**STUDENT
ACHIEVEMENT
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FOUNDATIONAL SKILLS · KNOWLEDGE & PERSONALIZATION · VOCABULARY & PERSONALIZATION · WRITING & PERSONALIZATION · READING COMPREHENSION & PERSONALIZATION

LITERACY ACCELERATOR #5 | READING COMPREHENSION & PERSONALIZATION

Reading Comprehension...
The Rest of The Story

OVERVIEW

Comprehension is a term we all use all the time. But it can be misleading since *everything else in reading lies underneath and contributes to reading comprehension.* If a student has weak word recognition, which, as you know by now, means too small a sight-word vocabulary, she can't be fluent (<u>Accelerator #1</u>). In that case, she will undoubtedly struggle with comprehension. If she is fluent and has a good-sized sight vocabulary but knows the meaning of too few words (<u>Accelerator #3</u>) and has limited prior knowledge (<u>Accelerator #2</u>) for what she's encountering, she will continue to struggle with comprehension. If she cannot marshal textual evidence in the service of a skilled interpretation of what a text says directly or inferentially (<u>Accelerator #4</u>), then again, her depth of comprehension will be compromised. A costly and widespread failure of much reading instruction has been the failure to realize that inferencing during reading does not exist in a vacuum. Ever. Inferencing is embedded in a nest of other capacities, already explored in the other syntheses in this series.

But if all of these ingredients are in place, is there anything else? The efforts made to answer this question have spanned decades. Forests have been felled in this quest. A search on Google Scholar for "comprehension skills" yields nearly two and a half million hits in a fraction of a second. We'll shortcut that for you in these several pages and bring the best current thinking to bear. Bottom line, reading comprehension is not a thing; it is not a cluster of observable skills. It exists in the reader's mind. Scientists refer to this existence of comprehension in our mind as "representation."

Even when the other four literacy accelerators are in place, comprehension still requires readers to develop a mental representation of the text. Turns out, this representation in our minds exists at three levels—surface level, text-base level, and the situation model—all of which are needed to comprehend a text truly (Kintsch, 1998). All three develop *simultaneously* as students read the text.

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Generating these levels of understanding draws on students' ability to bridge inferences both among idea units within the text and between the text and the reader's knowledge. Doing this well also depends on cultivating

in students a habit of mind that drives them to make sense of what the author is saying. Designing instruction that focuses on both these elements can turn good readers into great readers.

HOW EXACTLY DOES THE READER'S ABILITY TO REPRESENT TEXTS PROMOTE COMPREHENSION?

Again, there are three levels of text representation: surface-level, text-base level, and situation model.

A **surface-level** understanding allows readers to recognize the text's words and read them fluently even if they do not understand their meaning. We can think of this as essentially decoding or word recognition. In the sentence "The lome saths grib," we can pronounce the words and read the sentence fluently, but it has no meaning, so it exists in the mind *only* at the surface level. In other words, what is in mind is the visual representation of the words and the sound or auditory representation of the words. You may have experienced this for yourself singing or reciting something from a language you don't know.

The next level is **the text base**. Renowned cognitive scientist Walter Kintsch split the text base into two parts: the "macrostructure" and the "microstructure" of the text (1998). The *macrostructure* is the overall structure of a text—how the author organizes the text. The macrostructure for narratives includes setting, protagonists, what the characters intend to do, and the outcome (what happened, whether intended or not). The macrostructure for nonnarrative texts can have various structures: problem/solution, goal/action/outcome, chronological, descriptive, generalization, and examples or any combination across a given text. Understanding the macrostructure helps a reader determine the most important ideas and the author's purpose. Teaching students to attend to and recognize macrostructure supports comprehension even in very young students (Williams et al., 2016).

Cognitive scientists define the *microstructure* as the "propositions." Propositions are individual idea units in the text. Here's an example from Kintsch (2019):

> *The hiker watches the elk through his binoculars.* We have a subject (the hiker), an action (watches), an object (the elk), and in this case, an instrument (his binoculars). The proposition is an idea unit, and the idea unit is stable even if the syntax changes. *For example, here are two:*
>
> *Through his binoculars, the hiker watches the elk.*
>
> *Watching the elk through his binoculars was a hiker.*
>
> These all present the same proposition or idea unit even though they are different sentences—some clunky!

