‘Elbow Room’: How the Reading Brain Informs the Teaching of Reading

Maryanne Wolf

The Albert Shanker Institute, endowed by the American Federation of Teachers and named in honor of its late president, is a nonprofit, nonpartisan organization dedicated to three themes—students' education, unions as an advocate for quality, and both civic education and freedom of association in the public life of democracies. Its mission is to generate ideas, foster candid exchanges and promote constructive policy proposals related to these issues.

The institute commissions original analyses, organizes seminars, sponsors publications and subsidizes selected projects. Its independent board of directors is composed of educators, business representatives, labor leaders, academics, and public policy analysts. This document does not necessarily represent the views of the members of its board of directors.

Copyright and Permissions

‘Elbow Room’: How the Reading Brain Informs the Teaching of Reading

Maryanne Wolf

September 2025

About the Author

Maryanne Wolf is a scholar, a teacher, and an advocate for children and literacy around the world. She is the Director of the Center for Dyslexia, Diverse Learners, and Social Justice at the UCLA School of Education and Information Studies. Previously she was the John DiBiaggio Professor of Citizenship in the Eliot-Pearson Department of Child Study and Human Development at Tufts University. She is the author of Proust and the Squid: The Story and Science of the Reading Brain (2007, HarperCollins), Dyslexia, Fluency, and the Brain (Edited; York, 2001), Tales of Literacy for the 21st Century (2016, Oxford University Press), and Reader, Come Home: The Reading Brain in a Digital World (August, 2018, HarperCollins).

She has received multiple awards, including the highest awards from the International Dyslexia Association and the Dyslexia Foundation for her research on cognitive neuroscience and dyslexia. For her teaching she received the American Psychological Association and the Massachusetts Psychological Association awards for Distinguished Teacher of the Year. For her work on the impact of digital mediums on reading, she received the Walter Ong Award and the Alfred Korzybski Award. For her translational work for education, she was awarded the Benita Blackman award for contributions to literacy instruction. She is a Fulbright scholar and the author of over 170 publications on literacy, the reading brain, dyslexia, and reading in a digital culture. She was recently named a permanent member of the Vatican's Pontifical Academy of Science.

Acknowledgments

I wish to acknowledge the support of both the National Institute for Child and Human Development for grants to my esteemed colleagues and co-authors, Dr. Robin Morris and Dr. Maureen Lovett, for studies on multi-component intervention, and the Office of Special Education Programs for studies of differential intervention. I am indebted to my colleagues at the UCLA Center for Dyslexia, Diverse Learners, and Social Justice: Laura Rhinehart, Rebecca Gotlieb, Sue Sears, Veronica Pedroza, Trang Nguyen, and Young-Suk Kim. I am grateful to Susan B. Neuman and Claude Goldenberg for their valuable feedback. I thank Esther Quintero and Mary Cathryn Ricker of the Albert Shanker Institute for their exceptional support and guidance in the publication and dissemination of this paper. I am grateful to all the teachers I have known. I will always be in their debt.

Cover art by Ben Wolf Noam.

Report design by Megan Gilmore.

"Blame no one. But set the record straight."
—Marcus Aurelius

My first goal in this paper is to use evolving knowledge about the developing reading brain to illumine how differing perspectives about the ways children best learn to read might be brought together. Toward that end, I describe both an expanded view of foundational skills and a more elaborated understanding of deep reading comprehension, the ultimate goal of all approaches. My second goal is to give every teacher something new to learn and something valuable to contribute. As the poet Rilke wrote about the life of a writer, and what I hope for every teacher's life of learning: "Be a beginner; always a beginner."

Origins of an Unnecessary Divide

For over half a century a divisive, Hydra-headed type of debate over the teaching of reading continues to divide our nation's educators. Framed as "the great debate" by reading scholar Jeanne Chall (1970, 1983), there are deeply held philosophical and pedagogical differences on how children best learn to read. At the most basic level, the debate revolves around how the alphabetic principle is best acquired. The alphabetic principle refers to the understanding that in an alphabetic writing system (e.g. English, Korean, Arabic), the sounds (phonemes) of spoken language are represented by written symbols. It is the cognitive insight involved in making this connection that enables us to learn to read. Proponents of the explicit teaching of the alphabetic principle emphasize direct instruction for the child in foundational skills like phonics, phoneme awareness, fluency, and decoding. By contrast, advocates of whole-language approaches emphasize the ability of the learner to *induce* the alphabetic principle through reading "authentic literature" and through close attention to meaning and words. More philosophically aligned with whole-language approaches, balanced literacy methods were originally aimed at a better balance, but over time typically provided insufficient systematic instruction about how children learn to decode with more emphases placed on stories and writing.

The debate has resurfaced in recent years and has been the subject of considerable, heated public attention. Parents, school boards, and policymakers ask why so many children today are ill-prepared in reading skills, with all the life-altering consequences this has for every aspect of children's learning and indeed for our society. The release of the most recent data from the National Assessment of Educational Progress (NAEP, 2025) highlights not only the very disturbing literacy levels of fourth- and eighth-graders in the United States, but also the fact that eighth-grade children are reading at the lowest levels in more than three decades and fourth-graders at their lowest levels in two decades.

