

**A review of the simple view of reading: Decoding and linguistic comprehension skills of
low-progress readers**

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Abstract

The purpose of this paper is to review recent studies examining the two components of the simple view of reading (i.e., decoding and linguistic comprehension) in relation to low-progress readers. The assertion of the simple view of reading that reading disability results from deficiencies in decoding, linguistic comprehension or both, is supported by the research. Research has clearly shown that low-progress readers (a) present deficits in decoding and linguistic comprehension skills, and (b) can benefit from decoding and linguistic comprehension interventions. Three kinds of decoding interventions (i.e., phonemic awareness instruction, phonics instruction and fluency instruction), along with several other important issues are examined. Linguistic comprehension interventions targeted at syntactic skills and background knowledge seem to receive less research attention.

A review of the simple view of reading: Decoding and linguistic comprehension skills of low-progress readers

There is strong evidence supporting the view that reading development is not a natural process; children do not learn to read as they learn to speak (Lyon, 1998; Stanovich, 2000). Reading, perhaps especially reading with meaningful understanding, appears to be an unnatural and complicated task in that it requires readers to apply and to integrate a variety of skills. The awareness that words are composed of sounds (i.e., phonemic awareness) and the ability to read words accurately and fluently are considered important skills in the beginning stages of reading development (Lyon, 1998). In addition, readers need to have adequate vocabulary knowledge, background knowledge and comprehension strategies, and an appropriate level of interest (Lyon, 1998; Cunningham, Moore, Cunningham & Moore, 2004), so that reading with understanding can take place.

While not denying that reading is a complicated task, Gough and Tunmer (1986) and Hoover and Gough (1990) proposed a simple view of reading whereby reading can be decomposed into two basic components or processes, decoding and linguistic comprehension (Gough & Tunmer, 1986; Hoover & Gough, 1990). This paper will examine the two components of the simple view of reading in relation to low-progress readers and also with regard to what might be done to help them, with reference to empirical studies, meta-analyses and literature reviews published between 1990 and 2005 in peer-reviewed journals.

Overview of the simple view of reading

It has been well documented that decoding and linguistic comprehension contribute separately to reading comprehension (Hoover & Tunmer, 1993). However the simple view of

reading argues that neither decoding nor linguistic comprehension is sufficient for reading comprehension to take place, and that the effect of one of the two components on reading comprehension is determined by the level of the other component (Gough & Tunmer, 1986; Hoover & Gough, 1990; Hoover & Tunmer, 1993).

Decoding refers to the ability to translate a sequence of graphemes (letters of written language) into their corresponding representations as phonemes (sounds of spoken language), which are then used to gain access to word meaning in the reader's memory (Hoover & Tunmer, 1993). To be regarded as skilled decoders, children must be able to read words accurately and fluently (Gough & Tunmer, 1986). Decoding ability is typically measured by asking readers to read a series of pseudowords, which can be decoded using grapheme-phoneme correspondence knowledge (Gough & Tunmer, 1986; Hoover & Tunmer, 1993). Arguably, the ability to manipulate phonological structures of spoken language (i.e., phonological awareness) will impact on decoding ability (Tunmer & Hoover, 1992).

Linguistic comprehension refers to the ability to obtain the meaning of words and to interpret the meaning of sentences and discourse (Hoover & Gough, 1990; Hoover & Tunmer, 1993). Skills for linguistic comprehension are basically the same as those for reading comprehension, except that the former is related to spoken language and the latter is related to written information (Hoover & Gough, 1990; Hoover & Tunmer, 1993). Accordingly, reading comprehension is often assessed by asking readers to read a text and to answer questions in relation to the text, whereas linguistic (or listening) comprehension can be assessed by asking readers to listen to a passage and then to answer questions in relation to the passage (Hoover & Gough, 1990; Hoover & Tunmer, 1993). It has been argued that there are several cognitive components that support linguistic comprehension, namely, linguistic knowledge (which is

composed of phonology, semantics and syntax) and background knowledge (Wren et al., 2001).

This model of reading is widely accepted by professionals and researchers in the field of reading as it provides a relatively transparent model that can be used not only to understand reading development but also to assess and treat reading difficulties (Roberts & Scott, 2006). Researchers have demonstrated the existence of different categories of children with reading disabilities as postulated by the simple view model (e.g., Aaron, Joshi & Williams, 1999; Catts, Hogan & Fey, 2003). This model has also been adopted as a conceptual framework to guide the development of reading instruction (Rose, 2006; Roberts & Scott, 2006).

Scope of this review

This paper is aimed at unpacking the simple view of reading. We will review recent studies examining the different forms of reading disability in the context of the simple view of reading. We use the term low-progress readers to encompass a heterogeneous group of children with different forms of reading disabilities, categorised on the basis of the simple view of reading model. Low-progress readers is a neutral term as it does not discriminate among children on the basis of etiology. It is a simple descriptive term to describe readers whose performance on established psychometrically sound reading tests (either word recognition or reading comprehension tests or both) are usually below the 25th percentile. This means that low-progress readers would differ continuously across the decoding and linguistic comprehension dimensions.