Connections between propositions can be explicit, with the author signaling the reader how one proposition connects to another, or more inferential, leaving it to the reader to figure out (infer) the connections. The ability to make these inferences while reading is a skill. Numerous studies (Soto, et al., 2019; Kendeou, et al., 2016; Kintsch, 2019; Cain et al., 2001) have shown that students who make these inferences are more proficient readers. That's good news, because skills can be practiced—in this case by being encouraged and shown how to make inferences in context while reading.

The **situation model** goes a step beyond to connect the text base's representation in the reader's mind to the reader's existing knowledge base. In other words, proficient readers fully understand the text base and enrich that understanding with their existing knowledge[1] , thus forming a complete picture of the text. Importantly this knowledge does not replace the text but rather adds nuance, richness, and context. In a sense, it elaborates on the text-base model. Through the situation model, the reader transfers her thinking from short- to long-term memory. This deeper, fuller understanding of what was read is then integrated into a student's ever-evolving knowledge base. It is how the mind ultimately represents the text in all its fullness. The

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[1] Knowledge, background knowledge, and prior knowledge are often used interchangeably. Background knowledge, though, implies what you know from your lived experience. In contrast, prior knowledge and knowledge are more broadly conceived to include lived experience and what is learned from reading or other sources, organized learning, or a combination.

situational model—not the surface level or text base—is what readers use when recalling the text in the future. The situation model develops and is adjusted in real-time as the reader progresses through the text.

It is important to note that all three mental models are in play when a reader is actively reading. Here is another example with all three models in play:

> Consider two proficient middle-school students reading a passage on hibernation. Both could read the words (*surface level*). Both could develop a text base level of the microstructure connecting the relevant propositions (e.g., how hibernation slows down metabolism, its adaptive advantages, dangers from predators while hibernating). Both could develop a text base incorporating the text's structure (concept, examples). But the student who had previously read several texts about bears or was familiar with animals that hibernate from reading or watching nature shows could develop a yet richer sense of hibernation. His knowledge elaborates on the text base without invalidating it. Researchers sometimes refer to inferences that connect to knowledge as "elaborative" inferences. Not all knowledge enhances the situational model, however! If another student connected the text on hibernation to his grandfather's naps, he would not have understood the essence of hibernation. Elaborative inferences only enhance the situation model when they are relevant to the text base—and when knowledge is accurate.

We are talking here about initial reads and rereads, which should always be for students to develop or begin to develop depending on the difficulty of the text a situation model of the information texts are transmitting. There could, of course, be times that teachers ask students to go back to a text for a specific purpose (e.g., explain how a character has changed, identify the main idea) for either a discussion or when being assessed. *But when that one-skill-at-a time instructional method reigns supreme, students' focus will become too narrow to develop a full model of the text.*

It gets little to no attention, sadly, given its instructional implications, but the reading research tells us that texts reflecting a mix of both a students' lived and unlived experiences best support growth in comprehension and building a situation model. Here's why:

- When students read texts *more* reflective of their lived experience, the bridging inferences needed to tie together the text base both between propositions and to the readers' knowledge are more likely to be automatic and more likely to yield a richer, more nuanced situation model. Those texts are easier to read for that student but important in honoring and affirming their experiences and possibly deepening their knowledge base. This has obvious implications for equitable representation of student identities through text selection.

- When students read texts *less* reflective of their lived experiences, they get to exercise the muscles needed to make the more effortful bridging inferences between propositions and to their knowledge. The reading may feel more challenging, but their inferencing muscles have grown more robust in the process. This has obvious implications for varying both topics and text selections so every student has broad exposure to alternative perspectives and unfamiliar topics.

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HOW DOES A READER'S ABILITY TO MAKE BRIDGING INFERENCES STRENGTHEN READING COMPREHENSION?

Oudega and Van den Brock (2018) note that "readers' ability to generate inferences during reading, from background knowledge or information read earlier in the text, is one of the strongest predictors of reading comprehension development." Numerous additional studies (Soto et al., 2019; Kendeou et al., 2016; Kintsch, 2019; Oakhill & Cain, 2012; Kendeou, Bohn-Gettler, White, & van den Broek, 2008; Cain et al., 2001) back up this finding.

Which students effectively make these inferences as they move through a text? And what determines why some do, and others don't or why some do more so than others? Of course, students can't make an inference with knowledge they don't have. And as noted above, you can't glean information about what kind of connection to make if you don't know the meaning of the connecting word or other words relevant to making the inference. On the other hand, having knowledge does not *necessarily* mean students will make the bridging inferences.

