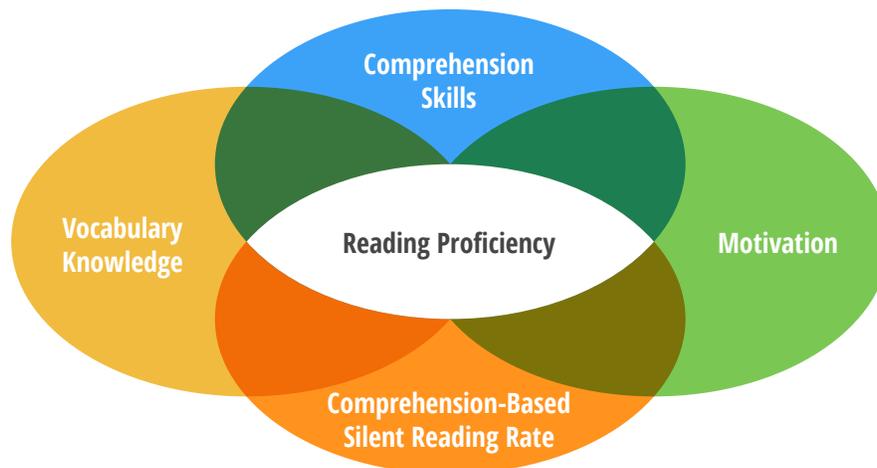


THEORETICAL FRAMEWORK AND FOUNDATIONAL RESEARCH

INTRODUCTION

The Reading Plus program is designed to help all students to become the best readers they can be. The program is based on up-to-date reading research but is also grounded in a rich family history. In the 1930s, brothers Earl, James, and Carl Taylor started the undertaking with pioneering research and groundbreaking inventions, developing the first devices designed to record eye-movements during reading and increase silent reading fluency. During the second half of the 20th century, Earl's son Stanford Taylor carried on this work, with ongoing research and development that led to extensive publications on the topic and computer-based versions of the technology and later to web-based versions of the tools, an effort spearheaded by Stanford's son Mark Taylor in the early 2000s. Since that time, the program has evolved extensively in a process informed by new developments in reading research, feedback from students and educators, and analyses of student performance while using the program.

Reading Plus focuses on four key components of reading proficiency: vocabulary knowledge, comprehension skills, reading efficiency (comprehension-based silent reading rate), and reading motivation. Once early foundational skills have been established, an optimal approach to fostering reading proficiency is to address these four components in an integrated fashion so that they develop in concert.



The following sections of this document review recent research on each of these four components of reading proficiency and describe the ways in which this research has informed the design of Reading Plus. Also included is a section on research related to the Reading Plus silent reading assessment (InSight), which is used to screen students, identify instructional needs, place students within the program, and evaluate their progress over time.

THE VOCABULARY COMPONENT

Foundational Research

The ability to read words with speed and accuracy is not sufficient to ensure comprehension. To illustrate this point, former Reading Plus advisor Jay Samuels (2007) described his experience of reading a text written in Spanish—while it may have sounded good, he comprehended almost nothing because he didn't know the language!

Reading can only lead to comprehension if one knows what the words mean. Even when reading text in one's own language, comprehension levels decline sharply when the text contains more than a small percentage of unfamiliar words (e.g., Allington et al., 2015). This observation affords persuasive evidence for the critical role of vocabulary knowledge in reading comprehension. It also underscores the importance of providing developing readers with texts that are appropriate for their current vocabulary level.

On the other hand, texts containing just a small percentage of unfamiliar words can be a powerful catalyst for vocabulary growth. Encountering a new word in such a text provides the reader with an opportunity to infer at least an imperfect impression of the word's meaning, along with some information about its syntactic and semantic features of the word based on contextual clues (e.g., Perfetti & Stafura, 2014). This initial impression can then be refined and expanded upon during subsequent encounters with the word in new contexts.

The contributions of reading to vocabulary growth are more extensive than commonly realized. For example, many words of cultural, social, and scientific significance are found in printed material but are only rarely spoken, making it unlikely that they would be learned from aural sources such as conversation or television (e.g., see Cunningham and Stanovich, 2001). Yet such words can be essential to communicating important concepts, subtleties, and distinctions. Learning such words also contributes to the richness of a reader's semantic network—their cognitive framework for inferring meaning and relating new ideas and information to what they already know. Students with stronger vocabulary knowledge are also more likely to attend to words they do not recognize or that seem inconsistent with the presumed meaning of a passage (Zargar, Adams, & Connor, 2020).

Evidence suggests that, overall, free reading is more efficient than explicit vocabulary instruction in building vocabulary knowledge (e.g., McQuillan, 2019). However, a program that properly integrates reading with targeted vocabulary instruction can be even more effective than either approach alone. For example, because unfamiliar words in a text make comprehension more difficult, there can be advantages to introducing unfamiliar words prior to students encountering them in their reading (e.g., Pullen, Tuckwiller, Konold, Maynard, & Coyne, 2010). Further, having students use target words in sentences and craft sentences that include them can not only increase their knowledge of the specific words (Coyne, et al., 2019), but also enhance their abilities to infer the meanings of other unfamiliar words that they encounter going forward.

