Developing accuracy and fluency in word reading skills

Toni Seiler and **Suze Leitão** tackle the development of efficient word recognition – an essential skill underlying reading fluency. They outline the theoretical basis for a research program that has involved developing and evaluating a practical strategy for providing students with extended practice in decoding words, helping students to progress from 'L Plates' and 'P Plates' in word recognition, through to achieving 'D Plates', with driver status. The driving lessons described in the research come with a free web-based app.

In this paper, we talk about a key requirement for reading comprehension: accurate, fluent word reading. We draw on theory and research evidence that underpins the science of reading, highlight critical components of early reading instruction that promote accurate decoding and fluent word reading, and discuss our programme of research that has investigated this area. We conclude with some important take-home messages and links to the free web-based app developed for our research, that has been shown in our preliminary investigations to strengthen decoding and word reading skills.

Models of reading

A widely regarded view of reading comprehension (the aim of skilled reading) is that it depends on two sets of linguistic skills: accurate word reading and listening comprehension (the oral language skill of understanding the meaning of words and sentences we hear). This model, the Simple View of Reading (Gough & Tunmer, 1986) is well-supported (e.g., Lervåg, Hulme, & Melby-Lervåg, 2018). It suggests that compromised reading comprehension is likely to occur if a person can accurately read words but has reduced listening comprehension, or, has adequate listening comprehension but is unable to read the words. The ability to accurately read words is usually indicated by reading fluency, i.e., reading at an appropriate rate and with expression (Hasbrouck & Glaser, 2018). Accurate and fluent word reading is essential for skilled reading throughout the lifespan (García & Cain, 2014; Sparks, Patton, & Murdoch, 2014) but is impaired in most people with reading difficulty (Catts, Hogan, & Fey, 2003; Torppa et al., 2007). To effectively teach children in the early stages of reading, we need to understand what is involved in fluent word reading.

The development of automatic fluent word reading is a gradual process.

Skilled readers flip effortlessly between two ways of reading words: they either automatically recognise the word or they use grapheme-phoneme (letter-sound) knowledge to sound out and blend to decipher a new or

unknown word - in other words, they decode the word. This view of the reading process is referred to as the dual route model, reflecting the two pathways (Coltheart, 2006). Skilled readers eventually acquire a large bank of words that are instantly recognised, and can be spontaneously read (existing orthographic representations), pronounced (phonological representations), and understood (semantic representations).

The development of automatic fluent word reading is a gradual process. Ehri's Phase Theory (Ehri, 2005) describes how children progress from an initial reliance on sounding words out and using decoding, to automatically recognising a greater number of words. This occurs as a connection-forming process – using knowledge of the sounds in words (phoneme awareness), the decoding process (sounding out and blending), and existing oral language to form connections which link written words to their pronunciations and meanings. Four phases are described. Initially a few words are recognised within context, (e.g., 'EXIT' on an exit sign). This is followed by emerging grapheme-phoneme knowledge often with inaccurate decoding, to full mastery of most grapheme-phoneme correspondences allowing decoding of unfamiliar words. Finally, knowledge of grapheme-phoneme connections expands to include larger units (e.g., rimes, syllables, morphemes, and whole words), allowing accurate decoding

of multi-syllabic words, development of an increased bank of orthographic representations of known words, and wider knowledge of English orthography. For example, some words have different pronunciations and meanings (e.g., wind – "wind up the fishing line", and "the wind blows"); others need to be specifically learned (e.g., yacht). While Ehri's theory describes developmental phases in word reading and allows identification of the level of breakdown for a struggling reader, it does not inform teachers about effective strategies for instruction and intervention - that is, how to answer questions such as, "How do I foster fluent word reading?" and "What is the best prompt to use if a child is unable to read/remember a previously taught word?"

A possible explanation to support the development of fluent word reading is phonological recoding theory (Share, 1995). Phonological recoding takes

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place when a child sounds out and blends the sounds (decodes) to read the word. This acts as a self-teaching mechanism which allows the child to pay attention to the internal structure of the word to generate its pronunciation, and in this way, make links between the written orthographic and the sound-based phonological representations. The role of phonological recoding in the development of fluent word reading has been examined by many independent research groups in different populations. In these studies, the child is usually asked to read a story containing an unfamiliar word – a nonword or a very rare word is often used, as this ensures that the decoding pathway is used. The child is then presented with tasks to assess whether they can automatically read or spell the word (to check whether orthographic learning has occurred). The results have shown that, in the early stages of reading development, typically developing children:

- Easily learn novel words after six presentations (Cunningham, Perry, Stanovich, & Share, 2002).
- Are affected by dose rate: eight presentations were better than four (Bowey & Muller, 2005).
- Have reduced word learning if they are prevented from using decoding by being asked to say repetitive syllables ("la la la") as they read the words (Kyte & Johnson, 2006).
- Learn words more efficiently when the words are presented in isolation, and corrective feedback is provided (Martin-Chang, Ouellette, & Bond, 2017). (Though a child may have correctly read a word within a story context, retention of the word is stronger when the word is read in isolation.)

