Why We Need a New Approach to Reading Assessment and Intervention

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1. Introduction

"Those who succeed in becoming fluent, strategic, and joyful readers are not guaranteed success in school or in life, but they are well on their way. However, those who do not succeed in reading, or who become reluctant readers, face long odds in achieving success in school and life" (Slavin, Lake, Chambers, Cheung, & Davis, 2009, p. 1391).

Tragically, huge numbers of American students fall short of achieving reading success, limiting their potential. Too many students are missing the essential reading abilities they need for academic and career success. A better approach is needed to help these students learn to read.

According to the 2019 National Assessment of Educational Progress (NAEP), the percentage of fourth graders reading proficiently was 34 percent nationally and eighth graders were at 32 percent. Troublingly, research suggests that approximately half of struggling readers have deficits in foundational reading skills, which should have been mastered in elementary school (Cirino et al., 2013; Hock et al., 2009). By middle school, many of these students have minimal access to specialists who know how to train their missing foundational skills, and they are rapidly running out of time to catch up to grade-level expectations. Without an approach that remediates their reading deficits, these students face a major uphill battle to succeed.

Reading deficits disproportionately affect students of color and those from less advantaged backgrounds. Only 15% of black eighth graders and 22% of Hispanic eighth graders showed reading proficiency, compared to 42% of white students.

Longitudinal studies show that students who lag behind their peers in reading at early grades show comparable (Shaywitz et al., 1995) or exacerbated (Cain & Oakhill, 2011) deficits in reading at later grades, and these deficits often lead to downstream difficulty with higher level academic skills (Duff, Tomblin, & Catts, 2015).

Only 20% of students who qualify for the National School Lunch Program were proficient readers, and English learners were also challenged as only 4% of these students in the eighth-grade NAEP reading sample demonstrated reading proficiency. And it's not just under-resourced students who can't read. Only 44% of eighth graders whose parents have college degrees demonstrated reading proficiency.

Practitioners thus face parallel challenges: identify struggling readers early to quickly improve foundational skills, and develop ways to remediate skills of students who reach middle school without adequate reading skills.

2. The need to focus on decoding and automatic word recognition

The National Reading Panel identified five critical areas for effective early reading instruction: phonemic awareness, phonics, fluency, vocabulary and comprehension (National Reading Panel, 2000). These same areas were emphasized by the US Department of Education in their 2009 Practice Guide (Gersten, 2009). Although these are discussed as independent pillars for reading ability, there is substantial interdependence between these skills.

However, struggling readers with missing foundational skills will not be able to develop as readers for comprehension. Shankweiler and colleagues noted that decoding abilities were extremely predictive of reading comprehension, with decoding accounting for substantially more variance in comprehension than even spoken language comprehension (Shankweiler et al., 1999).

"Decoding abilities are extremely predicative of reading comprehension" - Shankweiler et al

The role of decoding in comprehension

These findings suggest that decoding intervention may be critical to achieving effective comprehension. A randomized control study of students aged 7 to 10 showed that an intervention focusing on decoding skills also boosted reading comprehension scores (McCandliss, Beck, Sandak, & Perfetti, 2003; see Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998 for similar results). This study identified students with decoding deficits, and provided a subset with 20 sessions of targeted decoding training.

The students in the training group showed substantial gains between pretest and posttest, while those in the untrained group showed a slight decline from pretest to posttest. Foundational decoding skills in this study had a clear benefit for high-level reading comprehension ability.

Decoding on its own is insufficient to create an effective reader. Reading text for comprehension demands that the reader understand the content of the text, particularly as texts become more complex. Transitioning to more complex reading requires that students are competent at automatic word recognition. The need to read for content in middle school and high school is predicated on students' ability to extract new knowledge from texts, and to integrate this knowledge into discipline-specific understanding.

