d = 0.36$) and prereading skills ($d = 0.35$–0.42) compared with the active control group. However, a larger effectiveness trial evaluating this intervention produced null results. The reasons for this failure to replicate are unclear. The authors note that it was affected by the COVID-19 pandemic; more generally, without the social support of Children's Centers, it may be difficult to engage parents of children who most need help in preparing for school.

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Rather than training parents to deliver preschool intervention, Hagen et al. (2017) designed an intervention for delivery in mainstream settings for children performing below the thirty-fifth percentile on a language screening test. The intervention comprised vocabulary, narrative, and active listening activities during shared reading and other activities, delivered over a school year. There were extremely large improvements in language at post-test ($d = 0.66$) as well as substantial improvements on distal language measures ($d = 0.56$). These effects were maintained at a 7-month follow-up.

Along similar lines, West et al. (2024) developed a 20-week language intervention for delivery to 3- to 4-year-old children in preschool by teachers and teacher aides. The intervention comprised both a whole class (tier 1) program of language enrichment based around the storybooks, and a small group (tier 2) program for children with poor language skills. In each setting ($N = 70$), two professionals were trained—the teacher who would deliver the whole group sessions and a teacher aide to work with the children identified as requiring more intensive teaching. The program was structured to maximize the opportunity for children with the lowest language skills to practice speaking by retelling the stories they heard in class and to consolidate vocabulary knowledge. The intervention was particularly effective for those receiving the tier 1 enrichment ($d = 0.26$) but produced weaker but statistically significant effects for the tier 2 group ($d = 0.16$). The tier 2 children, by definition, started with poorer language skills, and the authors speculate that many of these children who were young (3 years) may have been too immature to benefit from the intervention.

Research on preschool language intervention is at an early stage, and there are many unanswered questions. In the preschool years, language skills are not stable, and some children with language weaknesses will resolve these before school entry (Snowling et al. 2016); other children may not be sufficiently mature or self-regulated to benefit, and the preschool workforce is less skilled than that in mainstream education. However, evidence is clear that preschool interventions can be effective and are typically of low cost, which provides a strong case for them being more widely implemented.

READING INTERVENTIONS

In contrast to the relatively small amount of research on oral language interventions, there are many studies examining reading interventions. These interventions tend to follow the recommendations of the National Reading Panel (2000) report. Studies focusing on the development of word-level reading skills have been reviewed extensively in meta-analyses (e.g., Galuschka et al. 2014, McArthur et al. 2018). Together, these studies show that systematic instruction in alphabetic skills including phonological awareness, print knowledge, and phonics is effective as a tier 1 method of teaching and as a supplementary form of instruction in tier 2 (for a review, see Savage 2022). As predicted by the RIL and simple view models, there are also moderate effects of interventions targeting code-related skills on reading comprehension (Denton et al. 2022; $g = 0.37$).

Fewer interventions have targeted reading fluency (measured by the speed and accuracy of reading passages), often an area of continuing difficulty in children with reading disabilities. These interventions mostly involve repeated reading of words and texts, focusing on speed and accuracy rather than on prosody. A review of 16 studies (Hudson et al. 2020) reported highly variable effects on rate and accuracy and similar variability for reading comprehension. While the development of high-quality lexical representations is critical to reading efficiency (Perfetti 2007, 2017), and print exposure is an important determinant of reading growth, it seems likely that reading outside school rather than simply rereading texts is a more effective way of building knowledge of the orthography (van Bergen et al. 2018). Poor readers are less inclined to read than proficient readers,

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leading to a downward spiral of poorer reading achievement and progressively less inclination to read. Thus, interventions that go beyond reading instruction to include activities and incentives to enhance engagement with texts and motivate readers—for example, discouraging negative self-talk and replacing it with process-oriented feedback about the reading that has been completed—may be particularly important (McBreen & Savage 2020).