There are multiple external factors for these unacceptably low literacy levels—from the consequences of the COVID-19 pandemic to excessive digital exposure (Wolf, 2025). Yet the central question for many remains: whether the way children are being taught to read is the major factor in the decline. There is increased scrutiny by parent groups, policymakers, and journalists (see Emily Hanford, 2022) on programs that neglect or eschew both foundational skills and the science behind them. Support has grown across many states for what is now called the science of reading (SOR).

> [The science of reading] refers to a body of knowledge based on decades of empirical data from various disciplines that supports the importance of the explicit, systematic teaching of phonics and of multiple foundational skills for most readers.

Unfortunately, for many educators, SOR has become reduced simply to phonics, which, however necessary, is only one part of the foundational skills the historically broader science indicates. Indeed, SOR refers to a body of knowledge based on decades of empirical data from various disciplines that supports the importance of the explicit, systematic teaching of phonics and of multiple foundational skills for most readers.

Under the direction of leaders like Reid Lyon, Peggy McCardle, and Brett Miller at the Eunice Kennedy Shriver National Institute of Child Health and Human Development (NICHD), years of rigorous, randomized control-treatment intervention studies illumine not only the efficacy of phonics approaches over more inductive approaches like whole language and balanced literacy (McCardle & Miller, 2009), but also the increased efficacy of multicomponent approaches that embody an expanded, integrated view of multiple foundational skills over phonics-only approaches (Morris et al., 2012; Lovett et al., 2017; Lovett et al., 2022; Fletcher, Savage, & Vaughn, 2020).

These multicomponent, NICHD-funded programs have been underappreciated and insufficiently known outside scholarly circles (Fletcher et al., 2020). The results of these studies could not be more important in this moment of time. First, they present rigorous evidence for expanding the knowledge of all teachers and, in the process, improving the current reading levels of children, particularly struggling readers. Second, and equally important, they provide a theoretical framework for potentially bridging the divide between approaches.

As a scholar of the reading brain and co-author of several of these intervention studies, I want to describe first an expanded conceptualization of foundational skills and fluency that underlies these multicomponent programs. Second, based largely on the emerging reading brain's development, I describe a developmental approach to integrating these foundational skills with a more comprehensive view of the deep reading, comprehension processes used in the connected text of stories and literature. In essence, such a re-conceptualization connects the various processes in the reading brain and, in the process, has the potential to connect largely separated emphases in the different reading methods used by many teachers.

Multicomponent Intervention

This term originated in NICHD randomized control treatment studies (RCT) by Morris, Lovett, and Wolf (2012; 2018; 2022) in which interventions were constructed to simulate the multiple component processes in the developing reading brain. The goal was to study the potential for added efficacy over more unidimensional, structured phonics approaches. Evidence for the two created interventions (RAVE-O and Empower; see References for additional information) demonstrated the increased efficacy of addressing both phonics and specific, multiple processes for post-test measures of decoding, fluency, and comprehension. For example, the POSSUM acronym refers to the multiple individual processes (Phonology, Orthography, Semantics, Syntax, Understanding, Morphology) addressed in the RAVE-O Program which showed differential effects for vocabulary growth and comprehension. An important feature of multicomponent approaches is their ability to address specific areas of strengths and weaknesses of individual children as these change over time with instruction.

Toward an Expanded View of Foundational Skills

I'll begin as Emily Dickinson might have responded, had she been a neuroscientist instead of a poet: "Tell all the truth, but tell it slant; Success in Circuit lies."

In this paper, the *circuit* refers to the brain's circuit for reading. This circuit is, in reality, a circuit of circuits, each of which involves processes that already existed

before reading was acquired (Wolf, et al., 2024; Gorno-Tempini, 2024). The "slanted truth" is that, unlike oral language, there is no genetic program for written language to unfold naturally in the child. Reading is not natural at all. Rather, it is an invention that the brain learns due to a wonderful design principle, which allows the developing brain to form new connections among its original, genetically programmed processes like language, cognition, and vision. In other words, when a child learns to read, the brain learns how to *connect the multiple processes* that contribute to a new circuit for written language. It is one of the too little-sung miracles that young human beings can build a brand new circuit for reading that will elaborate itself over time with everything the readers read.

Reading is not natural at all. Rather, it is an invention that the brain learns due to a wonderful design principle, [...] when a child learns to read, the brain learns how to *connect the multiple processes* that contribute to a new circuit for written language.

The *elaboration of this circuitry over time* is key to achieving expert, proficient reading, the level of reading that an ever smaller minority of American eighth-graders are reaching. In the beginning of acquisition, an array of sublexical processes like letter-sound correspondence rules and phoneme awareness will contribute to very basic decoding of words. When these processes become rapidly connected with other language processes at the word level, attention can be allocated to more sophisticated cognitive, linguistic, and affective processes when reading connected text. Attaining such a level of fluency requires the rapid integration of multiple processes like semantic, syntactic, and morphological awareness at each of the letter-sound, word, and connected text levels (Hasbrouck & Glaser, 2019; Orkin et al., 2022; Wolf & Katzir-Cohen, 2001; Young & Hasbrouck, 2024).

