Reading science and educational practice: Some tenets for teachers

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Abstract

We are pleased to contribute to this inaugural issue of The Reading League Journal. The journal's goal is to share information about linking reading science to educational practice. The need is great: literacy levels in the US are shockingly low; a very large percentage of children and adults have only basic reading skills, as indicated by every systematic survey over the past 40 years. Reading achievement as measured on the National Assessment of Educational Progress (NAEP) and other assessments shows that the number of poor readers (basic and below basic levels) is larger than the number of good readers (proficient and advanced). These results can't be blamed on the test (e.g., because the NAEP scored too harshly) because the same pattern has been observed with different assessments, administered by different organizations, with children of different ages and with adults, over several decades.

Keywords: Reading development · Reading instruction · Cognition

Reading science and educational practice: Some tenets for teachers

Low literacy has multiple causes. The one that receives the most attention is poverty, which has an enormous impact on literacy, education, and every aspect of health and well-being. How reading is taught is not the immediate issue for children who do not attend school regularly because they are homeless, or face other circumstances that interfere with education. However, it doesn't follow that all children from poor backgrounds are alike, or that they are any less entitled to education, which assumes far more importance for them than for children from more advantaged backgrounds. Moreover, low literacy is not limited to poor children or children from ethnic/racial minorities: levels of proficient/advanced reading are low across income levels and ethnic/racial groups. Finally, educational practices can amplify the effects of economic inequality, as when they rely on parents and other caregivers to provide support in the form of additional instruction and practice, and access to resources such as a home computer and Internet access. These resources are not available to all.

A second important factor is the disconnection between what we have learned from basic research on reading, language, and learning, and what happens in the classroom. Hundreds of institutions offer programs leading to teacher certification, and there are exceptions to every generalization. It is certain, however, that almost no programs for general education reading teachers routinely include coursework in modern developmental psychology, linguistics, and cognitive science relevant to the craft of teaching children to read.

Rather than learning about this extensive body of research and exploring how it could be incorporated into classroom practice, prospective teachers are told it can be safely ignored. Instead they are exposed to a few core ideas from accepted authorities. For children's cognitive and social development, they are figures such as Dewey, Vygotsky, and Montessori. For reading, they are people such as Goodman, Smith, and Allington, who continue to promulgate beliefs about reading and instruction long after they had been disproved by empirical research. This message is being carried forward by the many "experts" they trained. Their education leaves most new teachers underprepared for the job and beholden to discredited beliefs about reading that make it harder for them to help all of their students to succeed at reading. Of course, many teachers are highly effective nonetheless; the need is for better training and in-service support to make this the norm

rather than the exception. This situation has been thoroughly documented (Goldstein, 2014), and is supported by observations of teachers themselves (Salinger et al., 2010).

Bringing what is known about reading, language, learning, and child development into teacher education and instructional practices would have enormous benefits, and gaining recognition of this fact from educators is still an enormous obstacle. Another limitation, however, is that there is not enough research on how to translate scientific facts into effective practices. Even the simplest, most basic findings are consistent with many practices that will not work equally well. For example, we know, about as definitively as science allows, that children who are better readers have achieved closer integration of spoken and written language, as seen in behavior and underlying brain organization and function (Seidenberg, 2017; Shankweiler et al., 2008). It follows that educational practices should promote this development, but it then has to be determined how to do so in ways that are effective and sustain children's motivation by being engaging and allowing them to succeed.

Research at the interface between science and practice has been another casualty of the "reading wars." In the meantime, sharing of information in forums such as this journal is important. To be fruitful, the discussion needs to include both educators and scientists; by doing so, we can avoid the propagation of misinformation that can arise in close-knit "communities of practice."

That also means that, as cognitive science researchers, we can share useful information but cannot tell practitioners how to run their classrooms. We only represent one side of the science-education dyad. With that caution in mind, we would like to offer some observations about translating science to practice for educators who want to engage what may seem like a daunting body of science. We call these "tenets for teachers," but they are only rules of thumb and observations that are common knowledge among reading scientists, but less widely known in education. We hope they will become part of an on-going discussion, in this journal and elsewhere.

Tenet 1: "Evidence-based" doesn't mean "true."

Science is based on evidence but scientists don't treat all evidence equally. Conducting a study and publishing the results is the first step, but it then has to be determined whether the results and conclusions are valid. That means repeating the study

many times, in different labs, with different procedures and participants. We look for multiple studies that converge on the same conclusion. The results of individual studies may be surprising, exciting, sensible, or intriguing but never definitive.
Finally—surprise!— some published studies turn out to be wrong (a hazard not limited to reading science). The first questions to ask about a new study with a novel finding are, how was the study conducted and what have other studies shown?