Second, we will review recent studies examining the profile of low-progress readers in the decoding and linguistic comprehension components. For decoding, two sub-components, accuracy in decoding (i.e., being able to decode words correctly) and fluency in decoding (i.e., being able to decode words automatically) will be examined. Three sub-components of linguistic comprehension, namely semantic knowledge, syntactic knowledge and background knowledge,

will also be examined. Finally, this paper will also review recent studies and meta-analyses on effective instructional methods for students who have problems with decoding and linguistic comprehension.

The simple view of reading and reading disability

The simple view of reading claims that reading ability is adequately predicted by the product of decoding and comprehension and can be expressed in a mathematical formula as $R = D \times C$ (Gough & Tunmer, 1986), where R denotes reading comprehension, D denotes decoding, and C denotes linguistic comprehension/listening comprehension. This view of reading has important implications for reading disability. If one component (either decoding or linguistic comprehension) equals zero, reading comprehension itself will equal zero. Students who do not have decoding skills ($D=0$) will be regarded as non-readers ($R=0$), even though they have adequate linguistic comprehension skills ($C=1$); conversely, students who do not have linguistic comprehension skills ($C=0$) will also be considered non-readers ($R=0$) even in the presence of decoding skills ($D=1$) (Gough & Tunmer, 1986). Based on this multiplicative model, reading disability could result in three different ways: either from an inability to decode (i.e., poor decoders), or an inability to comprehend (i.e., poor comprehenders), or both (i.e., garden-variety poor readers) (Hoover & Gough, 1990).

Hoover and Gough (1990) assessed 254 bilingual children from first grade to fourth grade, and found that in three of the four grade levels, decoding and linguistic comprehension were negatively correlated among low-progress readers. The negative correlation between decoding and linguistic comprehension indicated that there were two groups of low-progress readers: (a) low-progress readers with weak decoding and relatively good linguistic comprehension, and (b) low-progress readers with weak linguistic comprehension and relatively

good decoding.

Aaron et al. (1999) attempted to test the prediction proposed by the simple view of reading. They administered tests of reading comprehension, linguistic comprehension and decoding to low-progress readers. Students whose score on the reading comprehension test was one standard deviation below the expected level were defined as having reading disability. Within the group of students identified as having reading disability, those who achieved a score of one standard deviation below the expected level on the decoding test or the linguistic comprehension test were defined as having a specific deficit.

Based on these criteria, Aaron et al. (1999) were able to provide evidence that decoding and listening comprehension are independent of each other. In general, there were three subgroups of readers with reading disability: readers with weak linguistic comprehension and good decoding, readers with weak decoding and good linguistic comprehension, and readers with difficulties in both decoding and linguistic comprehension. Interestingly, they also found a small group of students who did not have difficulty with decoding accuracy, but were having problems with reading fluency. They argued that reading fluency could be a third component underlying the reading process.

Catts et al. (2003) commented that the validity of the classification approach (one standard deviation below the mean standard score) used by Aaron et al. (1999) was limited because the samples of low-progress readers were small. Catts et al. (2003) attempted to further investigate forms of reading disability using the same classification approach. From a sample of 183 second-grade students who were classified as poor readers, the researchers were able to identify four subgroups that differ in their patterns of strengths and weaknesses in word recognition and listening comprehension. The majority fell into two subgroups: 35.5 per cent of

the sample were children who had adequate linguistic comprehension but weak word recognition, and 35.7 per cent of the sample were children who were weak in both word recognition and linguistic comprehension. However, it must be noted that these subgroups are not discrete and homogenous, rather their strength and weakness in both word recognition and listening comprehension were continuous and spread throughout the two parameters. This means that the majority of low-progress readers in their sample have deficits in the word recognition component (71.2 per cent). These findings certainly have important implications for intervention in the early grades.

In summary, the assertion of the simple view of reading that reading disability may result from poor performance in decoding, poor performance in linguistic comprehension, or both, is supported by the research. Most importantly, identification of specific areas of reading problems will help teachers select the most appropriate intervention (Aaron et al., 1999; Catts et al., 2003). Given that low-progress readers have difficulty with decoding or linguistic comprehension, it is important to examine their performance profile in each component compared to good readers.

Decoding difficulties

According to Gough and Tunmer (1986), decoding ability varies directly with letter-sound correspondence knowledge and the purest measure of decoding is the ability to pronounce pseudowords. In one of the studies, Gottardo, Chiappe, Siegel, and Stanovich (1999) administered tests of pseudowords (standardised and experimenter-devised) to 68 third-grade low-progress readers and 23 first- and second-grade readers matched for reading level. Results showed that low-progress readers performed more poorly than younger readers on the standardised test and on one of the experimenter-devised tests. The experimenter-devised test was constructed based on the spelling pattern of irregular consistent words, namely words that

consist of vowels pronounced not according to their most common letter- sound correspondences but that share the same vowel pronunciations and word parts with their neighbours (e.g., bind, kind, mind).