For children with more severe word-reading difficulties (e.g., dyslexia), more intensive interventions are needed (tier 3). A widely held belief is that the systematic, sequential introduction of spelling–sound consistencies using multisensory methods should be used with such children. However, evidence is lacking, and a recent meta-analysis found negligible evidence for their effectiveness (Stevens et al. 2021). Another approach is to intensify intervention by increasing its duration. Wanzek et al. (2018) conducted a meta-analysis of early intensive interventions comprising all or some activities focused on code-based skills, oral fluency, and reading comprehension, delivered for at least 100 sessions. They reported that such approaches were effective for struggling readers in the early school grades ($d = 0.38$). In this analysis, there was support for the contention that one-to-one support ($d = 0.59$) is of greater benefit than small group work (2–8 students; $d = 0.33$), but this finding is based mainly on the progress of first graders and may not generalize.

Finally, most approaches to remedial teaching offer similar supplementary support to all students, usually aligned with whole-class instruction. Tailoring support to the needs of individual students might be expected to be more effective. In a landmark study, Connor et al. (2004) showed that while some children do indeed benefit from a code-based approach, others benefit from more meaning-focused work. Furthermore, given the irregularities of English spelling, allowing children to go beyond a code-based approach to use context to support their decoding of words can be important, though findings are mixed (Li & Wang 2022).

Beyond reading intervention per se, spelling difficulties are common and persistent in children with reading difficulties (Maughan et al. 2009), and many children require specific support. Galuschka et al. (2020) reported a meta-analysis of 36 studies that had used spelling intervention to address reading and spelling deficits in children with dyslexia. These studies used a variety of approaches and were conducted in English or other European languages; they produced large improvements in reading ($g = 0.42$) and spelling ($g = 0.68$).

INTERVENTIONS FOR READING COMPREHENSION

As formalized in the RIL model and the simple view of reading, reading comprehension depends upon both decoding and language comprehension. As predicted by these models, interventions that improve either decoding or language comprehension can lead to improved reading comprehension.

Denton et al. (2022) reported a meta-analysis of 47 interventions in the early years (kindergarten–grade 3) that measured reading comprehension. They reported a moderate effect ($d = 0.37$) that declined at follow-up ($d = 0.21$). Surprisingly, there was no difference between interventions that focused purely on code-related skills and those that also included vocabulary instruction or training in comprehension strategies. Similarly, Lovett et al. (2022) synthesized evidence concerning the efficacy of multicomponent reading interventions on reading comprehension outcomes by merging data from four studies of children with reading disabilities. After a year of instruction, the interventions all improved reading comprehension, but the effect of training on comprehension was considerably reduced when improvements in decoding were statistically controlled. Interestingly, younger children showed the largest benefits: robust improvements in decoding skills and reading comprehension. These findings suggest that gains in reading comprehension in these studies were largely the result of gains in word decoding,

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underlining the fact that poor decoding is a bottleneck to comprehension for many poor readers and an important focus in the early years. Thus, interventions for children with low levels of decoding skills should focus on teaching code-related skills, particularly the mapping of letters in printed words onto their sounds, and once decoding has developed sufficiently, work gradually introducing more meaning-focused, lexical strategies will be needed (Compton et al. 2014).

One strategy that has been explored as a means of improving context-dependent decoding (for example, to read words with low frequency vowel pronunciations) is to teach children to use the set for variability approach. In this approach, children are taught to explicitly compare the regularized pronunciation of an exception word—for example, stomach pronounced *STOW-MATCH*—to words that they know the meaning of and that would make sense in the context of the passage, in this case, to recognize that the regularization (*STOW-MATCH*) is close to a word whose meaning is appropriate to the sentence context, "He was hungry and his stomach rumbled." Dyson et al. (2017) trained children to use this strategy to correct their reading errors (see also Savage et al. 2018). The results suggest it is worth including this strategy in interventions for children developing phonic-decoding skills and perhaps, through this, requiring them to learn only the most useful letter-sound mappings (the simplicity principle; Vousden et al. 2011).

Another way of encouraging children to pay attention to word meanings involves teaching about the morphological structures of words; approaches that train mappings between grammar, meaning, and orthography may be particularly important for learners of transparent languages where the connections between orthography and phonology are regular (e.g., Lyster et al. 2016) or, indeed, in Chinese where the morphological level of representation is critical to reading accuracy (McBride et al. 2022). According to a meta-analysis by Goodwin & Ahn (2013), morphological approaches improve decoding ($d = 0.59$), vocabulary ($d = 0.34$), and spelling ($d = 0.30$) skills.