Automatic word recognition and fluency

Effective readers go beyond decoding skills to automatically and effortlessly recognize words which increases reading comprehension (Oslund et al., 2018). Reading without automatic word recognition is akin to doing arithmetic by counting on one's fingers. A fluent reader needs to be able to read without focusing effort on each specific sound-letter pairing. This concept of the deployment of decoding knowledge is often thought of as the natural end-state of learning to decode. However, recent research has shown automatic word recognition to be a unique and reliable predictor of word reading fluency for middle school readers, over and above decoding skill (Roembke, Hazeltine, Reed, & McMurray, 2019).

This study showed that automatic word recognition is not simply high-level decoding skill. Decoding, on its own, is insufficient to elicit skilled fluent reading. The study assessed the degree to which traditional decoding measures can predict fluency outcomes and found that automatic word recognition is indeed a separate, measurable component of fluency. Although fluent reading and strong reading comprehension require more than decoding and automatic word recognition, they are impossible without these foundational reading skills.

Unfortunately, many of the middle school students struggling to read have little opportunity to receive support for deficits in foundational skills. Middle school educators are rarely trained to identify and teach basic decoding abilities, as these abilities are typically taught in elementary school. Many struggling middle school readers receive interventions that focus predominantly on comprehension – decoding is rarely directly measured, much less targeted for intervention. Within approaches that emphasize decoding, few specifically target automatic word recognition as a specific extension of decoding.

Effective readers must be able to recognize words automatically and effortlessly, freeing cognitive resources for use in reading comprehension. The most fluent readers are those who know how to apply the decoding rules, and who have considerable skill deploying this knowledge automatically.

Over the past several decades, significant effort has revolved around explicit and direct instruction of phonics. This approach has had clear benefits for many teachers and students and it is broadly acknowledged that it delivers better results than less systematic instruction.

However, recent reading research suggests that the narrative surrounding reading pedagogy needs to incorporate findings from the science of learning that go beyond explicit instruction.

Hoover and Tunmer, (2020) state "Much, if not most, of what children learning to read in English come to know about its orthographic-phonological relationships is acquired through implicit learning, especially knowledge of context-sensitive correspondences that depend on position-specific constraints or the presence of other letters (Bryant, 2002; Tunmer & Nicholson, 2011; Venezky, 1999).

The focus must shift to identify the processes underlying this implicit learning and to incorporate systematic and explicit curricula that will provide the experiences and support for all students to learn to fluently read for comprehension. The pivot has already begun.

Although fluent reading and strong reading comprehension require more than decoding and automatic word recognition, they are impossible without these foundational reading skills.

3. A systematic, approach to implicit learning and automaticity in word recognition

Automatic word recognition refers to the ability to read a word without relying on effortful decoding. This seemingly effortless ability to recognize words is a hallmark of skilled reading – effective readers can process large quantities of text quickly, with little conscious processing of letter-to-sound mappings.