An additional advantage to thoughtfully structured explicit vocabulary instruction is the opportunity to provide students with an understanding of morphology in English (e.g., Hiebert & Bravo, 2010). Adding prefixes and suffixes to root words changes their meaning, and in many cases, their lexical category (e.g., noun, verb). In other cases, root words are combined to create new compound words. Instruction focusing on high-utility root words and illustrating the ways in which morphologically related words are derived from them provides students with a template that they can generalize and use to infer the meanings of other unfamiliar words with the same root or morphology (e.g., Bowers & Kirby, 2010).

Applying Vocabulary Research

The vocabulary component of Reading Plus provides a structured context in which students work to master critical academic and literary vocabulary—vocabulary that they ought to know at each grade level in order to learn new concepts across subject areas. Students will also encounter these words when reading text selections in the reading component of the program.

The Reading Plus vocabulary is based on a proprietary general academic vocabulary list that features a core vocabulary derived from 2,451 morphological word families. The focus is on words commonly found (i.e., > 10 occurrences per million words) in elementary through high school level texts and thus regarded as important for successfully comprehending academic content. The words have been assigned to grade levels using age of acquisition, word frequency, morphological profile, and other relevant criteria (for additional details see Hiebert, Scott, Castaneda, & Spichtig, 2019).

The instructional focus on morphological word families serves to amplify the impact of the vocabulary component. An emphasis is placed on high-utility root words and the ways in which they can be modified with affixes. On lower grade levels, for example, the root “use” is introduced along with the derivations “useful” and “useless.” Students also encounter various forms of this root in the reading comprehension component, including “user,” “users,” “uses,” and “using.” By exposing students to these words and variations in both the vocabulary and reading comprehension components of the program, students are provided with multiple examples of how the words are used in connected text. This reinforces and deepens vocabulary knowledge by showing how a root word can have multiple forms and shades of meaning.

The vocabulary component also provides a foundation for learning to distinguish morphemes in contexts that highlight their syntactic roles and semantic features. Extending the example of “use,” for instance, after students have been shown the morphology of the key inflected and derived forms in the vocabulary component, they are provided with opportunities to generalize their knowledge when they encounter additional forms of the root in reading comprehension component. In this example, the vocabulary utilized in the comprehension component includes “uses,” “overuse,” “overused,” “reusable,” “reuse,” “reused,” “reusing,” “unused,” “usable,” “unusable,” “usage,” and “usefulness.” This approach, with its focus on high utility morphological word families, is a highly efficient means of increasing vocabulary knowledge as well as the ability to infer meaning when encountering unfamiliar words in text (Bowers & Kirby, 2010).

Students begin work in the Vocabulary component at their individualized instructional level based on the initial Reading Plus assessment results (InSight). The amount of instruction devoted to each vocabulary word depends on a student’s performance. All students complete the first two activities described below. If a student makes an incorrect response on one or both of these, the second two activities are included:

- **Instant Recognition:** This first activity determines whether a student can instantly recognize and assign meaning to a word. This is an essential skill for fluent reading with comprehension. When the student is ready to begin, the target word briefly flashes. The student must then choose the word or phrase that most closely matches the target word’s meaning.
- **Word in Context:** The second activity assesses a student’s knowledge of the target word in context. The student must determine which sentences correctly use the target word. If the student is unsure of the word’s meaning, contextually rich “hint sentences” are available. Because many words can have multiple meanings based on how they are used in a context, it is essential that students consider how a word is used in a sentence and use context clues in order to understand the word’s meaning. Working with words in context also helps students develop the contextual analysis skills needed to distinguish homonyms and unlock the meaning of unfamiliar vocabulary.
- **Teaching Page:** Students in need of additional instruction are engaged in an activity that is designed to develop their vocabulary knowledge. Students are presented with explanations of word meaning and examples of the word in contextually rich sentences. The definitions and explanations are “student-friendly.” The activity also formally introduces students to the target word’s morphological “word family.”
- **Sentence Completion:** This activity asks students to demonstrate their knowledge of word meaning and morphology by completing a sentence using the correct form of the target word. The word family is displayed to assist students who struggle with the exercise.

These activities are designed to help students develop a richer knowledge of a given target word, as well as to prepare them to distinguish the target word from antonyms, thematically related words, and words with similar morphology. The ultimate goal is for students to be able to efficiently and accurately infer meaning when new forms of the target word are encountered in the reading comprehension component.

During a typical 8- to 10-minute Vocabulary lesson, a student will work on 10 to 15 words—depending on how many activities per target word a student completes. If a student struggles with a word, that word will automatically be repeated in future lessons until the student masters the word.