The difference in decoding as measured by single real word reading and reading in context between low- progress readers and good readers has also been explored. Jenkins, Fuchs, van den Broek, Espin, and Deno (2003) administered two reading tasks to two groups of fourth-grade students (85 good readers and 24 students with reading disability). For contextual reading, students read a folktale in paragraph form. For list reading, students read the words in the folktale in a randomly ordered list. Performance was indexed as accuracy (words read correctly divided by the number of words read) and fluency (words read correctly in one minute). Results indicated that good readers scored significantly greater than the disabled readers on both the fluency and accuracy measure for both contextual and list reading. Specifically, good readers were three times faster in contextual reading and twice as fast in list reading.

The researchers then classified the disabled readers into impaired and non-impaired groups on the basis of accuracy and fluency z-scores. One of the important findings was that disabled readers did not have a context- specific problem, meaning that all the students who displayed impairment in contextual reading were also found to be impaired in list reading. On the basis of this finding, the researchers argued that students' accuracy and fluency problems in passage reading were related to single-word reading, and that hence fluency intervention at the single-word level has to be considered.

Bearing in mind that low-progress readers generally present significant deficits in decoding, as shown by the studies reviewed, above, it is of great importance to question how decoding ability contributes to reading comprehension. Perhaps the significant contribution of

decoding ability towards reading is that it paves the way for sight word reading (i.e., recognising words accurately and instantly). Research has suggested that the ability to read words by sight is dependent on readers' knowledge of letter-sound correspondences and their ability to decode words based on this knowledge (Aaron et al., 1999; Ehri, 1998). Thus, phonically regular words will eventually become sight words when they have been encountered enough times in reading. Reading words by sight is considered the best word recognition strategy because it does not overtax the reader's mental effort or cognitive processing skills (Ehri, 1998). Readers can then focus their attention more closely on comprehending the text. Similarly, we can also argue that if readers are not able to decode words, it is impossible for them to derive meaning from text (Wheldall & Beaman, 2000). This conforms to the assertion of the simple view of reading, that if one does not have decoding skills, reading comprehension will always be zero.

Given the importance of decoding ability, teachers need to help low-progress readers who are having decoding problems strengthen their decoding skills. While attempting to design intervention approaches, teachers need to consider not only the student's ability to decode words in isolation, but also their ability to decode words in connected text. During the process of reading, both the decoding component and the linguistic comprehension component need to work interactively together. The decoding component translates print into linguistic information and the comprehension component then makes sense of this linguistic information (Catts et al., 2003). As was illustrated by Jenkins et al. (2003), decoding problems can occur not only out of context (i.e., reading words in isolation) but also in context (i.e., reading words presented in text).

Decoding interventions

Teaching phonemic awareness and decoding strategies

It has been well documented that in order for a child to be able to decode unfamiliar words and to read familiar words by sight, the child has to learn the alphabetic principle, and the key to the development of the alphabetic principle is phonemic awareness (PA) and knowledge of letter-sound correspondences (Adams, 1990; Ehri, 1998; Carnine, Silbert, Kame'enui & Tarver, 2004). These two skills are taught in phonemic awareness instruction and phonics instruction. The goal of phonemic awareness instruction is to teach manipulation of phonemes in spoken words and the goal of phonics instruction is to teach letter-sound correspondences and how to use this knowledge to decode words (Ehri, Nunes, Stahl & Willows, 2001). It should be noted that even though these processes have different sets of goals, inevitably there is some overlap between them as phonemic awareness builds into phonics instruction. The part of phonemic awareness instruction that uses letters to teach grapheme-phoneme correspondences would qualify as phonics instruction (Ehri, Nunes Willows, Schuster, Yaghoub-Zadeh & Shanahan, 2001).

Many tasks are used to teach phonemic awareness. Among them are: phoneme isolation, phoneme identity, phoneme categorisation, phoneme blending, phoneme segmentation and phoneme deletion (Ehri et al., 2001). Of these skills, blending and segmentation are directly linked to decoding. Blending refers to the ability to convert a sequence of sounds into a word (Konza, 2000). For example, on hearing /s/ /u/ /n/, a student with blending skills will be able to say sun. Segmenting refers to the ability to isolate sounds within a word. For example, given the word man, the student will be able to segment it into /m/ /a/ /n/.

Ehri, Nunes, Willows, et al. (2001) conducted a meta- analysis of 52 experimental studies examining the effects of phonemic awareness instruction on phonemic awareness, reading and spelling. They found that: (a) phonemic awareness instruction improved phonemic awareness

and reading not only among typically progressing readers but also among at-risk students and reading-disabled students; (b) larger effect sizes were obtained for at-risk readers in preschools, kindergarten and first grade; (c) phonemic awareness instruction contributed to children's ability to read real words and pseudowords, and to comprehend text, and (d) phonemic awareness instruction focusing on blending and segmenting skills was significantly more effective in improving children's reading than phonemic awareness instruction that taught three or more phonemic awareness skills.