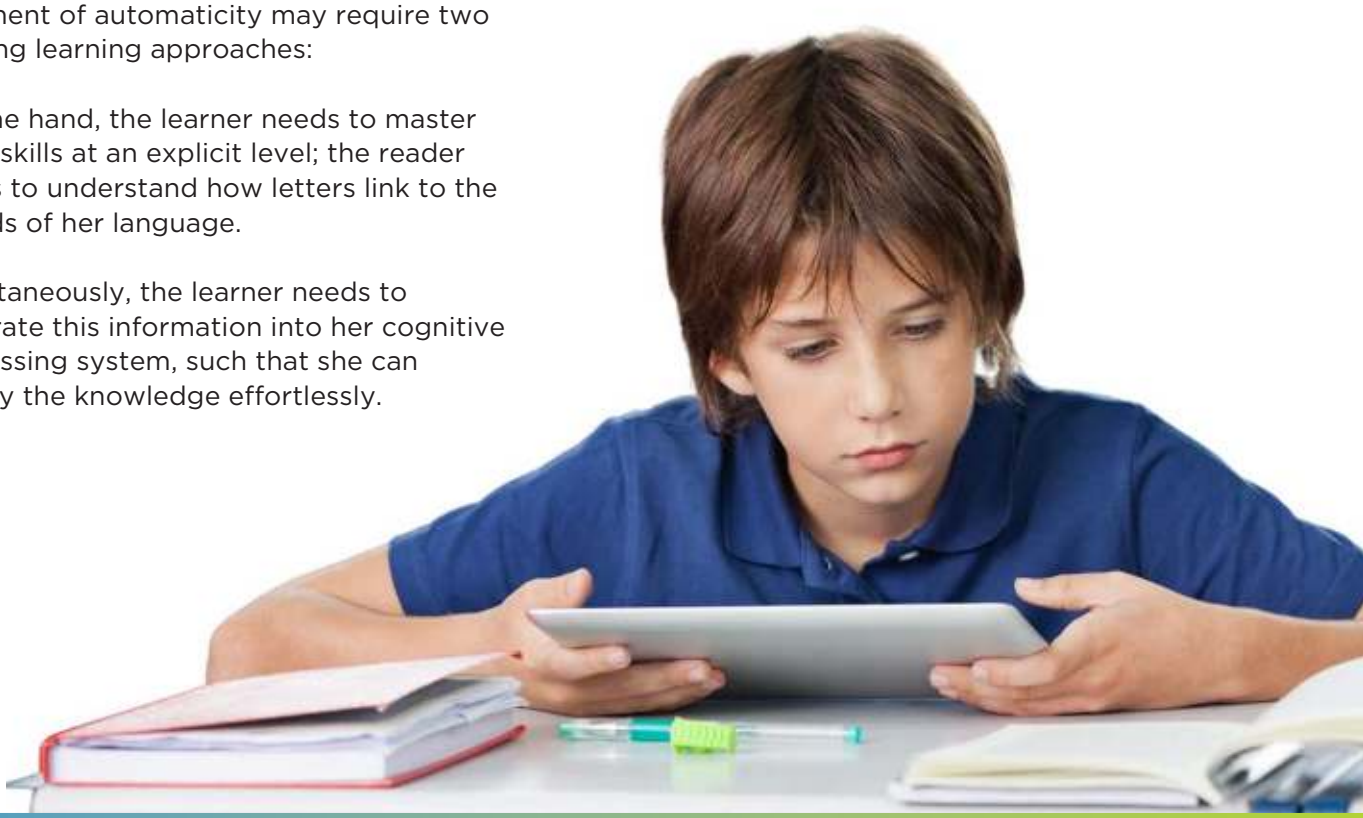
The development of automaticity has been most thoroughly studied in motor learning (e.g., Romito, Krasne, Kellman, & Dhillon, 2016; Wulf, Shea, & Lewthwaite, 2010; Wulf & Su, 2007). Many motor domains require the learner to produce motor actions without explicit thought. Complex motor skills that encompass multiple basic skills require a series of actions that need to be coordinated to produce fluent outcomes. As such, substantial research on motor skill development has emphasized how to train implicit, automatic skill use.

Research findings suggest that the development of automaticity may require two contrasting learning approaches:

- On one hand, the learner needs to master basic skills at an explicit level; the reader needs to understand how letters link to the sounds of her language.
- Simultaneously, the learner needs to integrate this information into her cognitive processing system, such that she can deploy the knowledge effortlessly.

Research on motor, perceptual and cognitive learning suggests that these parallel tracks or stages (explicit and procedural learning), may benefit from different forms of training (Wulf & Shea, 2002; Brown, et al, 2012; and Ashby and Maddox, 2011). Neuroscience and neuroimaging research also support the existence and impact of these contrasting systems (Ashby and Maddox, 2011).

An approach to training these parallel tracks comes from research on perceptual learning. Perceptual learning refers to a learner's ability to extract statistical regularities in patterns of input, typically through implicit means; this implicit awareness of regularities is precisely the type of learning needed to use knowledge quickly and automatically in diverse settings.



Explicit learning is often highly effective for recognizing simple patterns, where a single feature distinguishes categories. However, more complex patterns are better learned implicitly (Ashby & Maddox, 2005). In some cases, learning is improved when explicit learning is prevented. Forcing learners to rely on implicit learning rather than explicit learning helps them acquire information that is readily deployed.