Optional Teacher-Directed Instruction: Reading Plus provides teachers with an array of resources (Teaching Tools) that enable them to provide data-informed instruction in specific vocabulary skills and strategies based on student performance in the reading component, as well as in a proactive fashion to teach and review specific skills.

READING COMPREHENSION

Foundational Research

Critical to successfully fostering reading comprehension is the selection of texts that coincide with a student's interests, and are appropriate to the student's developmental level along the dimensions of vocabulary, syntax, semantic complexity, required background knowledge, and text length (e.g., Guthrie & Klauda, 2014; Hiebert & Mesmer, 2013). Reading comprehension is facilitated by having students read texts with the understanding that they will be asked to answer questions about what they read. Effective questions are designed to highlight key ideas and concepts in a text and lead the student to infer connections both within the text and more broadly (Hall, 2016; Kendeou, et al., 2016; McKeown, Beck, & Blake, 2009; McMaster, et al., 2015). Questions intended to increase comprehension skills are more effective if they are calibrated to a student's level of reading proficiency (e.g., McMaster, et al., 2012).

The educational benefits of silent reading practice combined with systematic questioning are enhanced by providing scaffolds for students who need them, such as structured opportunities to reread relevant parts of a text. This is akin to a structured dialogue centered around comprehension skills, a highly effective means of enhancing reading comprehension (Pearson & Dole, 1987). Comprehension skill tracking can help guide the selection of skills targeted for structured practice. Research has shown that working on a single comprehension skill is likely to produce concurrent gains in other comprehension skills as well (Reutzel & Hollingsworth, 1990). This is likely so because structured practice in, for example, locating details, summarizing main ideas, and drawing conclusions, all direct attention to the structure and meaning of text. As such, when combined with silent reading practice, systematic questioning and targeted comprehension skill training comprise a highly effective form of instruction for producing meaningful gains in overall comprehension (Pearson & Dole, 1987).

Writing is also an important part of the process of learning to read proficiently. During reading, students start with the words on a page, then decode and combine the words

grammatically in an effort to understand the author’s meaning at the discourse level. Writing begins with meaning at the discourse level and requires students to think about the words and grammar needed to convey that meaning. The levels of the systems are the same, but the direction of the process is reversed (e.g., Berninger, 2015). In beginning readers, writing practice strengthens knowledge of sound-letter combinations, connections between words and meaning, spelling, punctuation, and other text conventions. As this knowledge becomes more deeply ingrained, attention can shift to reading and writing for meaning.

When readers are tasked with writing about something they have read, they are called upon to demonstrate that they have in fact derived meaning from the text. The process compels them to identify, analyze, personalize, and make connections between the ideas and concepts they have encountered during their reading. This writing experience in turn can affect the way a

student approaches future reading by calling increased attention to the ways in which writing is structured and meaning is conveyed; that is, the ways in which authors present information and ideas and tell stories in text. As a consequence, students who write about what they have read will not only improve their writing skills, but also improve their reading skills (e.g., Graham & Hebert, 2010).

Applying Reading Comprehension Research

The silent reading practice and the writing activities in Reading Plus are closely aligned with the research findings just described. Highlighted below are some of the ways Reading Plus translates these findings into practical, applied approaches to promoting reading comprehension development.

Choice: The Reading component of Reading Plus (SeeReader) offers students a wide and diverse choice of curated text selections that align with their reading proficiency level and their reading interests (including recommendations based on an algorithm that considers prior choices and student ratings). The selections also align with STEM and social science content areas. All of the text selections – including many based on student suggested topics – provide rich educational content. They are intended to deepen knowledge on familiar topics as well as broaden students’ horizons by introducing new topics. In addition, the program shows students how their own interests link to other interest areas and curricular topics, thereby building an appreciation for the value of reading and laying the groundwork for increased intrinsic motivation. High interest text selections with low readability scores (i.e., easy to read) are also available for older students who are reading far below grade level, ensuring that students of all abilities have a choice of content that is developmentally appropriate in terms of both text complexity and interest.

Text Metrics: The text selections in the reading component of Reading Plus are leveled based on the Lexile® Framework for Reading, but more than this, they are crafted to meet more stringent metrics for the individual quantitative components that make up the Lexile measure (vocabulary and sentence length) as well as other factors such as conceptual complexity. Over 20 additional qualitative and quantitative features are taken into account as well, so as to provide each student with developmentally appropriate and instructionally meaningful texts.

These extra steps result in a far more reliable and accurate level of text complexity that is truly grade appropriate. This design also provides a more authentic “staircase of text complexity” than can be achieved using commercial measures alone. Furthermore, the program builds students’ comprehension capacity and stamina by presenting them with texts of increasing complexity and word count as their proficiency increases. Our robust text complexity approach benefits readers of all abilities and is especially crucial for students who are reading far below grade level and are in need of more targeted comprehension intervention.