Our understanding of foundational skills has changed over time from the more traditional view that was articulated by the National Reading Panel two decades ago. Emphases in that view included phonics, phoneme awareness, vocabulary, fluency, and decoding. In a more expanded view, each of these areas is broadened, deepened, made more specific and more inclusive of spoken language processes.

In the rest of the paper, I want to unpack this conceptualization of expanded foundational skills and of the reading circuit. In so doing, I hope to illumine how the developing circuit includes the major emphases in the seemingly divergent approaches: specifically, the critical role of foundational skills (as seen in systematic, structured literacy approaches) and the critical role of word- and text-level knowledge (as seen in balanced-literacy and whole-language approaches).

The Origins and Development of the Reading Circuit

Before any child learns to read, the major requirement for the first reading circuit is that all its parts are developing in the period from birth to age 5—that is, before any attempt to connect them to each other in formal teaching. These essential component parts are the precursors of the reading circuit. They include an impressive range of cognitive, linguistic, motoric, and affective processes, beginning with language processes from phonological and semantic processes to syntactic and morphological ones. Morphology, mind you, begins before a child enters preschool with 20 morphemes or more acquired in the first two to three years (Berko Gleason, 1958). Together with these language processes, cognitive processes build both background knowledge and important conceptual knowledge that gradually lead to the child's grasp of the alphabetic principle. Three concepts are critical and emerge over this early period: (1) that words represent things and thoughts; (2) that words are made up of individual sounds; and ultimately, (3) that these sounds are represented by letters, which when written together make words. These three cognitive

Three concepts are critical and emerge over this early period: (1) that words represent things and thoughts; (2) that words are made up of individual sounds; and ultimately, (3) that these sounds are represented by letters, which when written together make words. These three cognitive insights form the basis for the *alphabetic principle that is at the heart of learning to read.* They are the equivalent of the Helen Keller epiphany of early childhood.

insights form the basis for the *alphabetic principle that is at the heart of learning to read*. They are the equivalent of the Helen Keller epiphany of early childhood.

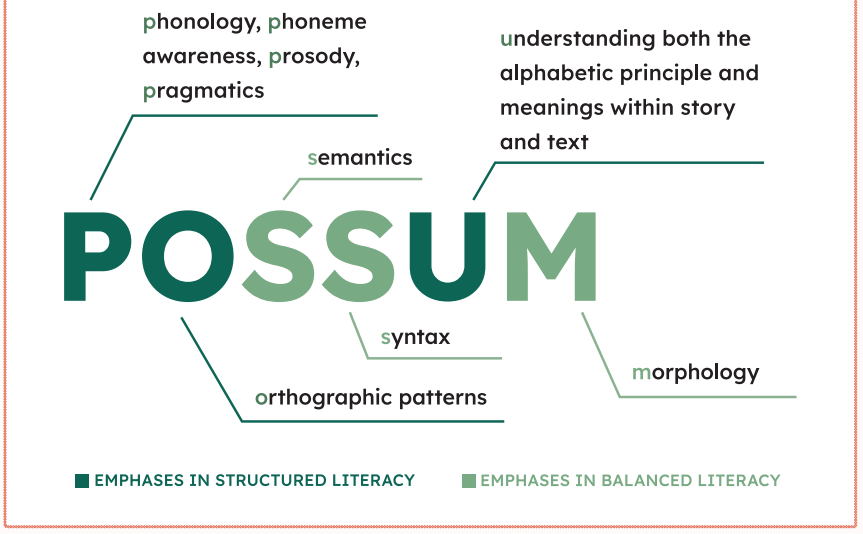
Like Carol Chomsky (1972) years ago, Herron and Gillis (2020), and their colleagues emphasize the importance of early encoding as a portal to children's understanding of the alphabetic principle in early reading. As seen in children's first attempts at writing (recall Glenda Bissex's impatient child writing, *R U DF!*), encoding involves knowing that speech sounds can be represented by the letters the child writes. Years before this happens, all the things that parents and early childhood educators provide by simply reading, talking, and singing to their children will increase the child's knowledge about books and the words, sounds, and letters found within their pages. In other words, the richness of the child's language environment, whatever the first, second or third language in the home, prepares the child to encode and can accelerate or impede the time when the alphabetic principle is gained. It is unacceptable in American schools that later reading levels can be predicted by the ZIP codes of early childhood.

Inequities within our children's environments will, therefore, prevent ensuring that all of the early contributing parts of the first reading circuit are developing in the period from birth to age 5. The development of reading (regardless of approach and regardless of first or second language or dialect) begins before any child opens the kindergarten door.