In phonics instruction, children are taught letter-sound relationships and how to use this knowledge to decode words. For example, in teaching children how to read a three-grapheme word, mad, the teacher has the student sound out each letter separately (i.e., /m/ / a/ /d/) before saying the word mad. Blachman, Tangel, Ball, Black, and McGraw (1999) used a different approach to teach blending skills by asking the student to pronounce the continuous sounds as a single unit, that is, by stretching out the sounds without pausing (e.g., /mmaaad/).

Ehri, Nunes, Stahl, and Willows (2001) conducted a meta-analysis of 66 treatment-control groups from 38 experimental studies evaluating the effectiveness of systematic phonics instruction compared to unsystematic or no-phonics instruction. In systematic phonics instruction, phonics elements are taught sequentially based on a set plan, whereas unsystematic phonics instruction are taught in context as the need arises, typically in a whole language approach to reading instruction. Their meta-analysis showed that: (a) systematic phonics instruction was more effective than unsystematic or non-phonics instruction in improving children's reading ability, and it produced superior outcomes for students in kindergarten and first grade, and (b) phonics instruction exerted the greatest impact on the ability to decode phonically regular words and pseudowords (both types of words contain letters or letter

combinations that represent their most common sounds), followed by the ability to read.

The effects of phonics instruction on low-progress readers were particularly significant. Ehri, Nunes, Stahl, and Willows (2001) found that systematic phonics instruction prevented reading disabilities in at-risk beginning readers and also is an effective way to remediate reading problems among children struggling to read. However, they found that it did not help children with general cognitive disabilities. Further analysis indicated that phonics instruction helped reading disabled readers in terms of decoding of regular words and pseudowords, reading of irregular words, reading fluency and reading comprehension.

Ehri, Nunes, Stahl, and Willows (2001) also analysed the effectiveness of two major types of systematic phonics programs: synthetic phonics programs and larger-unit programs. Synthetic phonics programs involve teaching children letter-sound correspondences and blending of letter-sounds to decode words. Larger-unit programs involve teaching children to decode parts of words. Results indicated that their effectiveness on reading did not differ significantly from each other. Of interest is whether the combination of synthetic phonics programs and larger-unit programs would produce more gains than would either program alone.

One study that further contributed towards effective remedial reading instruction for children with severe reading disabilities was conducted by Lovett, Lacerenza, Borden, Steinbach, and De Palma (2000). Lovett et al. (2000) identified the critical components of effective remediation of children with reading problems and delivered it in two training programs for students with reading disability, aged between six and 13 years. The first program was the Phonological Analysis and Blending (PHAB) and the second was the Word Identification Strategy Training Program (WIST). PHAB was developed according to the synthetic approach (where children were taught phonemic awareness and letter-sound correspondence skills) and a

direct instruction model (where children were provided with many opportunities to practise, overlearn and review the skills). The WIST program, which is based on the analytic approach, taught students to critically analyse and use pronounceable parts within a word. For example, students were taught to read an unknown word by flexibly changing pronunciations of the vowel (e.g., the letter combination ea in the word bread would be pronounced as ea as in head or bead to determine which pronunciation would make sense). Results showed that students who participated in the combined program condition outperformed students in the single program condition (either WIST or PHAB) on most of the word reading measures. They suggested that to achieve an optimal remedial outcome for children with severe reading disabilities, a multi-dimensional approach, which combines direct phonological and strategy-based instructional methods, should be implemented. Lovett et al.'s (2000) study suggests another possible dimension to decoding interventions for students with reading disabilities.

Developing reading fluency

Students may be able to decode words in isolation or in lists accurately and automatically. However, this does not imply that they do not have any problems in decoding words presented in text. Accuracy and fluency in decoding can break down at the list-reading level as well as at the text-reading level (Jenkins et al., 2003). Wheldall and Beaman (2000) have pointed out that there may be students who are able to decode words, but "do so only at a painfully slow rate". They argue that reading at a slow rate may impede reading comprehension in two ways. First, it overtaxes the reader's cognitive processing skills resulting in no space available for reading comprehension. Second, it is highly possible that the reader may have forgotten the words at the beginning of a sentence by the time they reach the end of the sentence.

Given the result that phonics instruction is more effective in training word reading than

text-processing" ability (i.e., being able to read text fluently and accurately), as shown by Ehri, Nunes, Stahl, and Willows (2001), it is of great importance to locate interventions that specifically address text-processing ability. Fluency instruction seems to be one of the instructional approaches that specifically address this issue.