Comprehension Questions: After reading each literary or informational text selection, students must complete a comprehension check that samples a broad range of comprehension skills related to key ideas and details (“Core”), craft and structure (“Craft”), and the integration of knowledge and ideas (“Critical”). Questions and answer choices in the Reading component follow a rigorous comprehension-probe rubric designed with the guidance of Reading Plus academic advisor, Dr. P. David Pearson. Comprehension questions increase in complexity, scope, and depth as a student progresses in the program. Comprehension questions are based on 24 individual reading skills aligned with the College and Career Readiness (CCR) Anchor Standards for Reading 1 – 10 (CCR.A.R1 – CCR.A.R10). The ten comprehension questions follow a formula that controls the mix of Core, Craft, and Critical questions based on a student’s instructional focus. For lower levels, students encounter a higher percentage of Core questions. Craft and Critical questions appear with increasing frequency and complexity as students advance to higher proficiency levels. Core questions align with Anchor Standards 1 – 3, Craft questions align with Anchor Standards 4 – 6, and Critical questions align with Anchor Standards 7 – 9. All of the work a student carries out in the Reading Component fuels the achievement of end-goal Anchor Standard 10, the ability to read and comprehend complex literary and informational text independently and proficiently.

Comprehension questions are presented in a variety of formats, including several that mirror formats found on national and state assessments (e.g., selected response, drag and drop, and highlighting). Multiple choice questions are presented on-screen in four different formats. This variety ensures that students are provided with ample opportunities to engage with presentations that meet multiple modalities of learning. Students are presented with varied combinations of the following question formats for each selection:

- A question and foils. Students answer skill-based questions probing their comprehension of the text they read.
- An excerpt from the text, a question, and foils. Students answer questions related specifically to the excerpt, such as the meaning of a word in context.
- Two excerpts, a question, and foils. Students see two excerpts (both from the text, or one from the text and one external source). This format is used for comparative reading analysis.
- An image, or other visual element, a question, and foils. Students analyze visual elements in the context of the selection that was just completed.

If students answer a comprehension question incorrectly, they are presented with the portion of the text where the evidence for the correct response can be found. As they answer questions, students are also presented with opportunities to proactively reread portions of text, closely and critically, before selecting an answer option. These scaffolds provide students with support in developing metacognition; they must consider what they know and do not know, and then decide whether or not to utilize a re-read option.

Comprehension Skill Tracking: The comprehension questions that follow each text selection in Reading Plus align with the CCSS College and Career Readiness Anchor Standards for Reading, helping students develop and strengthen the 24 comprehension sub-skills that are critical for deep understanding of complex texts. Each student's performance is tracked and recorded for each comprehension question so that specific skill strengths and deficiencies can be identified. If a comprehension weakness is identified, Reading Plus provides students with optional skill instruction that is specifically targeted to their skill deficiencies and reading level. Reading Plus also provides educators with actionable data, along with materials for offline skill instruction that is specifically targeted to a student's skill deficiencies and reading level. Reports automatically group students by shared deficiencies for targeted teacher-directed individual or small-group instruction. These reports indicate which students are in need of remediation in each of the CCSS Anchor Standards for Reading. Educators can use this report along with the Offline Skill Teaching and Learning Pages to provide differentiated, explicit, individual and small group instruction.

Writing: To support writing practice and its benefits, appropriately leveled writing prompts are provided for all comprehension passages in Reading Plus. After completing each reading selection, students receive a related writing prompt. Students can complete their writing assignments within the Reading Plus interface, creating a seamless transition between reading and writing. The integrated writing tool lets students reread selections closely and critically and use word processing tools to produce and edit their writing. Electronic comment threads between the teacher and student can help students learn how to incorporate feedback into their writing.

Writing prompts include:

- Expository prompts that require students to use information gathered from reading selections and from their own prior knowledge to inform their audience through writing.
- Narrative and opinion prompts that ask students to draw upon their experiences, creativity, and imagination as well as extract evidence and support from the reading selection.
- Evidence-based prompts that ask students to form an argument or hypothesis and substantiate their positions with prior knowledge and relevant evidence from the text.

Educators may assign additional writing prompts from a large library of skill-based writing prompts. These prompts facilitate development within the 24 comprehension sub-skills that are critical for deep understanding of complex texts.

READING AUTOMATICITY/EFFICIENCY

Foundational Research

One factor that distinguishes more successful readers from their less proficient peers is efficiency, or the automaticity and ease with which they navigate lines of text, decode common words, and construct meaning from text without having to devote a great deal of conscious effort or attention to the process of reading (e.g., National Reading Panel, National Institute of Child Health and Human Development, 2000).

Automaticity comes from reading practice and the development of efficient silent reading habits. With practice, word decoding speed increases, sight vocabulary expands, and word recognition becomes increasingly automatic. At some point, given sufficient exposure to appropriately leveled texts, an adequate percentage of words in a text will be sight words and, according to prevailing theories, cognitive resources formerly required for word decoding can be redirected toward processes that support comprehension (Hamilton, Freed, & Long, 2016; LaBerge & Samuels, 1974). Importantly, the latter include such strategies as using background knowledge and contextual information to infer the meanings of unfamiliar words (Daugaard, Cain, & Elbro, 2017; Verhoeven, van Leeuwe, & Vermeer, 2011).