Within that context, the first nascent circuit in the reading brain is based on both the early development of its still unconnected, individual process parts and the gradually dawning epiphany about the alphabetic principle. Helping young children make that epiphany by connecting those original circuit parts is at the essence of teaching a child to read. I have used the acronym POSSUM as a mnemonic to encapsulate the contributing component parts in this first circuit: **P** (phonology, phoneme awareness, prosody, pragmatics), **O** (orthographic patterns), **S** (semantics), **S** (syntax), **U** (understanding both the alphabetic principle and meanings within story and text), **M** (morphology). For those who would disdain a marsupial acronym, consider that the Latin word *possum* means "to enable."

Teaching the child to connect the first parts of the circuit is akin to providing children with the lower rungs of a "ladder to reading" (see Young & Hasbrouck, 2024). Although some children can leap upward without much help, the majority of children need these

FIGURE 1



lower rungs to learn to connect processes ever more rapidly to each other and to connected text. As the circuit parts become increasingly automatic, the reader has precious more milliseconds of time to allocate attention to the more sophisticated cognitive, linguistic, and affective processes used for comprehension of stories. All of these processes, in turn, *enable* the elaboration of the reading brain circuit over time.

> It is insufficiently emphasized that the more one knows about a word, the faster and better the word is read and understood. This too-little-known dimension of SOR has important implications for multilingual readers who may have less knowledge about English words to bring to decoding.

As demonstrated in decades of research, this developmental process is jump-started through approaches that emphasize the direct teaching of the connections between the visual representations of letters and the phoneme-based representations of the sounds of their language. Phonics-based approaches revolve around building up these connections. In approaches like whole language and balanced literacy, these earliest connections between letter and sound and the kind of epiphany experienced by Helen Keller are often insufficiently or unsystematically taught (sometimes not at all). As discussed earlier, this neglect is based on the assumption that the child will *induce* these connections for themselves through exposure to the world of words and stories and be the better for making these connections on their own. It is an intrinsically compelling, even romantic view of learning that has understandable appeal. Unfortunately in such an approach, the research evidence behind it is missing along with three key foundational skills: phonology, orthography, and often enough, the conceptual understanding of the alphabetic principle—the P, O, and U of POSSUM. Although any emphasis on stories contributes to the ever important joys of reading, a great percentage of early readers are never directly taught three of the most important parts of the circuit within this teaching method.

By the same token, many early readers who are taught solely with phonics-based methods can have other parts of the circuit insufficiently learned and connected: specifically, the SSM of POSSUM. For readers to form an increasingly elaborated reading circuit, they require not only explicit emphases on phoneme representation (and its awareness), letter-sound knowledge (and its awareness), but also multiple aspects of spoken word knowledge. The most typical definition of foundational skills (the focus of most phonics-based approaches) includes phoneme awareness, letter-sound correspondence rules, decoding and fluency, with some attention to vocabulary. With the exception of some excellent systematic literacy approaches, most phonics instruction does not give sufficiently explicit attention to connecting decoding processes to the various semantic, syntactic, and morphological aspects of word knowledge, all of which contribute to fluency at both the word and connected text levels. Further, there is often insufficient attention to immediately applying fluent decoding skills to stories and connected text – an area where balanced

Helen Keller Epiphany

The pivotal insight that things like ponies and dogs have names is an experience in every child's life similar to what Helen Keller, who was deaf and blind, must have experienced when she first realized that water – her tactile experience of it – had a name, a label that she could communicate through sign language to everyone. The special quality of this insight is based on the brain's ability to connect two or more systems to make something new. Thus, underlying Helen Keller's epiphany and a child's understanding of the alphabetic principle is the young brain's ability to connect and integrate information from several systems: vision, cognition, and language.

literacy and whole-language trained teachers excel. The skills of these teachers should never go unutilized.

It is insufficiently emphasized that the more one knows about a word, the faster and better the word is read and understood. This too-little-known dimension of SOR has important implications for multilingual readers who may have less knowledge about English words to bring to decoding. The more all our children know about how the English language works, the better all reading will be at word and connected text levels.

How the First Circuit Teaches Every Child

An understanding of the many processes in the first reading brain circuit has the potential to expand our teachers' conceptualization of foundational skills that, in turn, will help more children learn to read, particularly those who fuel the NAEP scores lowest levels. As alluded to in the introduction, compelling data on multi-componential intervention approaches from randomized- control-treatment studies—the most rigorous, gold standard of research methods—illustrate that the more learners know about a word before they decode it, the more accurately and fluently all children will decode and understand it (see Lovett et al., 2017, 2022; Morris et al., 2012).