Given the developmental perspective of the RIL model, training in comprehension strategies is likely to be of increased importance for older readers (for a review, see Shanahan 2019). Filderman et al. (2022) reported a meta-analysis of 64 studies targeting reading comprehension strategies in struggling readers (grades 3–12). Interventions focused on one or more of the following: (*a*) strategy instruction, in which students were taught to extract text structures, plan an approach to reading, extract the main idea, make inferences, and draw conclusions; (*b*) the development of vocabulary and background knowledge; (*c*) metacognitive strategies, such as comprehension monitoring and look-back; and (*d*) instructional enhancements, such as the use of visual aids and graphic organizers. Generally, these different interventions had positive effects ($g = 0.59$); similar findings were reported by Sohn et al. (2023) based on 37 such studies ($g = 0.63$).

Clarke et al. (2010) focused on how to improve reading comprehension in 9- to 10-year-old children with comprehension difficulties but adequate decoding skills. In a randomized trial they compared three different interventions with an untreated control. The interventions all included vocabulary instruction, narrative skills, and reciprocal teaching to develop comprehension strategies (inferencing, prediction, questioning, and summarization) and were delivered 3 days a week for 20 weeks to pairs or individuals. One version of the program was delivered using written texts and the production of written narrative while another was delivered entirely through spoken language and required the production of oral narrative. A third version combined oral and written work, each delivered half of the time. Reading comprehension in all three treated groups improved significantly immediately after intervention ($d = 0.59$–0.99). However, there was a striking group difference 11 months later when those who had received the oral language program had pulled ahead of the other two groups ($d = 1.24$). These findings show that oral language skills can be improved in the middle school years and may, in turn, improve reading comprehension.

The study by Clarke et al. (2010) did not measure written or spoken narrative even though narrative skills were taught explicitly. A more recent study by Esposito et al. (2025) evaluated a revised

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version of the Clarke et al. oral language program. This study reported substantial improvements in oral language ($d = 0.38$) and written narrative production ($d = 0.42$). Consistent with this, a meta-analysis by Graham et al. (2018) showed that interventions for reading comprehension have a positive effect on writing outcomes ($d = 0.66$), which can be maintained at follow-up ($d = 0.37$; 10 studies). A likely reason is that comprehension strategies include work on story structure and strategies to improve discourse and sentence-level processing, all of which contribute to writing quality and skill.

Response to Reading Intervention

The MTSS framework was designed primarily to ensure that children in early school grades (kindergarten through grade 3) had the best chance of entering the later grades as proficient readers (Fletcher & Vaughn 2009). The aim was for all children to receive universal provision (tier 1) with screening after approximately 8 weeks to identify children who needed supplementary support. Regular monitoring allows children to move smoothly between tiers according to their needs (for an example, see Coyne et al. 2024). However, an alternative approach is to screen at school entry and to place at-risk children into tier 2 or tier 3 from the outset (depending on the severity of their difficulties) (Al Otaiba et al. 2014).

Within the MTSS framework, a small number of studies have discussed the characteristics of treatment resisters, some 2–6% of children in grades 1 and 2 (Torgesen 2000, Vellutino et al. 2000). Reviewing these studies, Austin et al. (2017) found that most treatments for such children include the same ingredients as tier 2 and tier 3 programs but provided more frequently or intensively. They show that poor responders can make significant progress from tier 3 intervention but typically fail to catch up to their more responsive peers. Arguably, it is unrealistic to expect children with severe reading or language difficulties to reach age-expected performance, but the high rates of dyslexia among children with DLD (Snowling et al. 2019) suggest that providing oral language support in the context of decoding interventions could be beneficial. More generally, given the frequent comorbidity of reading disorders with other learning disorders (Moll et al. 2020), interventions for poor responders may need to address these co-occurring difficulties (attention-deficit/hyperactivity disorder would be one example; Roberts et al. 2021). In short, children who respond poorly to evidence-based reading interventions may require different treatment pathways than those who respond well.