As noted earlier, vocabulary knowledge provides an essential link in the pathway from decoded text to the comprehension of meaning. The percentage of words in a text already known to the reader is a key factor in determining the extent to which comprehension occurs (e.g., Allington, McCuiston, & Billen, 2015). These observations are relevant to understanding reading efficiency as well: Students tasked with reading text that is excessively challenging will often begin to read words quickly but with marginal comprehension. After a few paragraphs or pages, students who lack sufficient reading stamina often slip into this behavior as well (e.g., Spichtig, Pascoe, Ferrara, & Gehsmann 2019; Trainin, Hiebert, & Wilson, 2015). These undesirable patterns make it clear that measures of silent reading rate collected without having evidence of adequate text comprehension cannot be regarded as valid and characteristic reflections of a student's reading ability (Spichtig, Pascoe, Ferrara, & Gehsmann 2020; Taylor, 1965).

In contrast, silent reading rates associated with good comprehension are a meaningful measure of reading efficiency, and are distinguished by the label comprehension-based silent reading rates (Hiebert, et al 2010). All measures of silent reading fluency in Reading Plus are comprehension-based silent reading rates (cbSRRs). National norms for these rates have been established (Spichtig et al., 2016).

In the following section, additional research informing various efficiency-promoting features of Reading Plus is cited in the context of its application.

Applying Efficiency Research

Reading Plus promotes reading efficiency on multiple levels by addressing visual and perceptual skills, modeling efficient reading behavior, and building reading stamina:

Visual Skills: In the Visual Skills component of Reading Plus, students develop the visual and perceptual skills that are the foundation of efficient reading. Students engage in two separate activities that work in concert to develop visual discrimination skills, short-term memory, visual memory, and left-to-right navigation, as well as to increase perceptual span. This program component was developed under the direction of Reading Plus advisor Dr. Ralph Radach (University of Wuppertal; Florida State University), a leading international expert in the use of eye-movement analyses to study information processing in reading (Radach & Kennedy, 2013; Radach & Spichtig, 2013). The two activities are as follows:

- **Scan:** This is a non-linguistic reading task that builds oculomotor and attentional stamina. Students' eyes are guided across lines of "text" via a moving window. However, all of the letters have been replaced with circles (called Landolt Rings), and students must press the spacebar each time they see a circle with a break in it. As students engage in this activity, they are employing the same attentional, visual discrimination, and visual tracking skills that are used while reading text; essential skills that determine the ease and comfort with which we read, but without the additional cognitive demands of decoding and semantic interpretation (Radach & Kennedy, 2013; Radach & Spichtig, 2013). Students work at rates that are appropriate for their individual level of efficiency; the system gradually increases the difficulty of the task in accord with each student's performance.
- **Flash:** In this task, students focus on a plus sign (+) in the middle of their screen as different trigrams (or trigraphs) are flashed to the right or left of the plus sign. Trigrams are strings of three-letter combinations extracted from high utility academic vocabulary. The trigrams are flashed at increasing distances from the central plus sign to support development of students' perceptual span and short-term visual memory, which play important roles in the rapid word recognition required for reading automaticity (Radach & Spichtig, 2013).

The Guided Window: In the SeeReader reading component of Reading Plus, students with an instructional focus on reading efficiency will typically see text presented using the patented Reading Plus Guided Window system. This system displays pages of text using a filter through which the general features of the page layout can be discerned, complete with lines and paragraph breaks, but the text is only legible through a window that moves from left to right over the lines of text at a student's individualized reading rate. This format provides students with a notion of where they are on the page, where paragraph breaks occur, and general word shapes and boundaries –features that play an important role in organizing and integrating textual information as well as in guiding the physical aspects of navigating the eyes across lines of print, such as planning fixations and fixation landing positions (Kuperman, Dambacher, Nuthmann, & Kliegl, 2010; Radach, 1996). The actual letters and words, however, can only be recognized when the text is revealed within the Guided Window, which moves across the lines of text at a student's individualized reading rate. The Guided Window is approximately 25 characters wide. This design is compatible with natural reading in that it accommodates the right-oriented perceptual span asymmetry of readers of English (McConkie & Rayner, 1975; Rayner, 1986), as well as typical saccade spans, which commonly average eight to ten

characters during silent reading, and over 90 percent of regressive saccades (Rayner, 1998; Vitu & McConkie, 2000). An important study of text presentation formats found that the use of a guided window during computer-based silent reading was more effective than using either static text or displaying text line by line, in terms of producing larger gains in reading efficiency on two nationally normed reading assessments (Spichtig, 2012).