Cain et al. (2001), set out to answer these questions in an ingenious experiment. They used two groups of students. They matched each group in decoding, word recognition, and fluency, but one group had strong comprehension, the other weaker comprehension. The research team created an imaginary planet. Both groups had lessons and stories about the fictional planet until, based on assessments of what they had learned, their knowledge of the planet, *including what they remembered*, was equal. Cain et al. found that "less skilled comprehenders' difficulties with inference making were not wholly accounted for by memory for the text or information outside of the text that was essential for inference generation. An analysis of errors revealed that a more likely source of inference-making difficulty for this group was an inability to select the information relevant to making the inference." In other words, "less skilled comprehenders" failed to make necessary inferences or connections to their knowledge of the imaginary planet even though it was clear, based on assessments, that they had that knowledge and their memory of the text was a good as the high comprehension students. They also failed to make inferences among the text's propositions even though their memory of the text was as good as the more skilled comprehenders. Cain et al. attributed this to the idea that "the less skilled comprehenders experienced difficulty in selecting the relevant information on which the inference should be based." Another study, Todaro et al. (2010), had similar findings, noting that "less skilled readers are not as adept at suppressing irrelevant information..."

In other words, these less skilled readers' problems could be twofold. They aren't making necessary inferences because they are unable to:

1. Connect to the knowledge they have about the topic;

2. Suppress irrelevant information or select relevant ideas on which the inferences should be based.

Cain controlled for both the students' memory of the text needed to make inferences between propositions and the knowledge base needed to make inferences to prior knowledge. In our current planet however, a student cannot make these inferences if the vocabulary and knowledge demands are too great for her stores of word and world knowledge to meet (Accelerators #2 and #3). Nor can a student make reading inferences if the words on the page cannot be automatically and fluently processed (Accelerator #1). Thus, growing those stores and building those foundational aspects of reading need to be an essential part of reading instruction *and must be considered first whenever comprehension breaks down.*

Models of reading comprehension clearly show that successful comprehension requires students to use inferences to integrate the text's propositions with their knowledge. In some cases, students can integrate automatically; in others, the task requires more effort (Van den Broek & Helder, 2017). Inferencing skills can be developed and practiced—in this case, by being encouraged and shown how to make inferences in context

while reading with supports from the teacher. Students need to learn to use bits of information when they appear. We also know that when students possess a strong standard of coherence, as discussed in the next section, the integration process is more likely to succeed (Oudega & van den Broek, 2018).

HOW DOES A READER'S DRIVE TO MAKE MEANING STRENGTHEN READING COMPREHENSION?

Strong readers possess a drive to make meaning. Researchers have tagged it as readers possessing a standard of coherence when they read. Standard of coherence is the reader's expectation to comprehend what the author has put before them, and how much they are willing to work for that understanding (Oudega & van den Broek, 2018). When students develop this habit of mind, they expect to get a fuller understanding of what they read than students who haven't yet grasped this conviction. Graesser, Singer, and Trabasso (1994) note that when students' standard of coherence is high, those readers are more likely to use strategic reading in search of the coherence they expect to find.

Students with a higher standard of coherence are more likely to notice if they fail to make a needed inference and more likely to stop and repair whatever is interfering with that understanding. Conversely, Ferreira, Bailey, and Ferraro (2002) note that when readers' standard of coherence is low, they are more likely to be satisfied with a surface "good enough" sense of what they read. When readers have higher standards of coherence, they spend more time, make more connecting inferences, and build more robust mental models of the text (Narvaez, van den Broek, & Ruiz, 1999; van den Broek, Lorch, Linderholm, & Gustafson, 2001; Yeari, van den Broek, & Oudega, 2015). Although this body of research shows that different tasks set before readers will induce different standards of coherence, it also shows that students with higher standards of coherence bring their determination to uncover meaning to any task (Oudega & van den Brock, 2018).

Why do some students have higher standards of coherence than others?

Personality and natural tenacity are likely one answer; however, many young people who are plenty tenacious in some aspects of their lives are quick to abandon efforts to make sense of complex readings when the going gets tough. Most students in our country learn to read and grow as readers during school. Thus, this disposition is most likely an outgrowth of instruction, adults providing encouragement, and what students learn in school. They develop beliefs about themselves as readers who can understand what they read if they work at it (or not). Students can be taught to pay attention to whether they understand and then do something about it when they do not. They can learn these habits through peer and teacher modeling, through lots of chances to process in company, and by teachers encouraging and expecting this stick-with-it-ness from all their students.

An essential part of developing a healthy standard of coherence is for teachers to present students with texts that challenge them. They must also present students with tasks that accompany those texts that give them

a chance to initiate a response on their own or with peers and then refine or affirm that response with teacher feedback (Oudega & van den Brock, 2018). All students must be encouraged to stick with challenging reading and given the tools they need to be successful in all aspects of it.