In their work with perceptual learning in mathematics, Kellman and colleagues distinguish initial recognition, when the learner is first acquiring knowledge, fluency, when the learner is becoming automatic at using this knowledge (Kellman, et al, 2010).

These stages are evidenced in reading. Initially, students develop knowledge of mapping letters to sounds, followed by fluency of using this knowledge automatically in connected text.

The most accomplished students are those who have completed both stages: they both know the material and are skilled at using it.

These studies have clear parallels in the reading domain. Reading benefits from explicit training of decoding knowledge (Ehri, Nunes, Stahl, & Willows, 2001), yet it also has highly complex patterns that are often hard to verbalize (Plaut et al., 1996).

Learners need to understand how letters map to sounds, but they also need to deploy this knowledge automatically to apply the knowledge to diverse words in connected text. As suggested by the research from motor learning and perceptual learning, building this automaticity requires engaging implicit learning systems.

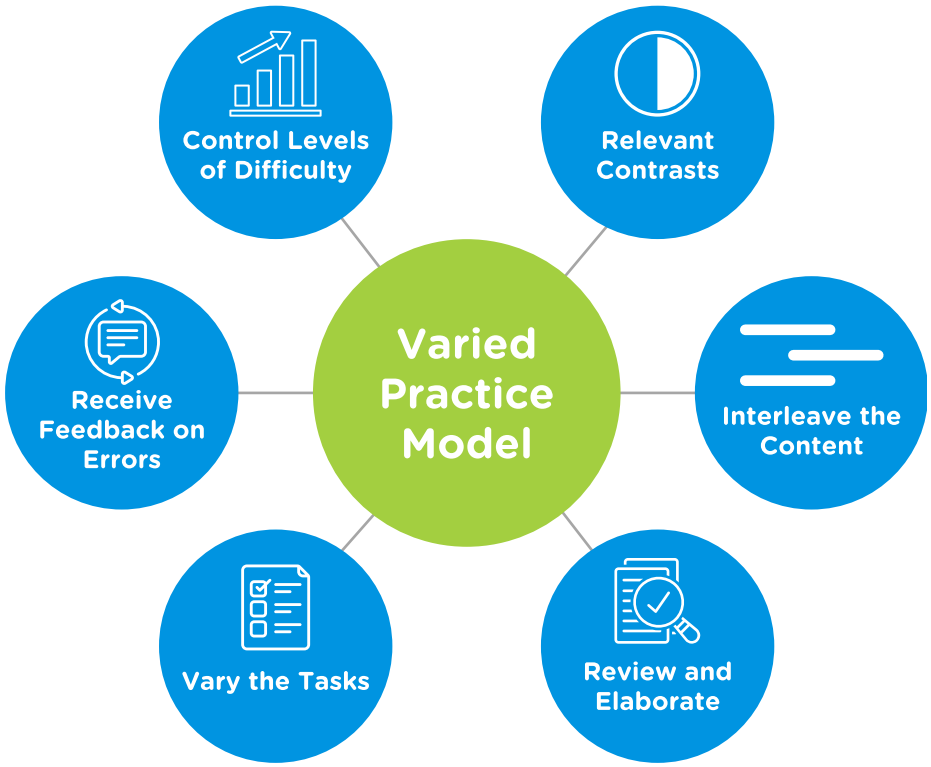
4. Support for statistical learning and varied practice in reading

The Varied Practice Model (VPM) is a learning-theoretic approach that emphasizes training diversity to boost learning. It is a subcategory of statistical learning that emphasizes the impact of systematic variation in the learning process (Arciuli, 2018). The theory suggests that exposure to variable training items and contexts leads to better retention and more flexible recall. Findings for early language learning showed that 14-month olds were better able to learn novel words if they heard them in multiple voices (Rost & McMurray, 2009, 2010).

The VPM emphasizes targeting of interleaving content, varying the tasks, assessing with immediate feedback, and incorporating "desirable difficulties" throughout learning. This practice approach has found support in a wide range of training settings, from motor skill learning to concept learning, suggesting that these fundamental learning principles generalize across domains.