Such an expanded view of foundational skills reflects a broader, still evolving view of the science of reading that has inaccurately been understood by many to be a one-dimensional emphasis on phonics and phoneme awareness. In no way does this diminish the importance of either; rather, it expands and connects these crucial emphases to our current understanding of how more comprehensive, *multicomponent instruction and intervention* align with the first reading circuit (see examples

A Word About Fluency

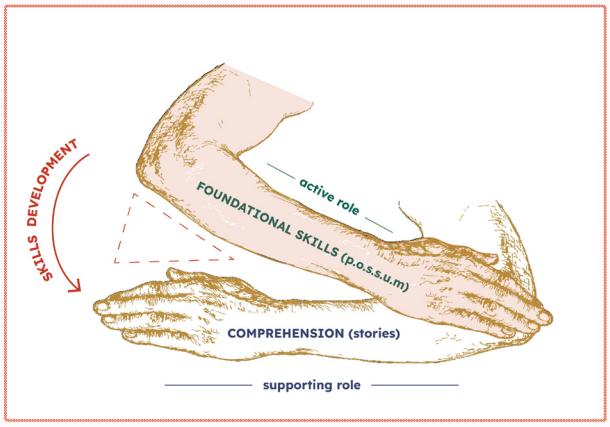
As noted more than 40 years ago by Allington (1983), fluency continues to be one of the most misunderstood and neglected aspects of reading development regardless of approach. Fluency is not simply a matter of increasing the speed of word recognition; nor is it helped much by the repeated reading of random texts that flows from this older view (Orkin et al., 2022). Rather, fluency is both the sum of multiple, contributing foundational processes, as well as the consequence of multiple exposures to words and texts (Wolf & Katzir-Cohen, 2001). Semantic development and syntactic knowledge make critical contributions to the speed with which words are accurately and fluently recognized, whether at the word or text levels. Equally important, they are also essential for the speed of understanding the word. As Connie Juel memorably opined years ago (2005): The biggest mistake most early instructional approaches make is to assume that when children decode a word, they know the word.

Some phonics-based programs overlook the roles that knowledge of spelling patterns (orthographic information), the meaning or meanings of words (semantic information), their syntactic function, and word parts (morphological knowledge) play in building fluency at both the word level and connected text levels. As Ehri (1995, 2005, 2014) has described developmentally, the systematic learning of letters, letter-sound correspondence rules, common orthographic patterns, and early sight words provides the equivalent of visual chunks, whose multiple exposures over time become the basis for "orthographic mapping" and more proficient decoding. When taught from the start, learning to recognize the most common morphemes further enhances rapid orthographic mapping. Indeed, just four of the most common morphemes (e.g., s/es, er, ed, ing) represent a large majority of the words with morphemes at the primer level (Orkin et al., 2022). Simultaneously, morphemes provide syntactic information and semantic clarity that accelerate both accuracy and fluency at word and text levels.

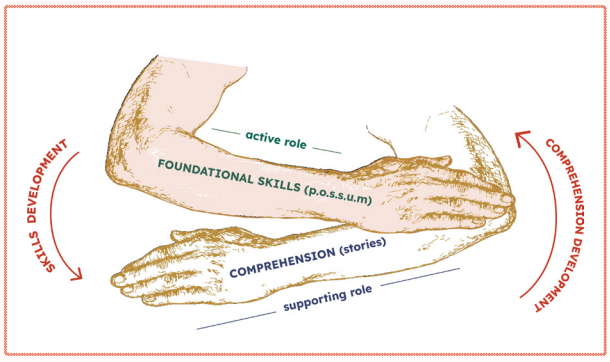
● FIGURE 2

Lovett-Wolf Elbow Room Developmental Sequence of Foundational Skills and Comprehension Processes

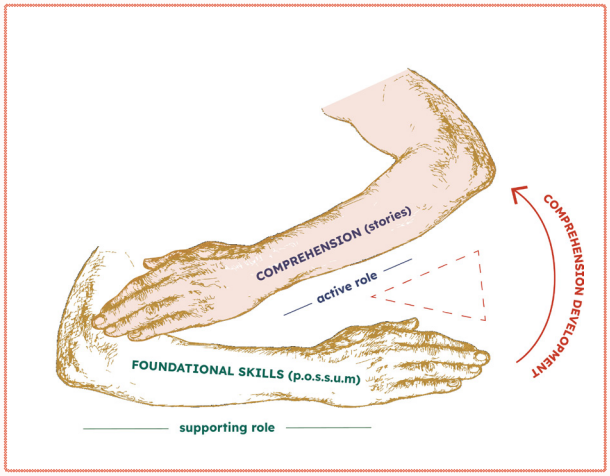
1. The more foundational skills develop…



2. the more of a supportive role they come to play, opening room for an instructional emphasis on comprehension...



3. which then takes an active role. Both play supportive or active roles as needed in shaping an increasingly sophisticated reading circuit.



of multicomponent interventions like Empower and RAVE-O in Lovett et al., 2017, 2022; Morris et al., 2012; Wolf et al., 2024; see also work of Phillips et al., 2024).

All of this leads us back to another recurrently asked question about the sequencing of phonics and comprehension processes: e.g., whether early instruction should be phonics first or phonics only in the beginning. It is here that an expanded view both of foundational skills and of the first reading circuit change the question and contribute most to our teaching. In a diagram inspired by my intervention colleague, Maureen Lovett, I want to provide a visualization of a developmental, dynamic teaching sequence of how emphases on the expanded foundational skills and comprehension processes shift over time as fluency develops. Imagine your two elbows positioned with your left forearm resting on top of the right.