Comprehension starts to break down or become corrupted when an individual proposition is not understood. That proposition is then either not integrated into the text base or integrated in such a (faulty) way that the reader's text base no longer reflects what the author wrote. The same is true with failures to make necessary bridging inferences between propositions and to prior knowledge.

> ## Students can be taught to pay attention to whether they understand and then do something about it when they do not.

Here again, a reader with a strong standard of coherence is more likely to recognize the breakdown, stop, and go back to make the comprehension repair. Otherwise, the mini-confusions stack up into too formidable an obstacle. When the reader does not have the requisite knowledge to make the necessary inferences, she may be able to use the knowledge she does have. If that is not possible there will inevitably be a breakdown in comprehension. This is why knowledge is so important. But even here a high standard of coherence would make the reader aware of the breakdown and possibly aware of the knowledge she is missing. In the age of Google, this breakdown might be easily patched thus helping to put a student with less knowledge on a more equal plane. Nonetheless, the more knowledge, the better.

Recommendations

How can instruction teach students to deeply comprehend texts? Below are ways for students to build their muscles to generate relevant bridging inferences and cultivate a habit of mind that drives students toward making sense of the text.

The lead approach—stated first—is the most productive and it is not conducive to personalization:

1. EMPHASIZE THE CAREFUL, FOCUSED, COMMUNAL READING OF RICH, COMPLEX TEXTS.

It is impossible to teach students to become great "inferencers" or readers with strong standards of coherence—with very simple texts. It is dreary and unproductive to do with unworthy text. Traditional leveled text programs that limit student reading exclusively to their designated independent or instructional reading level—too often simple, below-level texts—are disastrous for children and contrary

to this research. There is another important implication for how reading instruction should not be approached. Once students know how to decode, if instruction directs students to address specific strategies or standards, developing a standard of coherence becomes nigh impossible. Reading for a single purpose rather than understanding and gleaning information from text is a disjointed, *incoherent* approach, the opposite of what driving for coherence demands. And there is no evidence that limiting students in this way enhances performance as Tim Shanahan has documented repeatedly in his blog posts.

Nevertheless, this kind of one-thing-at-a-time instruction runs rampant in reading comprehension instruction. As explained throughout this discussion, models of comprehension and all the research show that proficient reading requires *integrating and updating* propositions from across the text into the readers' text base and situation model. In other words, readers are continually processing lots of elements of the text to understand the whole fully. If a reader were only reading to determine the relationship between two characters, their focus would be too narrow to develop a model of the text. It would not promote the expectation in students that they *should* develop a full model of the text. Teaching like that does not promote understanding, nor does it build the kind of tenacious drive toward complete understanding that successful readers demonstrate.

Learning how to comprehend text deeply is done via regular doses of communal close reading of complex texts—a mix of texts that are both mirrors and windows to students' identities. Close reading can focus on the text's ideas, their relationship to each other, and the text's central ideas. Asking students to make the inferences necessary to understand and then contrast their thinking with their classmates or their teacher's responses maximizes comprehension (Oudega & van den Broek, 2018) since students can learn from one another and not rely solely on the teacher's interpretations and modeling. This practice can and should be built into close reading instruction as a main ingredient, not a side dish. Teachers can coach students to pay attention to whether they understand and then ask them to do something about it when they do not. All students must be encouraged to stick with reading and given the tools they need to be successful in all aspects of it.

OPPORTUNITIES FOR PERSONALIZATION?

Not generally recommended when text complexity is high. Classrooms are centers of cultural exchange and co-learning. Making sense of rich, complex text must frequently be a social endeavor; not one learned predominantly in isolation where students are left to their own devices. Students can best learn stick-to-it-ness as a habit of mind through peer and teacher modeling in the context of close reading. In a social context, teachers can insist and expect this mindset from all their students. In this context, students could learn to expect the text to make sense and learn how to make the text make sense. Whether tech-enabled tools could ever entice this kind of hard cognitive work better than peers and teacher coaching is doubtful, and at the very least, far off into the future.