As a scaffold, the Guided Window provides a focus for visual attention that helps students maintain their place as they navigate their eyes across lines of text. This format encourages focused attention and the sequential intake of text, providing the student with a reading experience that models effective, efficient silent reading. With this practice, students begin to overcome inefficient reading behaviors that are often seen in emergent readers, such as habitual re-reading and decoding words they already know. This scaffold changes the way students take in text while gradually and effectively increasing the rate at which they can read text with good comprehension (i.e., their comprehension-based silent reading rate). As students develop reading efficiency and stamina, they are able to focus their efforts on comprehension and gaining knowledge rather than on the mechanics of reading. The Guided Window makes reading productive, and this in turn makes reading more enjoyable.

The speed of the Guided Window gradually increases as students continue to demonstrate consistently strong comprehension. This scaffold is removed (or made optional) when a student reaches the target comprehension-based guided reading rate for their grade-level (based on national norms; Spichtig et al., 2016), at which point the amount of independent reading is increased.

Independent reading provides a more traditional reading experience and allows students to practice and apply efficiency gains made during guided reading. Students see a full screen of text and click the “Go on” button on their computer or tap the touchscreen on a tablet when they are ready for the next screen of text. A subtle pacing guide is provided for additional scaffolding, if needed. Students who need to increase silent reading stamina will read text selections in sections. For example, a student may begin by reading 1,000-word passages divided into four segments with breaks in between. As the student builds stamina, increases reading rate, and demonstrates competence with more complex text, the lengths of the text segments will increase, and the number of segments decrease.

READING Motivation

Foundational Research

Some students embrace reading. These avid readers are likely to find reasons to open a book on a daily basis. They read millions of words each year, their vocabularies expand, their reading interests diversify, and they do well in school. Not surprisingly, these same students also report high levels of reading interest and confidence.

Unfortunately, many students do not like to read, and do not read unless they are compelled to do so (Mullis, Martin, Foy, & Drucker, 2013). The pervasiveness of this problem is suggested by the fact that one-third of 13-year-olds and 45 percent of 17-year-olds very rarely or never

engage in recreational reading (National Center for Education Statistics, 2013; Twenge, Martin, & Spitzberg, 2019). As a consequence, these students acquire less reading experience, spend more of their reading time stuck on unfamiliar words (or skipping over them), and stumble through grade level material at a pace far slower than normal speaking rates (Spichtig, Pascoe, & Ferrara, 2019). Naturally, these students do not develop an interest in reading or build confidence in their reading ability.

It can be challenging to turn reluctant readers into avid readers. Doing so requires engaging students in three ways (Fredricks, Blumenfeld, & Paris, 2004):

- **Behavioral Engagement:** Time on task (eyes on text); encouraging students to spend time reading.
- **Cognitive Engagement:** Reading with a purpose; encouraging students to read with the intention of understanding what they read.
- **Emotional Engagement:** Personal relevance; cultivating the attitude that reading is a useful and valuable skill, and that it is worth the effort required to become a proficient reader.

Targeting behavioral engagement in isolation is not likely to be effective (e.g., National Reading Panel, 2000). Naturally we want to increase the amount of silent reading that a student does. But the problem is that many students don't use their silent reading time as intended. Two-thirds of primary school students who were asked whether they read or "faked it" during silent reading time willingly shared their strategies for faking it – and these tended to be the students who needed reading practice the most (Griffith & Rasinski, 2004). A study of middle school students' behavior during their independent silent reading periods found that more than two-thirds of them remained offtask for essentially the whole time (Cipiti, 2010).

Even when students do read, there is a great deal of variability in the degree to which they engage cognitively and emotionally. Some students, for example, attempt to work out the meanings of unfamiliar words, make inferences and connections, and resolve apparent inconsistencies; that is, they strive to understand the meaning of the text (e.g., Oudega & van den Broek, 2018). Other students make less effort in this regard (e.g., superficial reading).

Successful outcomes are achieved when strategies to motivate behavioral, cognitive, and emotional engagement are combined. Cognitive engagement can increase when students read with a purpose and know that they will be held accountable for what they accomplish during their silent reading time. Active monitoring, record keeping, and comprehension checks can all serve to motivate cognitive engagement with text, as opposed to just going through the motions (Reutzel, Fawson, & Smith, 2008). Cognitive engagement can also be enhanced through systematic questioning designed to highlight key ideas and concepts and lead students to infer connections both within the text and more broadly (e.g. McMaster, et al., 2015).

Emotional engagement can be the most difficult to foster. Many students arrive in the classroom with a history of reading struggles and a desire to avoid reading. Such students are likely to experience a “collapse of motivation” when faced with text that is too challenging or lengthy (Snow, 2013). For these students, providing a choice of appropriately leveled, high-interest texts can serve to spark interest and engagement (OECD, 2015, p. 156). Promoting the relevance of reading assignments, providing explicit learning goals, and optimizing opportunities to make reading choices are some other ways educators have found to increase emotional engagement (e.g., Guthrie & Klauda, 2014; Miller, 2009).