English Language Learners

Most reading interventions have been designed for children who are proficient in the language of instruction. However, increasing numbers of children are educated in a language that they do not speak at home [referred to as ELLs in the United States and English as an additional language (EAL) learners in the United Kingdom]. The language skills of second language learners are typically below those of their majority peers, especially in the early years of schooling. According to Melby-Lervåg & Lervåg (2014), second language learners typically show small deficits in word-level reading skills (decoding $d = -0.12$) and phonological awareness ($d = -0.08$), but large deficits in reading comprehension ($d = -0.62$) and language comprehension ($d = -1.12$). Hence, language interventions are clearly desirable for these children, but there are few high-quality studies.

Graham et al. (2023) reported a meta-analysis of 38 studies of reading intervention for bilingual (mostly Spanish–English) students conducted in the United States (see also Ludwig et al. 2019). There were generally positive effects across pre-K through grade 12 ($g = 0.24$), with stronger effects for interventions targeting foundational (decoding) skills. A smaller review by Roberts et al. (2021) reported a pooled effect size of $g = 0.23$ for reading outcomes in kindergarten–grade 2 ELL

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students from 10 studies, 7 of which involved at-risk students (fluency, $g = 0.30$; foundation skills, $g = 0.27$; reading comprehension, $g = 0.27$). However, the effects of these interventions on oral language proficiency were disappointing ($g = 0.11$). It should be noted, however, that an extremely large RCT evaluating the NELI language program by West et al. (2021) found relatively strong effects on language outcomes ($d = 0.28$ and 0.32) and no evidence that the effects differed between EAL and non-EAL students.

It is clear that more research is required in this area, particularly to include children who need to master two different scripts (Vaid 2022) or contend with dialectal variation (Washington & Seidenberg 2022); however, we suggest that, unless there is evidence of decoding deficits, the emphasis should be placed on developing oral language and reading comprehension in ELL children (see also Melby-Lervåg & Lervåg 2014).

LONG-TERM EFFECTS OF READING AND LANGUAGE INTERVENTIONS?

Relatively few studies of interventions for language and reading problems report long-term follow-up data. It is claimed that educational interventions typically report pronounced reductions in the size of intervention effects over time (Bailey et al. 2020, Bus & van IJzendoorn 1999). However, there is some emerging evidence for sustained effects of language and reading interventions. Hulme et al. (2025) reported findings from a 2-year follow-up of children who had received the NELI intervention in the first year of school. At follow-up, there were reliable effects of the intervention on oral language ($d = 0.33$), reading comprehension ($d = 0.24$), and word reading ($d = 0.22$). Given that there was substantial attrition in this study, these figures need to be interpreted with caution, but they do suggest that language intervention can produce durable improvements in both reading and language skills under some circumstances. Speculatively, we believe that explicit, broad-based oral language interventions, such as NELI, that include work on how to infer the meanings of new words and how to produce good narratives may alter a child's approach to learning language and lead to enduring benefits resulting from them more actively engaging in learning language.

The longer-term outcomes of reading intervention are debated. Bailey et al. (2020) reviewed several studies indicating limited long-term effects of interventions to improve decoding. For example, after a decade, Blachman et al. (2014) reported a medium effect size for individuals who had received intervention, but only in word reading and not in other reading measures. Comparing different forms of intervention, Suggate (2014) reported a meta-analysis of 17 studies, showing a reduction in the effect size from $d = 0.37$ immediately post-test to $d = 0.22$ at follow-up; overall, there was maintenance of gains following training in phonological awareness and reading comprehension, while the effects of fluency and phonics interventions, as well as those targeting preschool and kindergarten children, tended to fade out.

INTERVENTIONS BEYOND THE LABORATORY: SCALE-UP AND IMPLEMENTATION

Despite the research accumulated for effective interventions, education globally has been slow to implement the findings, and the social, cultural, and political factors that promote the success of interventions delivered at scale are less well-understood. When the aim is to introduce interventions in new contexts, obstacles to scale-up include the acceptability of the intervention to the local community, fit to the curriculum, relevance of the outcome measures, and support given to the intervention from parents (Newbury et al. 2022). Even when an intervention is viewed positively, a school may not have the resources to continue delivering it, there may be scheduling issues, and/or

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the school may have other priorities; arguably, the most important of these is whether teachers can see the progress made by pupils who are given intervention.