One of the most common fluency instruction strategies is the use of repeated reading. Repeated reading requires students to repeatedly read a text until a satisfactory level of fluency is achieved (Samuels, 2002). In general, there are two forms of repeated reading, namely unassisted repeated reading and assisted repeated reading. In assisted repeated reading strategies, a model or partner is used to guide students (Dowhower, 1989). For example, the teacher (a live model) and the student read aloud a text simultaneously, or the student reads along with an audiotaped model (Therrien, 2004).

Other kinds of fluency-oriented interventions may also produce positive effects on reading fluency. Tan and Nicholson (1997) provided evidence that training at single-word, phrase and sentence level can promote text reading fluency as well as reading comprehension in low-progress readers. The researchers formed three matched groups (i.e., two treatment groups and one control) and selected 7-8 per cent target words (i.e., words in passages that were going to be read by students) for one- to-one flashcard training. The first training group read targeted words printed on flashcards whereas the second read phrases or sentences printed on flashcards. Training continued until students reached a predetermined reading rate or until the training time ended. The control group did not receive flashcard training but discussed the meaning of the words verbally. Results showed that although students in the two treatment groups did not differ in terms of reading speed or reading comprehension, both groups significantly outperformed the control group on these measures.

Burns, Dean, and Foley (2004) also examined the effects of single-word training. The researchers used a within-subjects design in which 20 learning-disabled students in third- and fourth-grade served as their own controls (i.e., all students received both the experimental condition and the control condition). The experimental condition required students to read keywords (i.e., words deemed to be important for passage reading) written on index cards prior to reading passages and answering questions. In the control condition, students read passages and answered questions but did not receive any keywords training. Results indicated that students' reading fluency and reading comprehension improved significantly in the experimental condition, further supporting the use of the single-word training strategy in promoting fluency and reading comprehension among low-progress readers.

Another aspect of fluency instruction is the use of text at the appropriate instructional level of the students. Kuhn and Stahl (2003) noted that researchers have not reached a consensus as to what level of text difficulty produces the most significant effect. Recently, O'Connor et al. (2002) examined the effect of text difficulty level on fluency using a pretest/post-test control group design.

O'Connor et al. (2002) identified 46 third-grade through fifth-grade students who had not achieved fluency on second-grade texts and randomly assigned them to one of two treatment groups or a control group. The content and instructional approaches in both of the treatment groups were the same except for the text used. Students who received the reading-level matched treatment (RLM) read materials at their instructional level whereas students who received the classroom matched treatment (CM) read materials at their grade level. Results indicated that the RLM group significantly outperformed the CM group and the control group on reading fluency when second-grade texts were used.

Based on the fluency scores at pretest, O'Connor et al. (2002) divided the participants in both groups into two subgroups, namely students with higher fluency and students with lower fluency. Results further supported the effectiveness of instructional level texts, as shown by the fact that students with lower fluency in the RLM group significantly outperformed those in the CM group on the second-grade fluency measure.

In summary, based on the review of meta-analyses and studies on decoding and fluency intervention above, certain conclusions can be made about decoding interventions for low-progress readers. First, decoding interventions that target low-progress readers should consist of both phonemic awareness instruction and phonics instruction (Ehri, Nunes, Stahl, and Willows, 2001; Ehri, Nunes, Willows, et al., 2001). Second, variables such as the number and type of phonemic awareness skills taught, the use of letters in phonemic awareness instruction, the length of instruction as well as instructional groupings should be considered (Ehri, Nunes, Willows, et al., 2001). Third, phonics instruction that is systematic with a structured cumulative curriculum appeared to be more effective for low-progress readers than unsystematic phonics instruction (Ehri, Nunes, Stahl, and Willows, 2001). As systematic phonics instruction was found to improve both word recognition and reading comprehension components, it should form the core of decoding intervention for low-progress readers. Fourth, in addition to phonemic awareness and phonics instruction, a strategy-based instruction, which teaches word recognition strategies in a structured and systematic manner, seemed to increase transfer and generalisation of reading among low-progress readers (Lovett et al., 2000). Fifth is the importance of fluency instruction in addition to decoding instruction for low-progress readers (Kuhn & Stahl, 2003). Research appears to suggest that reading fluency can be achieved through the strategy of repeated reading (Kuhn & Stahl, 2003; Therrien, 2004) as well as single-word training (Burns et

al., 2004; Tan & Nicholson, 1997), but the results remain equivocal as to what level of text difficulty produces the most significant effect (Kuhn & Stahl, 2003).

Given the promising results produced by phonemic awareness instruction, phonics instruction and fluency instruction, it is tempting to suggest that these approaches to reading are all that low-progress readers need. However, based on the simple view of reading, reading problems are not solely limited to decoding deficiencies (Hoover & Gough, 1990). Another source of reading problems are deficiencies in the other component of reading, which is linguistic comprehension.