Fortunately, reading interest and reading confidence increase naturally as students become more proficient readers (Becker, M., McElvany, N., & Kortenbruck, M., 2010; Reading Plus Research, 2016b). This in turn provides the momentum for further growth and achievement, along with setting the stage for turning reluctant readers into avid readers.

Applying Reading Motivation Research

Many features of Reading Plus were designed with student motivation in mind. Presenting students with a wide choice of appropriate text selections is key in this regard. Given such choices, on any given day, students can decide to deepen their knowledge of a familiar topic or explore a new topic, as they wish. Because students can explore their own interests, it is more likely that they will read for comprehension and thereby develop an appreciation of the value of reading.

As described in the section on comprehension, the text metrics of selections offered to individual students are carefully calibrated to their current level of reading proficiency and instructional objectives, and include scaffolds designed to ensure that they can experience success. These steps are critical for supporting students’ reading confidence and preventing motivational collapse.

The comprehension questions associated with each text selection motivate students to read more carefully and to think about what they read. They also serve to highlight key ideas and concepts and lead students to infer connections, both within the text and more broadly. This is critical for supporting the cognitive engagement that is essential to increasing reading proficiency.

The Inventory: The motivation inventory used in the Reading Plus assessment is designed to assess several dimensions of reading motivation. It is anchored to established motivation scales with good psychometric properties that have been used in studies designed to increase reading motivation and achievement in struggling readers (e.g., Klauda & Guthrie, 2015; Wigfield & Guthrie, 1997).

The prototype inventory was adapted for online administration in 2012 and first deployed as part of a placement test that was completed by 3,031 students, including more than 300 students in each of grades 4 through 10.

Data collected with the inventory in 2013-14 confirmed these psychometric properties in

separate analyses for student samples in each of three grade bands (grades 4-5, 6-8, 9-10). Since then, continuous research and inventory domain and item refinements have focused on understanding and informing the many links between vocabulary, comprehension, reading rate, and overall reading proficiency and motivation (Gehsmann, et al., 2017; Spichtig et al., 2017).

Results from the motivation inventory have been used to evaluate the impact of Reading Plus on students' reading motivations. Replicating the results of other research, these studies have shown that the gains in reading efficiency and reading proficiency students achieve with Reading Plus are significantly correlated with increases in their reading confidence and reading interest (Reading Plus Research, 2016a, 2016b).

THE INSIGHT READING ASSESSMENT

Foundational Research, Validity, and Reliability

The computer-adaptive InSight reading assessment was developed to provide an assessment that is useful in the 21st century standards-based environment. Development of the assessment was informed by the company's prior experience in the field of Computer Adaptive Testing (CAT), as well as by standards for educational testing outlined by the American Educational Research Association (AERA), the American Psychological Association (APA), and the National Council on Measurement in Education (NCME).

The InSight assessment measures reading motivation, vocabulary knowledge, comprehension, and reading rate (which is measured during the comprehension component). A student's vocabulary level, comprehension level, and comprehension-based silent reading rate are combined to create a composite reading proficiency grade-level score.

The assessment items and passages were developed in collaboration with Drs. John Guthrie, P. David Pearson, and Elfrieda Hiebert, leading experts in content creation, literacy, and curriculum. Content rubrics were based on multiple text metrics, including vocabulary, the Lexile® Framework for Reading, mean log word frequency, and average sentence length, state standards for academic content, and national guidelines for text complexity, such as the Common Core State Standards (CCSS). These materials were analyzed by an internal review team and an external review panel that included literacy researchers, curriculum developers, and classroom teachers.

Assessment items and passages underwent extensive field testing with students from all regions of the United States who had diverse levels of reading proficiency and demographic characteristics. Item Response Theory (IRT) modeling and other item statistics were used to evaluate the functioning of items and passages during the assessment development process.

Items and passages for each level were refined using a rigorous, iterative research design, which included multiple trials with target populations to ensure appropriate levels of complexity at each grade level. For ongoing maintenance, an iterative review process is used to identify passages and items that are not performing as planned and may need revision or replacement. New and revised items and passages are evaluated in content trials before being used for measuring student performance.

The measurement of comprehension-based silent reading rate was validated based on a national study of silent reading rates across school grades (Spichtig, et al., 2016). This study closely replicated a national study conducted in 1960 by company founder Stanford Taylor.

The proficiency scores yielded by the InSight assessment have been found to correlate strongly with the results of nationally normed English language arts assessments such as the SBAC (Smarter Balanced Assessment Consortium; $r = .84$) and the PARCC (Partnership for Assessment of Readiness for College and Careers; $r = .77$), and with the Group Reading Assessment Diagnostic Evaluation (GRADE; $r = .84$; Gehsmann et al., 2017). InSight assessment scores also have strong concurrent validity (Pearson's $r > .70$) and classification accuracy (lower bound of AUC CI $> .80$ and overall classification rate $> 75\%$) in comparison to the SBAC and PARCC ELA assessments (Ferrara et al., 2019). InSight has been reviewed by the National Center for Intensive Intervention and was rated as yielding "convincing evidence" of validity, reliability, and classification accuracy across a range of technical standards (National Center on Intensive Intervention, 2019)

Students receive no instructional support while completing the InSight assessment. As such, the assessment gauges reading proficiency in the "real world" and can be used with confidence to assess, track, and measure progress in reading proficiency growth. The InSight assessment can be administered up to three times during the school year.