At this point, "evidence-based" is a buzzword that says very little. Every reading curriculum and instructional practice is claimed to be "evidence-based." When everything is "evidence-based" it is necessary to look past the label and examine the actual evidence, how the study was conducted and by whom, whether the data support the conclusions and how the results relate to other studies of the same thing. Look for the reviews of the research in an important area that are frequently published.

Tenet 2: Teachers can make use of scientific findings, but be cautious.

You do not have to be a cognitive scientist or neuroscientist to make use of scientific findings (though it helps to think like one). The challenge is to find the secondary sources (books, articles) written by people who are reliable sources and good communicators. The same holds for websites and materials developed by seemingly authoritative organizations. The curse of the Internet is that there is so much information available it is hard to know who to believe. Our advice? With books and, especially, the Internet, you have to be an active, critical-minded consumer. Trust, but verify. Ask yourself questions like these:

a. Who is the book's author and what is their expertise?

b. Is the source a scientist or academic with relevant expertise, or a self-invented expert with a background in new age thinking? Are they promoting their personal "Readers are from Venus, Writers are from Mars" story, or do they offer conclusions based on a synthesis of findings from multiple studies?

c. On websites related to literacy, look first at the "who we are" page. Are the creators of the website or content identified by name and are their bios included? They should be. Are they businesspeople moving into the enormous educational marketplace or a team with business, scientific, and educational expertise?

d. Is the source selling a product or a non-profit that provides free information and tools?

e. How long has the organization been doing its work? Readingrockets.org has been creating and curating reading-related content since 2001. Contrast that with my-new-theory-of-dyslexia-and-buy-my-merch.com and similar web sites. Unfortunately, they greatly outnumber the reliable sources. The websites for organizations such as the National Institutes of Health, the American Academy of Pediatrics, and the International Dyslexia Association include material for parents and teachers that is informative, reliable, and readable. There are others of this quality.

On the science side, not everyone agrees about every detail, but that is normal: if the science is progressing, facts accumulate and theories (explanations) change. When researchers disagree, we have to look at why. Resolving those disagreements is important to advancing the science.

Tenet 3. Teachers are cognitive theorists.

Deciding what to teach, when, and how depends on your understanding—theory—of what needs to be learned (e.g., to become a skilled reader), how it relates to other types of knowledge (e.g., language, genre, topical, other "background knowledge"), how children learn, and how learning changes with development. The science is relevant because it can help you develop ideas about reading, learning, and all the rest that have a factual basis.

Like other theorists, teachers need to update their beliefs as knowledge increases. Creating a personal instructional educational philosophy and then only attending to evidence that seems to support your view amounts to closing one's mind to new ideas and discoveries. Teachers need to be comfortable challenging their beliefs and asking questions such as: What am I teaching? Why am I teaching it? How do I know that my approach is effective? Is my thinking consistent with other things researchers know about reading, language, and learning? The goal is not to make life hard for yourself; it is to be able to increase your effectiveness by absorbing new information when it is available. Learning is a lifelong activity; so is learning about learning.

Tenet 4: Reading problems are not necessarily about reading.

Reading depends on spoken language. A child does not re-learn a language when they learn to read; they link what they have learned from talking and listening to what they are learning about print. By the time they start school, children's spoken language skills differ; some know more words about more things and have more ways to express themselves. These differences arise from a range of factors, including characteristics of the environment and the child and how both change over time. The important point is that children already differ in ways that will affect their progress in learning to read on the first day of kindergarten. Some children are primed to succeed, others are more likely to struggle. Thus, some reading problems arise from issues in areas upon which reading depends, such as spoken language. Some struggling children may need more help with an enabling skill, such as language, than with learning about print.

We are particularly concerned about pedagogical practices in some schools that limit children's opportunities to engage in conversation, with teachers or peers. Spoken language development depends on experience. The language environment in the classroom is crucial. Opportunities for language development are missed in classrooms in which children are only expected to speak when they are asked to, or in schools where conversation is disallowed in the halls or at "silent lunch." Spoken language develops through active use: asking questions, having a conversational exchange, making observations, adding to a discussion, expressing feelings, and describing actions and situations. A richer spoken language environment leads to greater knowledge of spoken language which then facilitates learning to read, which depends on it.

Tenet 5. Skilled word reading is like a reflex.