Following are some additional methods to boost the comprehension accelerator that are more conducive to personalization[3]:

2. FOCUS STUDENTS' ATTENTION ON TEXT COHESION AND PROPOSITION CONNECTIONS:

While a focus on proposition connections are fodder for good close reading of complex text, there are obvious implications for the power of directly teaching (and practicing) how text connectives work to

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[2] Shanahan on Literacy Blog posts: 8.21.11, 2.7.17, 5.14.17, 1.11.20
[3] Note: These personalization ideas originate from the literacy research and their promise comes from how closely they hew to that research. There is not yet a separate personalization research base to support them, nor have they been brought into scalable form for classroom use.

assist understanding. Any student who may not have much experience with connective words, especially the fancier versions within each category, e.g., students who know *but* may not know *to the contrary*, will benefit. They need to understand the role these words play in carrying meaning. Connections can be explicit or they might be subtle. The author can signal to the reader how one idea in a text connects to another or be more inferential, leaving it to the reader to figure out (infer) the connections. The ease or difficulty of connecting propositions or ideas units inside the texts depends on several text features psychologists refer to collectively as cohesion. These are the features of the text that help tie it together. In terms of comprehension models, cohesion elements are the text features that make it easier to connect the network of propositions in the text base. There are two kinds of cohesion: referential and global.

· Referential or local cohesion: Referential cohesion is the repetition or overlap of words, phrases, or clauses from sentence to sentence. They can be sentences that are adjacent or farther away. The closer the sentences are that reference each other, the easier the text is to read.

· Global cohesion: Global cohesion is the language used to help readers tie together propositions throughout the text. As noted earlier, these text features are called connectives, and researchers have identified various types. Causal connectives are terms such as: *because, consequently, as a result, thus*. There are also temporal connectives (*later, afterward, earlier, during*); sequential connectives (*first, second, next, last, "from here on"*); additive connectives (*additionally, furthermore, moreover, both, what's more*); adversative connectives (*but, however, yet, although, nevertheless*). Connectives can also signal central ideas (e.g., "Despite these setbacks, their success was enormous").

A failure to attend to connectives can cause catastrophic failures in students' integrating propositions within the text base. They are the fodder of good close reading since every student deserves to be initiated into their importance. English learners have particular need to have connectives and their function in context explicitly pointed out to them by peers or teachers whenever text is being discussed.

OPPORTUNITIES FOR PERSONALIZATION?

Yes! Following close reading lessons, personalized and targeted practice with the meaning and import of referential and global text connections would advance students' abilities to make sense of text.

Looking for local or global cohesion can benefit from targeted teaching and practice—human or tech-enabled. One can imagine paper-based exercises and computer programs that supply this practice in lively ways. Experimental intelligent tutoring systems such as those designed by Danielle McNamara like SERT (self-explanation and reading strategy training), and iSTART (Interactive Strategy Training for Active Reading and Thinking), and others prompt and respond to student explanations of what they are reading. When the descriptions indicate students have missed a connective, these programs can point the student in that direction. McNamara's work with iSTART and SERT has shown promise through tech-enabled programs in encouraging the sort of self-explanations that lead to the development of a more robust and accurate text base and situation model. These intelligent tutoring systems can be used with any text and can support reading core texts or supplementary texts connected to topics being studied.

3. CONNECTED TO #2 ABOVE, TEACH STUDENTS TO DISTINGUISH BETWEEN RELEVANT INFORMATION NEEDED TO CONNECT A GIVEN TEXT PROPOSITION AND DETAILS THAT ARE EXTRANEOUS

Students benefit from teacher and peer support here; they benefit from whole class or small group work. With expert instructions, students can learn from one another about what to pay attention to and what to set-aside as they explore rich, compelling, complex texts.

OPPORTUNITIES FOR PERSONALIZATION?

Perhaps. Students need and deserve lots of explicit instruction in this area to accelerate literacy. Tech-enabled instruction is just beginning to emerge from experimental studies that can be a slice of students' instruction and provide them with targeted practice on what the class is doing.

Imagine programs that regularly follow up to provide students with practice inference-making in the context of these texts. They learn with feedback when selecting relevant information from less relevant and how it connects propositions in the text necessary for comprehension. Further, it could alert students as to how and why they may have gone astray in this process. As noted above, some ITS programs show promise (SERT and iSTART) in helping students see when they did not make the needed connections.

WHAT HAPPENS NEXT?

Once you have identified that you want to pursue a personalized approach and you have determined that it is tangibly tied to one or more of the literacy accelerators, ask yourself whether it:

1. **Advances the right content for your students?**

2. **Promotes equity and counteracts bias in both the assignment and delivery of the chosen instruction?**

3. **Offers opportunities to elevate student interest or agency in their own learning?**

4. **Is easy to use and implement?**

(*See the Consideration Questions (Appendix A) for more detailed reflections.*)

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