The most straightforward support for the varied practice approach as useful for reading education comes from studies that directly apply this model to academic material. There are also theoretical arguments in support of varied practice as a valuable tool for reading interventions. The result is that learners need to learn elemental rules, as well as more nuanced sub-patterns in how these rules apply in different contexts.

The substantial body of evidence demonstrating statistical learning bases in reading lead to a clear expectation of variability benefits when learning to read. Because readers need to uncover subtle statistical patterns in the mappings between letters and sounds, training in conditions of high variability should boost acquisition, retention and retrieval of this knowledge.

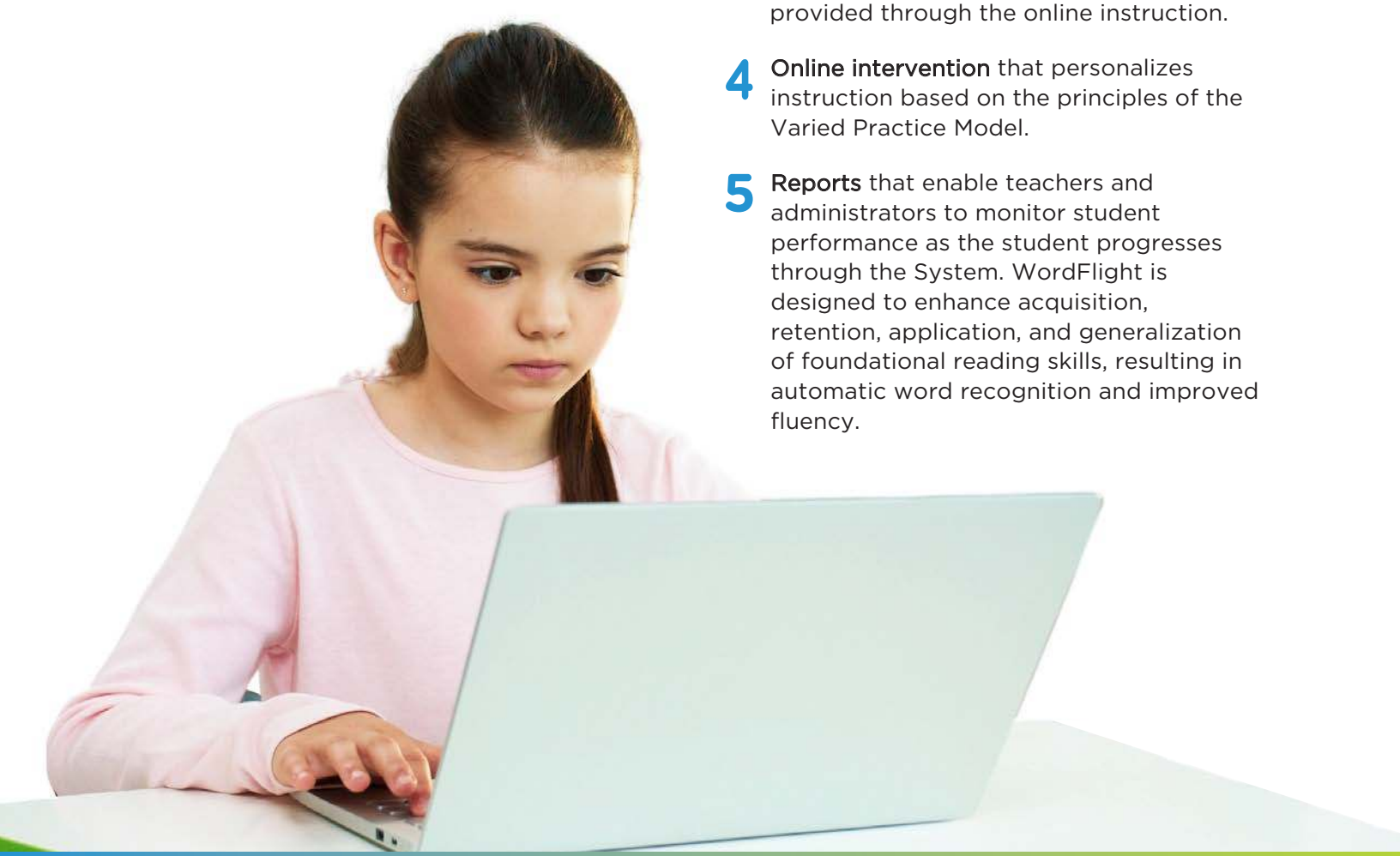


5. How WordFlight aligns with the research

WordFlight embraces state-of-the-art theories from the science of learning to best serve struggling readers. The primary goal of WordFlight is to build students' decoding knowledge and their automatic use of this knowledge. In this section, we briefly summarize how the structure of WordFlight accomplishes these goals.

WordFlight has 5 components:

1. A 20-minute **online screener** to quickly identify whether students have deficits in critical precursors to fluency.
2. An **online diagnostic** that identifies specific gaps in decoding knowledge and predicts automatic word recognition and fluency. It typically takes three 20-minute sessions to complete and is the only scaled measure of automatic word recognition currently available for students in Grades 5 and above.
3. **Curriculum guides** for teachers so they can extend, reinforce and deepen the learning provided through the online instruction.
4. **Online intervention** that personalizes instruction based on the principles of the Varied Practice Model.
5. **Reports** that enable teachers and administrators to monitor student performance as the student progresses through the System. WordFlight is designed to enhance acquisition, retention, application, and generalization of foundational reading skills, resulting in automatic word recognition and improved fluency.



Going beyond direct instruction

The goal of WordFlight is to help students acquire and use decoding knowledge within targeted practice opportunities, so they are able to automatically deploy this knowledge. The assessment identifies students with different areas of need, and the instruction provides targeted, personalized practice.

Teachers can use this information to tailor extension activities to specific areas of need; for example, a student who has strong decoding knowledge but lacks the skills to automatically recognize words should practice with tasks that emphasize rapid deployment of their knowledge in diverse contexts.

In contrast, a student with low decoding ability may need further explicit instruction along with practice of targeted content in a different set of tasks.