Now, raise your left elbow diagonally while your right arm stays in place (Figure 2). Imagine your forearms are the two equal sides of an isosceles triangle. Next, gradually switch the position of the arms so that your right elbow is now on top with the left arm beneath it.

This is the visual depiction of the changing dynamic between the early emphases on the expanded foundational skills and fluency (left arm) and the gradually increasing emphases on more sophisticated comprehension processes (right arm). It is a visual mnemonic for the way the skills and processes change their emphases over time while always leaving room for the other to develop with the increasing demands of text content.

This mnemonic illustrates how there is never a time when comprehension skills (even in simple two-word sentences) are neglected. Similarly, some emphases on advanced foundational skills — from decoding multisyllabic words to understanding syntactic complexity — are needed to support deep reading.

By incorporating the different emphases of the major methods, this visual mnemonic gives new meaning to the term “elbow room,” which, as a term, embodies one of the many Ps in POSSUM: polysemy.

The above diagrams depict the duration or amount of time needed for the various skills and theirintensity in

any area according to both the learner's Development X Individual Characteristics and their particular language backgrounds. It cannot be emphasized enough that the language environment, whatever the home language or language variations, plays a crucial role in the development of the parts of the reading circuit. The early linguistic input from every language provides, along with conceptual knowledge, two halves of the platform of background knowledge that every child either brings or doesn't bring to the acquisition of reading.

The upshot, therefore, is the need to connect explicit knowledge about decoding principles to explicit knowledge about the meanings of words (and their multiple meanings in different contexts—*polysemy*); how they are used grammatically; how morphemes change their meaning and use; and how they all work together in connected text and literature. As described by Goldenberg (2020) and Cárdenas-Hagan (2020), building this connected knowledge about words gives every young reader, particularly multilingual learners, an invisible primer on how the English language works.

Although all children should receive instruction that explicitly *connects* all the foundational skills to each other from the outset, some individuals (e.g., children with dyslexia and other language-based learning issues) will need more intensive emphases and longer duration in specific areas of foundational skills (e.g., phoneme awareness and/or fluency) than other learners. By the same token, other learners (e.g., children with varied differences in the development of standard American English language skills) may require more emphases on a different set of foundational skills, depending on their particular background. For example, some children with rich linguistic backgrounds in

> We need teachers who know that they always need to know more if they are to match every child to instruction that will lead to that child's untold potential.

Nothing One Size Fits All...

One of the most important aspects of multicomponent approaches to instruction and intervention is that they can be used to address the changing strengths and weaknesses of individual children over time. This does not mean that any multicomponent intervention can be used for every child. Rather, it underscores the importance of the teacher's ability to match the emphases in whatever method is used to meet the changing needs of the individual child. It is here that twin knowledge bases—of the reading brain's development and of the child's changing characteristics—can be of singular help in guiding instruction.

It is crucial to utilize well-conceptualized, multidimensional screeners along with teacher observations and parent knowledge to determine the particular mix of strengths and weaknesses of each individual student. Progress-monitoring is essential to adjust the areas of instructional emphases to match the child's progress. The two most common errors in intervention are: 1) to stop the intervention before it is sufficiently learned (e.g., because of too-slow words per minute measures); and 2) to continue the same intervention for years despite lack of progress. To be sure, an intrinsic advantage of multi-component interventions like Empower and RAVE-O is to allow for greater flexibility in increasing and/or decreasing certain emphases as the child changes. That said, it is the flexibility of the teacher to use data from progress-monitoring and ongoing observation that is key to using any evidence-based intervention method well. There are no interventions that fit every child. But teachers who are armed with knowledge about the reading brain are better prepared to adapt their instruction and intervention to meet the needs of individual children.

several languages can move quickly from an emphasis on the various foundational skills to a level of automaticity or fluency that supports growing comprehension processes. Still others with more impoverished language backgrounds may need particular emphases on both background knowledge and oral language skills—see Goldenberg (2020) and Cárdenas-Hagan (2020).

Expanded, Deep Reading, Comprehension Processes

Although a full description of the multiple, deep reading processes underlying comprehension is outside the scope of this paper (see Wolf, 2018), it is important to give a truncated description of how diverse and essential these processes are to the reading experience. Think of these processes that underlie comprehension like an orchestra playing a symphony. The various processes are like different instruments coming in and out to interact with each other to contribute to the whole. These interacting, deep reading processes include, among others: 1) the analogical reasoning that helps match the reader's background knowledge with new information in the text; 2) inferential reasoning about what this new information implies; 3) perspective-taking that enables the reader to "pass over" into the thoughts and feelings of others and that involves both cognitive empathy and affective empathy; 4) the integration of these interacting cognitive and affective processes for critical thinking and for an evaluation of the truth of what is read; and 5) insights of the reader gained from the sum of these processes through the contemplative or reflective function (Wolf, 2018). To be sure, it is not the case that all of these processes occur every time in the proficient reader, particularly the contemplative function that was heralded by both Thomas Aquinas and Proust as the heart of reading. Nevertheless, each of these processes contributes to expert reading (and writing) development, and each deserves emphases in instruction and intervention. And, just as for the foundational skills, the intensity and duration of emphases on each of these specific comprehension-related processes will be dependent on the individual's development, background knowledge, cultural and language variation, and diverse learning characteristics.