Assessing Reading Proficiency

As noted in the introduction, the focus of Reading Plus is on the four key components of reading proficiency: comprehension skills, vocabulary knowledge, reading efficiency, and reading motivation. The InSight assessment measures each of these components. Each segment of the assessment is preceded by a brief instructional video explaining and modeling the tasks to be performed. These segments and key related research are described next.

Motivation: The motivation inventory is completed first and measures students' self-reported reading confidence (self-efficacy) and reading interest, as well as self-improvement belief. Responses are collected using a six-point Likert scale. Items were originally based on established scales with good psychometric properties that have been used in studies designed to increase reading motivation and achievement in struggling readers (e.g., Kluda & Guthrie, 2015; Wigfield & Guthrie, 1997). They have since been developed further using an iterative process and ongoing research.

Vocabulary: Students next complete an adaptive vocabulary assessment. Target words are presented in short stems designed to minimize contextual clues other than the word’s lexical category, and students are asked to identify a synonym for the target word using a multiple-choice format (one correct response and three foils). Foils include antonyms, thematically related words, words with similar morphology, and words associated with incorrect alternate meanings, and are chosen so that students with richer knowledge of the target word will be more likely to respond correctly. The words included in the assessment are based on a proprietary general academic vocabulary list consisting of words found in elementary through high school level texts and are shared across subject areas—words thus regarded as important for comprehending academic texts successfully. The words were assigned to grade levels using age of acquisition, word frequency, morphological profile, and other criteria (for additional details see Hiebert, et al., 2019). Vocabulary scores yielded by this assessment were found to be highly correlated with results of nationally normed reading assessments such as the SBAC ELA ($r = .80$) and the GRADE ($r = .82$; Gehsmann et al., 2017). Each student’s starting point in the vocabulary assessment is determined by their grade level. Thereafter, the difficulty of each subsequent item is adjusted based on an IRT procedure, a two-parameter logistic model, and the adaptive logic. The vocabulary component yields a vocabulary grade level for each student. This is then used to determine an appropriate entry level for the adaptive comprehension assessment.

Comprehension: In this component, students read a sequence of leveled, multi-screen passages, each followed by five comprehension questions presented in a multiple-choice format (one correct response and three foils). The questions include a mix of literal and inferential items. Question and passage complexity are aligned. Passage length, number of screens, text complexity, and question complexity are initially based on a student’s vocabulary level but are then varied in relation to ongoing performance, the adaptive logic, and the logistic model. The passages range from 150 to 300 words in length with Lexile scores ranging from L250 up to L1430. When students finish reading a screen of text, they make a response to advance to the next screen, or if they are on the last screen, to view the first comprehension question. Students are not able to return to a passage when responding to the comprehension questions. The resulting measures of comprehension accuracy, passage difficulty, and question difficulty were used to calculate a comprehension grade level. In other research (Gehsmann et al., 2017), these comprehension scores were found to be highly correlated with results of nationally normed reading assessments such as the SBAC ELA ($r = .77$) and the GRADE ($r = .80$).

Reading Rate: Reading rate is calculated on each screen of each comprehension passage. Logic is in place to detect unreasonably fast responses and inordinately long pauses. If such responses occur, a message is displayed to the student, and reading rate data for that screen are discarded. The student is then given one additional chance to read the screen. Only reading rates calculated from screens with adequate comprehension and no warnings are considered to be valid for reading rate calculations.

Using the Assessment

Most students complete the InSight assessment in less than 45 minutes, including time spent watching the orientation videos. The resulting data can be used for screening, placement, and progress benchmarking.

Screening/Diagnostic Profile: The initial administration of InSight screens students to determine which students are in need of comprehension, vocabulary, and/or silent reading efficiency development, which students are proficient readers but could benefit from efficiency development, and which students may need to complete an additional assessment to determine their foundational skill development needs.

Placement: The first administration of InSight also calculates an individualized instructional path for each student, including the most appropriate program components for instruction, the initial placement level within each component, and the recommended intensity of instruction (weekly assignments in each component).

Progress Benchmarking: The first administration of InSight provides baseline performance measures and a projected growth path. Mid-term and end-of-term administrations can be used to benchmark and document changes in reading comprehension and vocabulary levels, comprehension-based silent reading rate, and reading motivations. Analyses of national data have documented increases in each of these measures commensurate with the amount of time students spend working in the Reading Plus program. This was found in the general student population as well as in students enrolled in programs for special education, English as an additional language, and subsidized lunch (Reading Plus Research, 2020).

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