The challenges of scale-up have long been recognized in health care, and the study of overcoming them is referred to as implementation science. Shiell et al. (2008) suggest that there are several layers of research to conduct before an intervention is embedded in routine practice. Mode 1 is basic science (RCTs), while mode 2 is qualitative and draws out what works in context, taking account of the multiple stakeholders that enable an intervention to be sustained in a community. In short, research with quantitative outcomes (e.g., the gains on a reading test for a reading intervention) may fail to consider its impact on teachers, teacher assistants, parents, or the other children in the classroom.

Space does not allow for discussion of the many internal and external factors that can affect the adoption of evidence-based interventions. Several frameworks are now available for considering problems of implementation, and Solari et al. (2020) discuss a road map for translating the science of reading into practice. However, issues of implementation should ideally be discussed at the outset of research in partnership with practitioners, who are then involved in the cocreation and evaluation of interventions (e.g., McGeown et al. 2023). Moreover, following a trial, it is reasonable to expect that adaptations to programs may be necessary for scale-up and to maximize adoption. Thus, it is important to identify the core features of interventions and to allow some flexibility. Kim et al. (2017) conducted an RCT to investigate whether allowing teachers to adapt a summer program designed for children with reading difficulties led to any loss of fidelity to the core elements or a reduction in the effects of the intervention. Although this was a short intervention delivered in the summer vacation, it improved students' reading comprehension and engagement, and there was no significant difference between the standard and the adapted versions. For the adapted program, adherence to the core principles was high, and teachers working in this way were better able to engage families, with a discernible difference in the number of books read and returned by the children receiving adapted programs.

Special Educational Needs

Children with special educational needs are one group for whom adaptation may be necessary. For example, many children with neurodevelopmental disorders experience language problems; a key question is whether such children benefit from the approaches to improving language and reading skills discussed in this review. Donolato et al. (2023) reviewed 38 studies evaluating oral language interventions for children with a range of neurodevelopmental disorders including Down syndrome, fragile X syndrome, and Williams syndrome. Although the quality of the studies was deemed poor, interventions were effective ($d = 0.27$; $d = 0.18$ at follow-up). Stronger effects were reported for expressive than for receptive language measures and for interventions of longer duration.

The most common neurodevelopmental disorder is autism spectrum disorder (ASD); given these children's difficulties with mentalizing (the ability to understand others' thoughts), executive function, and central coherence, interventions are likely to need adaptation if they are to be successful. Much of this literature involves single-case designs. Boyle et al. (2019) conducted a systematic review of these; shared reading showed positive effects on listening comprehension and smaller effects on expressive communication, and Singh et al. (2021) reported positive impacts of visual cueing and metacognitive strategies for improving reading comprehension. Adapting interventions to reduce the off-task behaviors frequently observed in autism—for example, using rewards, other incentives, or texts that were of interest to the student—was also helpful.

While many students with ASD are of high ability, other disorders are often associated with intellectual disability (ID). Most studies of reading intervention focus on those with moderate

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learning difficulties (IQs of 50–70) (Joseph et al. 2023). Hill (2016) reviewed studies of the efficacy of systematic phonics instruction (none of which were conducted in inclusive settings). The interventions improved reading-related skills with effect sizes on measures of phonological processing skills ranging from $d = 0.57$ to $d = 0.88$. Similarly, positive gains were reported by Shelton et al. (2019), who focused on explicit strategy instruction to develop reading comprehension, with weaker effects of multicomponent relative to single-component interventions. However, this review included only seven controlled trials.

The most common condition associated with ID is Down syndrome. Children with Down syndrome typically have difficulties with expressive grammar, and therefore, this has been the target for several small-scale studies. Baxter et al. (2022) evaluated an intervention designed to teach the past tense to 7- to 11-year-old children with Down syndrome. Children were randomly assigned to receive the intervention immediately ($N = 26$) or to join a waiting control group ($N = 26$). The intervention group made gains on the regular simple past tense verb forms (composite score $d = 1.63$) and on a standardized grammar measure ($d = 0.24$), with generalization to untrained verbs ($d = 2.37$) and overregularization errors to irregular verbs ($d = 1.45$). However, although gains were retained 12–14 weeks later, the intervention did not generalize to other measures of expressive grammar (irregular past tense or third-person singular) or to measures of the amount of information and/or detail used in expressive language.