Linguistic comprehension difficulties

Roberts and Scott (2006) argue that the broad-based language skills of semantics, syntax, morphosyntax, and world knowledge feed into linguistic comprehension. Semantic knowledge is concerned with the understanding of word meaning (receptive and expressive vocabulary). Syntactic knowledge refers to the understanding of how words are grouped to form phrases, clauses and sentences. Background knowledge, or world knowledge, refers to the understanding of how the world works (Wren et al., 2001). It is related to personal experience or the environment in which children live.

A search on research studies in linguistic comprehension revealed that most studies are not confined purely to children with reading disabilities, but were aimed at children with learning disabilities more generally. However, it would still be relevant to review studies on children with learning disabilities as past research has indicated that approximately 80 per cent of learning disabled children have, as their primary disability, difficulties in learning to read (Lyon, 1996).

Nation and Snowling (1998) provide evidence that students with comprehension difficulties have poorly established vocabulary knowledge in the presence of adequate

phonological and decoding skills. The rhyme task they employed required students to determine whether two spoken words rhymed (e.g., tape and cape are rhyming words, but tape and map are not) and to produce words that rhymed with a targeted word within 60 seconds. The synonym task required students to determine whether two words were synonymous and to produce words that belonged to a category name within 60 seconds. Results indicated that students with poor comprehension performed significantly worse than students with good comprehension on synonym tasks tapping their vocabulary knowledge, but they performed similarly to students with good comprehension on rhyme tasks tapping their phonological skills.

On the basis of students' discrepancy in oral reading fluency on English and science passages, Espin and Deno (1993) identified two groups of low-progress readers. Students were classified as having content-specific problems if they had significantly higher percentile scores in English than in science. Alternatively, students were classified as having general reading problems if they obtained low percentile scores in both English and science. A small percentage of students were identified as having problems specifically related to science vocabulary. The results that students with content-specific problems performed significantly better on English vocabulary tasks than on science vocabulary tasks, while students with general reading problems performed poorly on both English and science vocabulary tasks supported the hypothesis that content-specific problems were related to a lack of background knowledge in science.

Students who are lacking background knowledge/vocabulary knowledge may encounter reading comprehension problems, as indicated by the research reviewed above. Inappropriate use of background knowledge, however, may also pose a challenge to students with reading problems, as suggested by two studies conducted by Williams (1991, 1993).

In the first study (Williams, 1991), learning-disabled students and typically developing

students were asked to read and retell short stories and to answer comprehension questions. It was found that learning-disabled students tended to introduce irrelevant information (material that reflected the students' personal points of view) during their retellings of the stories and answering of the questions. This result was replicated in the later study (Williams, 1993) and it was also found that students who produced irrelevant material were less likely to be able to identify themes in the story.

In order to examine the importance of syntactic ability, Penning and Raphael (1991) administered free recall comprehension tests and probed recall comprehension tests to 30 learning-disabled readers and 30 good readers who were matched for sex, race and decoding abilities. For free recall tests, students were asked to orally recall the passage they had read without any prompting from the experimenters. For probed recall tests, students were provided with prompts in the form of questions. Results indicated that syntactic ability, the ability to recall complex sentences from the passage and to use complex sentences in their retellings, was a strong predictor of reading comprehension among good readers. It accounted for 54 per cent and 64 per cent of the variance in free and probed recall responses respectively. However, syntactic ability did not contribute to reading comprehension among learning-disabled readers. Their results support the important role of syntactic ability in text comprehension and the researchers recommended that syntactic ability should be assessed and be considered a potential source of comprehension difficulties for learning-disabled readers.

Nation and Snowling (2000) also examined differences in syntactic ability between good readers and low- progress readers. They matched 15 students with poor comprehension to 15 students with good comprehension according to decoding skills, non-verbal ability, and age. They constructed active sentences and passive sentences with incorrect word order and read each

incorrect sentence to the students. The students were required (orally) to put the sentences into the correct order. Results showed that both groups performed significantly better on active sentences than on passive sentences, but good readers significantly outperformed poor readers on both active and passive sentences. The result suggested that although syntactic complexity posed a challenge for poor comprehenders as well as good comprehenders, the latter seemed to be more sensitive to sentence complexity than the former.

Low-progress readers may be able to read words/ passages accurately and fluently but still be having problems with reading comprehension. These problems may be related to deficiencies in linguistic comprehension. As suggested by the research reviewed above, low-progress readers seem to have deficiencies in vocabulary knowledge, syntactic skills (e.g., they are less able to manipulate complex sentences) and background knowledge (e.g., they are less able to activate their background knowledge in an appropriate manner). The remainder of this paper is devoted to a review of intervention studies that have specifically addressed each component of linguistic comprehension.

Linguistic comprehension interventions

This section reviews interventions on subskills that are deficient among poor comprehenders. As was discussed in the above section, these are skills in vocabulary, syntax and background knowledge.