Even this brief description of what lies under the hood of what we call comprehension underscores how the building of the first reading circuits in our young is critical for the development of reading and of thought itself. It is a goal shared by every teacher from every method. Very importantly, the elaboration and incorporation of these deep reading processes in the young, reading brain require years of formation. The expertise of every teacher of every method has a contribution to make in the long journey needed for deep readers to develop.

> In an age in which distraction and disinformation compete with the perception of truth and beauty, deep reading is an act of resistance.

Just as we all need to think in terms of expanded foundational skills and their connections to fluency and comprehension, it is important for all teachers to share their knowledge about the different processes underlying deep reading comprehension. For, in this cultural hinge moment when information needs critical evaluation by all our citizens, it is imperative that the development of background knowledge, empathy/perspective-taking, inferential reasoning, critical thinking, and personal insight are seen as essential components of a deep reading brain circuit (see Wolf, 2018).

One of the most important contributions all educators can make to the future of our society and our species is to ensure that these deep reading processes are increasingly elaborated, maintained, and strengthened, whatever digital devices are created and used. In an age in which distraction and disinformation compete with the perception of truth and beauty, deep reading is an act of resistance. It is toward this shared goal that all our methods of teaching should unite.

Three Implications of the 'Elbow Room'

To give rude paraphrase to the musical Hamilton, this is the "room where reading can happen." The importance for the young reader of a mutually expanded view of both foundational skills and deep reading comprehension processes is the central message of this Lovett-Wolf Elbow Room mnemonic. Regardless of prior training, every teacher has something to give from their expertise, and every teacher has something to expand. The key for a teacher's ability to teach the majority of our nation's children is a systematic expansion of knowledge about all the processes involved in decoding and comprehension, while never cherry-picking a few of the processes based on the teacher's original method of teaching.

Equally important, the teaching of these multiple processes should not be conceptualized as a checklist to do in isolation, but rather as the component parts that are to be integrated daily. This is the essence of the POSSUM approach and of multicomponent interventions. Phonemes need letters. Phonics needs semantics, syntax, and morpheme knowledge. Words need stories. The reading brain connects all of these processes, and so should our teaching.

The second implication is that this diagram illustrates how there is never a time when comprehension skills (even through the simplest forms of connected text like two-word sentences) are neglected in the acquisition process. Similarly, there is never a time when some emphases on more advanced foundational skills—from decoding multisyllabic words to understanding syntactic complexity—is not needed to underpin deep reading across development. Think back to how you shifted your own crossed elbows. In the beginning, your left elbow is raised high with your right arm horizontal below it. As fluency and the automaticity that underlies it increase, the right elbow with its deep reading, comprehension processes ascends ever more, with the left arm below it in support. This is a dynamic that incorporates all processes and neglects none.

The third insight is the importance of matching individual characteristics with instructional emphases in both foundational and comprehension processes. Knowledge matters at every year both for a child's learning and also for a teacher's learning and teaching. We need teachers who know that they always need to know more if they are to match every child to instruction that will lead to that child's untold potential.

Toward an Evolving Science Of Reading

I would like to summarize by placing this more comprehensive and dynamic view of foundational skills and deep reading processes within the context of an expanded view of the evolving, multidiscipline science of reading. The beautiful complexity of an ever elaborating reading brain illumines how all the processes in the circuit and their *connections* are important to teach *explicitly and systematically* with emphases that will differ according to development and individual needs. This knowledge has a long history and, it is my hope, a long future. Such a view of SOR excludes the expertise of no teacher devoted to a particular approach, but rather invites the expansion of everyone's knowledge for our shared goals for readers of the future. Such a view connects not only the parts of the reading brain, it also connects the non-exclusive areas of expertise of our teachers. Such a view helps increase every teacher's embodiment of *possum*.

Finally, such a view connects science to story, propelling both. In the words of novelist E.M. Forster, "Only connect. … Only connect the prose and the passion, and both will be exalted."

"Ay, marry, now my soul hath elbow room..."
—William Shakespeare

Glossary

Phonology refers to the sound system within a language in which the minimal unit of speech is referred to as the Phoneme.

Orthography refers to the writing system of a language in which the patterns of that language are rendered in printed symbols like letters and letter patterns.

Semantics refers to the entire system of meaning(s) that surrounds words including their potential multiple meanings, associations, contexts for use. Although often used as a synonym for vocabulary, it is far broader in scope.

Syntax refers to the grammar of a language and how words function within sentences and connected text.

Morphology refers to the system in language in which the smallest units of meaning are used to construct words (e.g., "bat" is one morpheme; "bats" has two morphemes).

Resources

Free modules on Dyslexia and Literacy, developed by the Literacy and Dyslexia Task Force of the UC/CSU Collaborative for Neuroscience, Diversity, and Learning.