Burgoyne et al. (2012) evaluated the effect of an integrated reading and language intervention program for children with Down syndrome, delivered by teaching assistants to individuals in daily sessions. After 20 weeks, the intervention group ($N = 28$) showed significantly greater progress than the waiting control group ($N = 26$) on measures of single-word reading ($d = 0.23$), letter-sound knowledge ($d = 0.42$), phoneme blending ($d = 0.54$), and knowledge of word meanings taught in the program ($d = 0.47$). However, there was no generalization to skills not directly taught (nonword reading, spelling, standardized expressive and receptive vocabulary, expressive information and grammar).

In summary, interventions for language and reading problems are effective for children with learning disabilities. Though it seems to be unrealistic to expect interventions to show generalized effects in these populations, such interventions are likely to be of considerable importance to improving the lives of these children.

Teacher Education

Key to the successful implementation of any intervention is teacher education and professional learning (Savage 2022). The NELI oral language program described above is delivered by teaching assistants, who have undergone approximately 12 hours of online, self-paced, and accredited training. It comprises three modules, the first of which is an introduction to language and its component skills. This module is of fundamental importance because language is not covered as a stand-alone topic in initial or professional teacher education; rather, it is the domain of speech-language pathologists. This linguistic knowledge not only provides preparation for delivering NELI but also directs attention to their own use of language, which is so critical for interactions with children in tier 1 as well as day-to-day conversations (Dickinson 2011). Professional learning does not stop there: All those delivering NELI regularly attend webinars and support groups that allow sharing of best practices, challenges, and solutions. These activities ensure that school staff value NELI and contribute to the sustainability of the program. In scale-up beyond the RCTs that showed its efficacy, a regression discontinuity design conducted by independent evaluators showed that NELI has the same positive effect on children's language as in the research-led trials and, strikingly, its impact is higher for those of low SES who qualify for free lunch (Smith et al. 2023).

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In summary, while it is possible to translate research into practice, care needs to be taken in considering how this translation is made and how to address concerns raised by those responsible for implementation.

CONCLUSIONS

In this review, we describe the RIL model, which sees language and literacy as inherently intertwined. According to this model, any child with language difficulties in preschool will be at risk of later reading problems—problems with both learning to read words and understanding what they can read aloud. Therefore, interventions to improve oral language skills in the preschool and early school years can be expected to improve later language, word reading, and reading-comprehension skills.

We review a large body of work that has evaluated interventions to improve language and literacy skills (see **Figure 5**). The RIL model provides a useful way of bringing together what we know and leads to recommendations for future research. There is strong evidence that oral language interventions can produce meaningful improvements in children's language skills. There is, however, limited evidence to date that these interventions lead directly to improvements in word reading or in reading comprehension. Some of the studies reviewed do get such effects, while others do not. Further studies are badly needed. It should be emphasized that any such transfer effects may take some time to develop and that studies testing these ideas would need to span an appropriate developmental time period—from preschool through at least the first 2 years of formal