Speeded tasks encourage rapid deployment of knowledge, and thus help move students from slow, explicit decoding, to more automatic use of decoding abilities. The speed of these tasks adapts to student abilities. For each objective, a pretest determines how much knowledge of the current content the student already possesses. Students that demonstrate greater struggles during this pretest receive less time pressure, allowing them to focus more on developing the knowledge before pushing them to rapidly deploy it.

WordFlight's online curriculum consists of 24 structured units organized around the Varied Practice Model so that students encounter the content from multiple perspectives. The teacher-facilitated instruction provides a wealth of resources, including poems/passages, curriculum packets, and daily lesson plans to reinforce the development of automatic word recognition skills, improve reading fluency, and deepen and extend learning to new contexts that include vocabulary, comprehension, and writing.

6. Combining teacher-led instruction with online intervention

WordFlight supports and reinforces classroom teaching that provides students with explicit instruction in decoding knowledge. However, as discussed above, knowledge of decoding without effective ability to automatically deploy it will leave a student unprepared for reading success. The individualized and personalized blended learning model provides an effective and efficient way to deliver instruction that supports both explicit and implicit learning.

The online component of WordFlight serves students by automatically monitoring student responses and adapting personalized practice to meet their changing needs.

As students' decoding skills increase, the types of items and tasks that are most likely to benefit them will similarly shift. In the reading domain, dynamically adjusting instruction in response to students' learning is optimal.

Additionally, WordFlight's assessment data provides teachers with actionable insights and corresponding instructional materials to implement a blended learning model. This learning environment enables teachers to engage, support and reinforce learning in the student's ideal zone of proximal development.

7. Conclusion

The overwhelming preponderance of struggling readers in elementary, middle school and beyond makes clear the need for a more principled learning approach to intervention.

WordFlight harnesses the modern science of learning to help address these chronic reading deficits in elementary and middle school children.

Rather than focusing only on explicit instruction of the rules of reading, WordFlight embraces research on how to strengthen implicit access to explicit knowledge.

This parallel approach to teaching students to read helps create readers that both have the knowledge and possess the skills to use it effectively.

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