Once the mental and neural processes involved in reading a word are triggered (by focusing on it) they occur rapidly and without conscious effort. When you look at a familiar word, you cannot help but recognize and understand it. This is a good thing, the result of enormous amounts of reading experience that fine-tune the underlying neural machinery. The processes involved in reading words (and sentences and texts) are largely subconscious: we are aware of the outcome—comprehension—not how it was achieved. The goal is to find ways for children to gain this skill.

What is the opposite of a reflex? Sherlock Holmes deducing the solution to a crime

by making logical connections between clues. Deduction is slower, requires effort, and, unless you are Sherlock Holmes, often fails to yield the correct answer.

The pedagogical practice of teaching children how to deduce the pronunciation or meaning of a word using a variety of cues—guessing based on the linguistic context, the pictures in a book, knowledge of the topic, the initial letter of a word—encourages a strategy that is slow, laborious, and less accurate. How using such explicit strategies advances the goal of reading automatically and without conscious effort is unclear; no known theory explains how one approach could lead to the other. The Nobel Prize-winning psychologist Daniel Kahneman (2011) distinguishes between "fast" and "slow" cognition, separate but complementary systems with distinctive characteristics and different neural substrates. Methods such as three-cueing and other conscious, strategy-based approaches make use of the slow system. The goal, however, is to develop the "reflexive" reading of words supported by the fast system.

Tenet 6: Most learning is implicit, but explicit instruction matters.

Most of the knowledge that supports reading is learned implicitly. In other words, such knowledge is gained as we are engaged in tasks like reading and writing, talking and listening, and using written and spoken language for varied purposes. The amount we engage in these tasks is therefore crucial to developing skill. Consider vocabulary development. Children learn few of the words they know through direct instruction, if only because there are far too many to teach in the limited time available. Explicit instruction is nonetheless helpful: the impact of vocabulary instruction extends beyond the specific words that are taught, because it also paves the way for learning many additional, related words very quickly. This combination of a large amount of implicit learning plus timely, targeted explicit instruction is also the recipe for learning spelling-sound correspondences: phonics. Explicit instruction on specific words or patterns "scaffolds" the learning of many others.

Tenet 7: Balancing implicit learning and explicit instruction is hard.

Although both explicit instruction and implicit learning are both essential, there are differing views about the balance between the two. At one extreme are theorists who think that "children teach themselves to read" if they have sufficient opportunity to practice. This view underlies Krashen's (1993) advocacy of "free voluntary reading." The opposite

extreme emphasizes explicit instruction to the exclusion of other types of learning experiences. We are thinking here of phonics curricula that entail instruction on large numbers of rules (including all of the potential pronunciations of isolated vowels). Here is a spelling lesson from a popular instructional program: "Listen to this word: BUZZ. You need to double the final letter when you hear the "z" at the end of a one syllable word right after a short vowel." That rule is 25 words long and hard to comprehend or remember. Think of how many such rules are required to spell common words in English. That approach leans way too heavily on the "explicit" side. The optimal balance is somewhere between these extremes. The issue has been studied in the field called "machine learning," which is the study of computer systems that learn. The procedures used in training these systems are closely related to the ways that humans learn. For many types of problems, the most efficient type of learning is what is called "semi-supervised." It is our best account of the balance between explicit and implicit learning. For problems such as learning how to pronounce letter strings (or spell), a large amount of implicit learning combined with a smaller amount of explicit instruction seems to be optimal.

Tenet 8: "Components of reading" are for teachers, not for children.

Reading has components but the components are not independent and taking them as the targets for reading instruction is a mistake. Consider the Big 5 components identified by the National Reading Panel (NRP). The NRP did a fine job summarizing findings about important elements of beginning reading, but the report said little about pedagogical implications because that was not their assignment. In some contexts, such as professional development courses for teachers, they have been conceptualized as the "5 Pillars of Reading Instruction." In extreme cases that we have observed, each component is taught separately: 10 minutes a day on phonemic awareness, 15 minutes on phonics, 15 on fluency, and so on. This is a misapplication of the findings. Reading does incorporate the 5 components but the further assumption that they are skills to be taught is not warranted. Riding a bicycle is a complex event governed by physics, geometry, air resistance, gravity, conversion of human energy into kinetic energy, and more. All true, but irrelevant to teaching a child to ride.

Well, that is a start. The list could be longer, but this article cannot. We have included observations that are familiar to scientists and perhaps less familiar to

practitioners. Now that we share this knowledge we can explore the implications for classroom practices and decide how to determine what works. Consider this the kickoff to a longer discussion.

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