The findings of these studies highlight the importance of 'dosage' (multiple presentations may be necessary), the importance of accurate decoding to optimise the learning of the orthographic representations, and that words should be presented both in text and in isolation, since "when children read words in isolation, they seemed to lay down more detailed and precise representations" (Martin-Chang et al., 2017, p. 26).

Phonological recoding has also been shown to boost vocabulary development. In addition to showing written words with a matching picture, a recent study has shown that children

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who also verbally decoded the word learned the meanings better than those who didn't decode (Chambrè, Ehri, & Ness, 2020). These findings underscore "the importance of teaching beginning readers … to decode words … Not only is this knowledge important for developing students' ability to read words automatically by sight but also for building their vocabularies" (Chambrè et al., 2020, p. 1158). This is consistent with models of word learning which highlight the importance of building links in the lexicon (Leitão, 2003).

This body of research highlights firstly, the importance of teaching accurate and fluent word reading in the early phases of reading instruction, and secondly, that while other cues (e.g., story context and pictures cues) may sometimes result in accurate word reading, the most efficient method of developing fluent word reading is to reinforce accurate decoding.

How do theoretical models inform approaches to early reading instruction?

A number of large scale international investigations (National Centre for Family Literacy, 2008; National Reading Panel, 2000) have shown that the most effective teaching approach in early reading instruction includes a focus on phonemic awareness and grapheme-phoneme knowledge combined with decoding. Hudson, Torgesen, Lane, and Turner (2012) investigated the sub-skills involved in fluent reading and, consistent with Ehri's phase model, they identified the important role of phonemic blending. They concluded that "teachers need to ensure their young students become automatic in oral blending of sounds, individual letter sounds, and larger letter patterns" (Hudson et al., 2012, p. 501).

The systematic synthetic phonic (SSP) approach to early word reading instruction incorporates these well-supported principles, combining instruction in both phonemic awareness and decoding. SSP explicitly teaches grapheme-phoneme relationships, and encourages use of this knowledge to break words into sounds for spelling, and sound out and blend (synthesise the sounds) to read words. It starts with frequently occurring grapheme-phoneme relationships and progresses to less frequent ones (e.g., s-a-t, sh-ar-p, b-r-igh-t), and uses decodable texts to develop accurate text reading fluency. SSP was recommended following large scale international reviews of early literacy teaching (e.g., Rose, 2006), and the effect of its progressive roll-out across England was recently evaluated comparing reading outcomes of schools that had started using synthetic phonics with those that had not (Machin, McNally, & Viarengo, 2018). The results showed strong effects of synthetic phonics on early literacy acquisition, with persisting positive effects for struggling readers at age 11. Closer to home, an Australian study (Louden, 2015) which explored the characteristics of high performing Western Australian schools, found that, as well as strong leadership and well-developed school improvement plans, SSP in the early school years was a key feature.

What about those who struggle to master accurate and fluent word reading?

While most children master accurate and fluent word reading without specific additional teaching, a sizable proportion (nearly 40% of Australian students), do not achieve adequate literacy proficiency (Thomson, De Bortoli, & Underwood, 2016). Reading difficulties are often evident from an early age. As educators, we are faced with the challenge of assisting children who take longer to master grapheme-phoneme knowledge, and longer still to develop fluent word reading. While some authors have suggested that a focus on decoding actually slows progress and results in children "barking at print" (Rushton, Ewing, & Diamond, 2018), other carefully controlled research does not support this suggestion, and has identified underlying factors that cause this slow progress in word reading development.

Of significance, children with word reading difficulties have been shown to have weaknesses in underlying skills such as phonological processing (Snowling & Hulme, 2012). They have problems segmenting words into sounds and blending sounds to form words - the essential skills for mastery of fluent word reading. Other research has shown that these children eventually master accurate decoding, but they take longer and require more repetition to develop orthographic representations (Apel, Thomas-Tate, Wilson-Fowler, & Brimo, 2012).