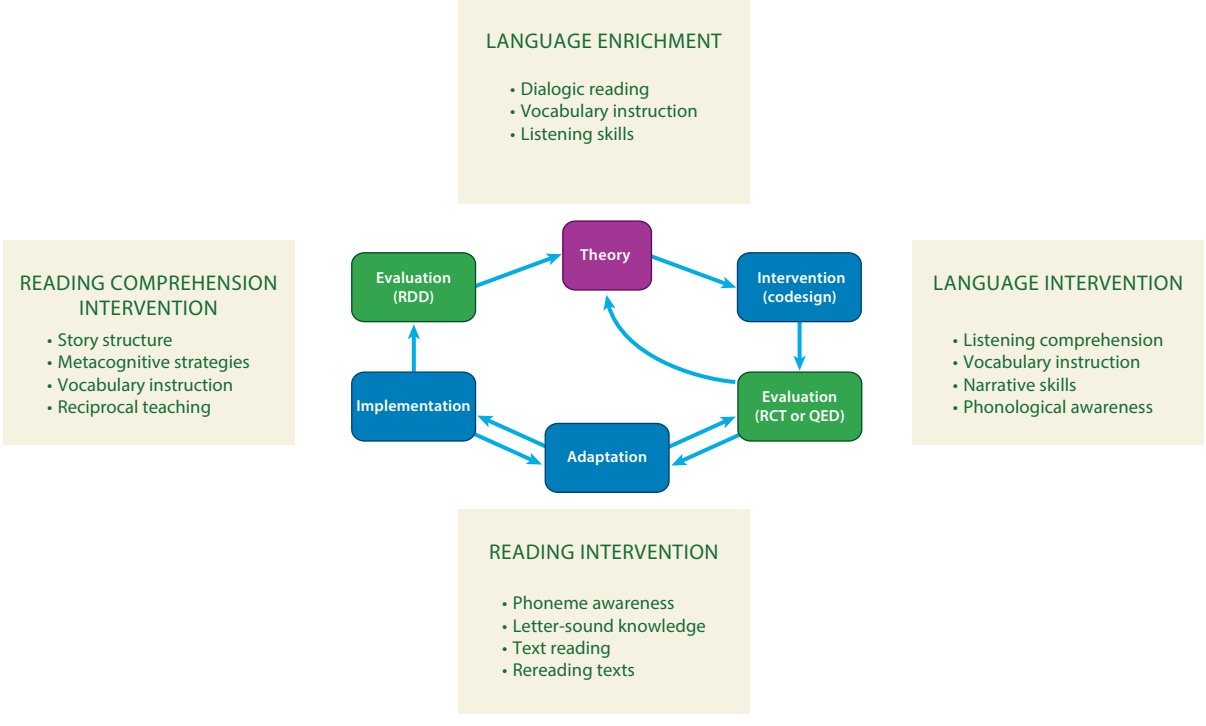

Figure 5

Graphic illustration of evidence-based interventions for language, reading, and reading comprehension consistent with the implications of the reading is language model. Abbreviations: QED, quasi-experimental design; RCT, randomized controlled trial; RDD, regression discontinuity design.

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schooling. We also emphasize that interventions need to be of sufficient duration and intensity to produce meaningful, lasting changes in language that may later transfer to improvements in both decoding and reading comprehension. Finally, interventions may not be successful for a variety of reasons. We can only expect transfer from language interventions to distal measures (reading accuracy and reading comprehension) if proximal measures (language) have shown meaningful improvement.

There have been many more studies of interventions to improve word reading than interventions targeting language. Interventions that follow the theory that decoding depends on mastering the alphabetic principle (relating sounds in spoken words to the letters in printed words) (Byrne 1996) are generally effective, with moderate effect sizes and relatively low costs (e.g., Hatcher et al. 2006). Such interventions also typically lead to improvements in reading comprehension, as would be expected from the RIL model and from the simple view of reading. Major outstanding questions include the durability of effects (or lack thereof) and whether more developmentally sensitive interventions that start by emphasizing basic decoding skills, but then gradually incorporate more emphasis on word meanings and morphology, would be more effective. We believe that they might be, but this is a major issue for future research. Another issue is whether these approaches to improving basic word-reading skills are sufficient to improve reading fluency. Current evidence suggests that fluency may depend on extended reading practice, and interventions may require refinement to increase motivation to ensure poor readers engage with reading practice.

In relation to reading comprehension, there is evidence that both oral language interventions and interventions to improve word reading can lead to improvements, as would be expected given the RIL model. There are also effective approaches that focus more directly on text comprehension. Within the current framework, such methods might be expected to have reciprocal effects on oral language. This is another important topic for future studies to address.

In summary, we argue that language and reading interventions need to be seen as inextricably linked. This field of research is now mature, and many studies of high methodological quality exist that have important implications for both practice and for the theoretical framework outlined here. Future studies need to be of longer duration and involve a wider range of outcome measures to assess some of the remaining questions.

DISCLOSURE STATEMENT

M.S. and C.H. are founders of and shareholders in OxEd and Assessment Ltd., a University of Oxford spin-out company that is licensed to distribute the NELI program as a commercial product.

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