Teaching vocabulary knowledge

Students may learn word meanings when they are involved in independent reading or through direct instruction (Carnine et al., 2004). This section will specifically examine how word meanings might best be taught. In a review of vocabulary instruction for students with learning disabilities at the secondary level, Bryant, Goodwin, Bryant and Higgins (2003) concluded that

vocabulary interventions that included computer- assisted methods, mnemonic approaches and semantic mapping/feature analysis approaches were more effective than traditional methods that focused on teaching students how to use a dictionary and derive meanings from contexts, and methods that only included explicit teaching.

In another review of vocabulary instruction for primary and secondary students with learning disabilities, Jitendra, Edwards, Sacks, and Jacobson (2004) commented that many studies did not evaluate the effects of vocabulary instruction on comprehension, and that therefore it remains unclear whether the vocabulary knowledge that students learned would transfer to comprehension. It is also important to note that vocabulary interventions may be superior to traditional methods in teaching word meanings, but the strong gains made may not transfer (or generalise) to comprehension of passages containing the taught words, as shown by a study conducted by Xin and Rieth (2001). Xin and Rieth speculated as to why acquired vocabulary knowledge did not promote significant gains in reading comprehension. The reasons for this could be classified as those related to learner variables (e.g., deficits in word recognition and other components of linguistic comprehension that might have confounded the results) and those related to instructional variables.

It is important for teachers to know the instructional variables that produce strong gains in reading comprehension. Drawing on the results of a meta- analysis conducted by Stahl and Fairbanks (1986), Stahl (1986) concluded that three instructional variables seem to be effective in promoting comprehension: (a) the opportunity to learn the definition of a word and to use a word in context such as in sentences; (b) the opportunity to construct relationships between words and to spend more mental effort on learning the meaning of a word, and (c) the opportunity to learn the meaning of a word repeatedly and through different contexts.

The vocabulary intervention study conducted by Mastropieri, Scruggs, and Fulk (1990) is one of the few studies that assessed comprehension gains made by students with learning disabilities. In this post-test only control group design, the researchers stratified participants by grade level and randomly assigned them to one of two conditions, the mnemonic/keyword condition and the rehearsal condition. In the keyword condition, the researchers created an interactive picture in which the meaning of a target word was related to a keyword. The researchers described the keyword and the picture for each vocabulary word. Students were then prompted to define the meaning of each vocabulary word and to describe the interactive picture. In the rehearsal condition, students were taught the same vocabulary word through drill and practice (i.e., orally repeated the meaning of a target word that was orally read to them, with opportunities to pronounce the word and to receive feedback). Results indicated that the keyword method was more effective in promoting definition recall and comprehension.

Activating students' background knowledge

Carr and Thompson (1996) provide evidence that the use of background knowledge activation strategies facilitates reading comprehension among students with learning disabilities at the secondary level. Students with learning disabilities were compared to two groups of students without learning disabilities (one was selected to match the chronological age and the other the reading level of the learning-disabled group). All three groups were pretested on decoding skills and background knowledge. Background knowledge in this study was defined as prior knowledge related to the study's 16 reading passage measures. A multiple-choice test was used to confirm empirically the extent of students' prior knowledge of the 16 topics. All three groups were found to be reasonably homogenous in terms of decoding skills and similar in terms of levels of background knowledge. Two experimental conditions (i.e., Experiment 1 and

Experiment 2) were conducted in which each student was expected to read passages, orally recall the story and answer comprehension questions. The difference between the experimental conditions was that in Experiment 2, the examiners helped the students activate their background knowledge using a two-step procedure: (a) asking students questions to elicit what they knew about the topic, and (b) repeating the response to the students to help them remember what they had said. Results indicated that the three groups all significantly benefited from the background knowledge activation strategy (i.e., their performance in Experiment 2 was significantly better than that in Experiment 1) when passages were unfamiliar.

Teaching semantic and syntactic knowledge

Using an alternating treatment design, Gillon and Dodd (1995) examined the effects of phonemic awareness instruction and semantic-syntactic knowledge instruction on reading accuracy and reading comprehension in 10 students with reading disability. Students were randomly divided into two groups. Pre-intervention assessment showed that the two groups did not differ in phonemic awareness, reading accuracy or reading comprehension. The researchers conducted training programs in two phases. Group 1 received phonemic awareness training in Phase 1 followed by semantic-syntactic training in Phase 2. Group 2 received the training in the reverse order. There were two components to the semantic- syntactic training. In the first component, the researchers taught students to manipulate complex sentences using worksheet activities. In the second component, students selected a theme of interest, generated words that were related to the theme using a brainstorming strategy, and constructed sentences using the words. Results showed that the semantic-syntactic training improved semantic- syntactic processing skills whereas phonemic awareness training did not. The semantic-syntactic training and phonemic awareness training was equally effective in promoting transfer to reading

comprehension.