A specific focus on accurate decoding to support orthographic learning has been shown to be an important element within interventions for children with word reading difficulties. Pullen and Lane (2014) found the word decoding task to be the essential component of their multi-component intervention. Biname, Danzio, and Poncelet (2015) examined orthographic learning for children with dyslexia – a decoding difficulty in which children have difficulty mastering relationships between the spelling patterns of words and their pronunciations (Snowling & Hulme, 2012). In their study, novel words were taught with a focus on accurate decoding and spelling (to optimise formation of orthographic representations). Compared to two other groups (one matched for chronological age and one for reading age), the children with dyslexia required more repetitions to develop orthographic representations; they had reduced retention one week later; and initial decoding inaccuracy was shown to reduce orthographic learning. This body of research again highlights the importance of initial decoding accuracy, and suggests that increased intensity and repetition over a longer period ('overtraining') may improve long-term retention.

The intervention developed and designed for our work, 'WordDriver,' is a web app which … randomly presents items (words and nonwords) in isolation and encourages extensive decoding practice at different levels of difficulty.

Figure 1: Screen capture WordDriver-2

Our programme of research

We drew on theory and research to develop and carry out a series of small-scale efficacy studies to evaluate an intervention which specifically targeted accurate decoding to support orthographic learning for children with persistent word reading difficulties. The intervention developed and designed for our work, 'WordDriver', is a web app which uses many of the evidence-based features previously discussed: it randomly presents items (words and nonwords) in isolation and encourages extensive decoding practice at different levels of difficulty. It is also delivered in an individual situation allowing the instructor to provide corrective feedback and reinforce the meaning of words, thus supporting the development of connections between orthographic, phonological, and semantic representations of words, building the links in the lexicon.

WordDriver has two stages: WordDriver-1 provides training in the decoding process by presenting items with 1:1 letter-sound correspondence (starting at 2- and progressing to 6-letter items), while WordDriver-2 expands orthographic knowledge by delivering items with consonant and vowel digraphs. The app displays graphics on the screen that use an analogy of learning to drive a car (see Figure 1). In each module, the learner progresses from an L-Plate (learning), to a P-Plate (practising), and then a D-Plate (driver), each presenting a wide range of target items. For instance, in the 4-letter word D-Plate in WordDriver-1, decoding targets are drawn from a pool of 468 items (234 words, each with a nonword matched for orthographic similarity, e.g., flat – clat).

We used single case experimental research designs to study the efficacy of this intervention approach with children who had previously received some form of extra literacy support but made limited or no progress. Each participant received 15 x 15-minute intervention sessions. In the study examining WordDriver-1 (Seiler, Leitão, & Blosfelds, 2018), irrespective of pre-intervention cognitive, oral language, and phonological profiles, all eight participants (aged 7 – 8 years) made significant gains in decoding accuracy: standard scores on nonword reading measures improved from moderate/severe impairment into the normal range on the targeted areas (words with 1:1

grapheme-phoneme correspondence). Though there were trends for gains in word reading, we concluded that participant delays in orthographic knowledge for vowel digraphs limited their progress. The second study, investigating WordDriver-1 followed by WordDriver-2 (Seiler & Leitão, in preparation), was delivered via teletherapy. It confirmed the previous results for WordDriver-1, and suggested that this approach effectively expanded orthographic knowledge for vowel digraphs. All five participants (aged 7 – 10 years) made significant gains (measured by researcher-developed nonword assessments) on two treated digraphs compared to an untreated vowel digraph.

While further validation of this tool is required, these results suggest that use of WordDriver resulted in improved decoding which would support further orthographic learning. It was concluded that this specifically targeted intervention may be an efficient component within the multi-component approaches that are necessary for this population.

Implications for classroom teaching

Some key take-home messages from this review of the research evidence on the development of word reading skills and the description of our intervention using WordDriver are that:

- Fluent word reading is an essential component of skilled reading.
- Accurate decoding helps in the development of clear orthographic representations of words.
- Students with persistent word reading difficulties take longer to develop decoding and fluent word reading, but intensive practice and more repetitions make a difference.

We would like to add a comment about an area that was not addressed directly in this article, but that is important in the context in which this research evidence is presented. It relates to the use of decodable readers in the early years of learning to read, as opposed to the provision of 'levelled readers' that are initially read predominantly by looking at the pictures and guessing from context. If young students are expected to read books that they cannot decode themselves, they may develop a disconnect between what they see as 'reading' and the practice of decoding. The disconnect may be particularly pronounced for children who do not find decoding easy. If on the other hand, their reading practice with decodable readers involves successful decoding experiences, the opportunities for self-teaching (Share, 1985) are enhanced, even for slower-progress readers.

To conclude, our ongoing research is encouraging in terms of demonstrating the efficacy of an approach to develop word recognition skills. When used within a comprehensive intervention program, our WordDriver software may be beneficial for students who have not responded well to earlier remedial approaches. The WordDriver app is freely available for teachers and researchers, and we are happy to provide support: languageandliteracyinyoungpeople.com and worddriver.com.

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