In summary, research has clearly indicated that various kinds of vocabulary interventions can be used to teach word meanings to low-progress readers (Bryant et al., 2003; Jitendra et al., 2004). However, it is still unclear whether strong gains made in vocabulary knowledge readily transfer to reading comprehension because many studies did not measure reading comprehension (Jitendra et al., 2004). There seems to be three instructional variables of vocabulary intervention that produce strong gains in reading comprehension, as suggested by Stahl (1986). Research into the intervention targeted on syntactic skills and background knowledge is very limited. The available literature suggests that background knowledge activation strategies, and teaching of complex sentences can benefit low-progress readers.

Concluding comments

The traditional IQ-reading achievement discrepancy model identifies two groups of low-progress readers: those who exhibit a discrepancy between IQ and reading achievement and those who do not (Catts et al., 2003). Use of such a model offers no recommendations for appropriate reading interventions (Aaron, 1991). Alternatively, the simple view of reading, which proposes that reading disability is related to deficits in either decoding, linguistic comprehension, or both, is useful in informing teachers about specific areas of reading problems and hence the more appropriate instructional approaches (Aaron et al., 1999; Catts et al., 2003). Teachers who are concerned with constructing the most effective programs for their students need to know whether their students have difficulties in decoding, linguistic comprehension, or both.

If students are less able to read words/texts accurately and fluently, teachers need to implement decoding interventions. The decoding intervention may entail phonemic awareness

instruction, phonics instruction and fluency instruction. If students appear to be able to decode words in isolation accurately and automatically, but are less able to read text fluently, teachers may need to focus on fluency instruction.

Research has clearly shown that reading disability is not restricted to decoding difficulties (e.g., Aaron et al., 1999; Catts et al., 2003). Therefore, the implementation of decoding interventions alone might not be adequate to meet the needs of all students with reading disability. If students have adequate decoding skills but are still having problems in reading comprehension, the teacher may need to focus on strengthening linguistic comprehension skills (Catts et al., 2003). Similarly, teachers may discover that their students are weak in both decoding and linguistic comprehension. Therefore, linguistic comprehension interventions have to be considered apart from decoding interventions. Solely concentrating on teaching phonics and phonemic awareness may not be sufficient for this type of student.

Research has provided evidence that low-progress readers can benefit from interventions that target decoding skills and each component of linguistic comprehension. With regard to decoding interventions, research has clearly indicated that phonemic awareness instruction, phonics instruction and fluency instruction all benefit low-progress readers in terms of decoding skills and/or reading comprehension (Ehri et al., 2001; Ehri, Nunes, Willows, et al., 2001; Kuhn & Stahl, 2003; Therrien, 2004). In implementing decoding interventions, one of the difficulties that teachers may encounter is selection of appropriate text. At present, if the issue of text selection in relation to low-progress readers is of concern, teachers may follow the guidance offered by Hiebert (1999). Hiebert has suggested that texts should be selected based on several key features. First, teachers should select texts which are highly decodable, so that students have opportunities to apply their phonics skills. Second, teachers should select texts containing many

of the most frequently used words, so that students have opportunities to build up a bank of most frequently used words. Finally, teachers should select texts which offer readers contextual supports.

Similarly, teachers may be faced with difficulty in selecting appropriate texts to promote fluency. Although O'Connor et al. (2002) have provided evidence that text at instructional level works best for reading fluency, Kuhn & Stahl (2003) have argued that the results remain equivocal. This is another area that needs further research attention. At present, it seems that teachers need to monitor the progress of their students frequently and systematically in order to determine the relative efficacy of different level of text difficulty.

Compared to decoding interventions, interventions focusing on different areas of linguistic comprehension (especially background knowledge and syntactic skills) seem to receive less research attention. In their review of vocabulary instruction, Bryant et al. (2003) and Jitendra et al. (2004) concluded that vocabulary interventions could be used to teach word meanings to low-progress readers. However, it is still unclear whether vocabulary knowledge has a positive impact on reading comprehension (Jitendra et al, 2004). Similarly, although research has shown that background knowledge activation strategies and teaching of syntactic skills can be used effectively with students (e.g., Carr & Thompson, 1996; Gillon & Dodd, 1995), it remains unclear as to how many options are available and how best to teach low-progress readers. It is possible that teachers do not need to focus their attention on activating background knowledge and teaching syntactic skills. Instead, teachers can teach general reading comprehension strategies such as questioning strategies and summarising strategies.

These strategies may indirectly overcome the problems related to background knowledge and syntactic skills. Finally, as we have emphasised, reading disability may result from poor

performance in either decoding or linguistic comprehension, or both. Both components are equally important to reading comprehension. Wheldall and Beaman (2000) have spelled out the importance of these two components as follows:

There is little point being able to decode, even to decode fluently, if you are unable to understand the words and sentences you are decoding. Clearly, if your decoding skills are poorly developed, so that neither your personal corpus of sight words nor your phonic word attack skills allow you to decode all or almost all of the words in the text you are trying to read, there is little chance of being able to understand it. But being able simply to decode every word in the text is no guarantee of being able to understand the meaning of the text either, (p. 192)

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