Developed by:
Dr. Sue Sears | Professor in the Michael D. Eisner College of Education at California State University, Northridge

Dr. Maryanne Wolf | Director of the Center for Dyslexia, Diverse Learners, and Social Justice, Professor-in-Residence at the UCLA School of Education and Information Studies

References

Allington, R.L. (1983). "Fluency: The Neglected Reading Goal in Reading Instruction. *The Reading Teacher, 36*(6), 556-561.

Berko-Gleason, J. (1958). "The Child's Learning of English Morphology." *Word, 14,* 150-177.

Cárdenas-Hagan, Elsa. (2020). "Literacy Foundations for English Learners: A Comprehensive Guide to Evidence-Based Instruction." *Brookes Publishing Company.*

Chall, J. S. (1967). Learning to read: The great debate: An inquiry into the science, art, and ideology of old and new methods of teaching children to read, 1910-1965.

Chomsky, C. (1972). "Stages in Language Development and Reading Exposure." *Harvard Educational Review, 42*(1), 1-33.

Crafting Minds Group, "RAVE-O," Crafting Minds, accessed October 10, 2025, *https://www.craftingmindsgroup.com/site/rave-o*

Ehri, L. C. (1995). Phases of development in learning to read words by sight. *Journal of Research in Reading, 18*(2), 116–125.

Ehri, L.C. (2005). "Learning to Read words: Theory, Findings, and Issues." *Scientific Studies of Reading*, *9*(2), 167-188.

Ehri, L.C. (2014).” Orthographic Mapping in the Acquisition of Sight Word Reading, Spelling Memory, and Vocabulary Learning.” *Scientific Studies of Reading*, *18*(1), 5-21.

Fletcher, J.M., Savage, R., & Vaughn, S. (2020). “A Commentary on Bowers (2020) and the Role of Phonics Instruction in Reading.” *Educational Psychology Review*, *33*(3), 1249-1274.

Goldenberg, Claude. (2020). “Reading wars, reading science, and English learners.” *Reading Research Quarterly* 55 (2020): S131-S144.

Gorno-Tempini, M.L. (2024). Personal correspondence.

Herron, J. & Gillis, M. (2020) “Encoding as a Route to Phoneme Awareness and Phonics.” *Perspectives on Language and Literacy*, Summer, *46*(3), 17-25.

Juel, C. (2005). *The Impact of Early School Experiences on Initial Reading*.” New York: Guilford Press.

Lovett, M.W., Frijters, J.C., Wolf, M., Steinbach, K.A., Sevcik, R.A., & Morris, R.D. (2017). “Early Intervention for Children at Risk for Reading Disabilities: The Impact of Grade at Intervention and Individual Differences on Intervention Outcomes.” *Journal of Educational Psychology*, *109*(7), 889.

Lovett, M.W., Frijters, J.C., Steinbach, K.A., De Palma, M., Lacerenza, L., Wolf, M., ... & Morris, R.D. (2022). “Interpreting Comprehension Outcomes After Multiple-Component Reading Intervention for Children and Adolescents with Reading Disabilities.” *Learning and Individual Differences*, *100*(6), 102-224.

McCardle, P., & Miller, B. (2009). “Why We Need Evidence-Based Practice in Reading and Where to Find that Evidence.” *Implementing Evidence-Based Academic Interventions in School Settings*, 19-48.

Morris, R.D., Lovett, M.W., Wolf, M., Sevcik, R.A., Steinbach, K.A., Frijters, J.C., & Shapiro, M.B. (2012). “Multiple-Component Remediation for Developmental Reading Disabilities: IQ, Socioeconomic Status, and Race as Factors in Remedial Outcome.” *Journal of Learning Disabilities*, *45*(2), 99-127.

Orkin, M., Vanacore, K., Rhinehart, L., Gotlieb, R., & Wolf, M. (2022).”The More You Know: How Teaching Multiple Aspects of Word Knowledge Builds Fluency Skills.” *Reading League Journal, 3*(2), 4-13.

Phillips, B. M., Lonigan, C. J., Kim, Y.-S. G., Clancy, J., & Connor, C. M. (2024). Impact of supplemental multicomponent early childhood language instruction. *Journal of Educational Psychology, 116*(6), 1034–1051.

The Hospital for Sick Children (SickKids), “Empower™ Reading and Learning Group,” accessed October 10, 2025, *https://www.sickkids.ca/en/learning/empower-reading/*

Wolf, M. & Katzir-Cohen, T. (2001). “Reading Fluency and Its Intervention.” *Scientific Studies of Reading*, 5, 211-238.

Wolf, M., Gotlieb, R.J., Kim, S.A., Pedroza, V., Rhinehart, L.V., Tempini, M.L.G., & Sears, S. (2024). “Towards a Dynamic, Comprehensive Conceptualization of Dyslexia.” *Annals of Dyslexia*, 1-22.

Wolf, M. (2025). “The Beauty and the Threat of the Screen: The Impact of Digital Culture and AI on Children’s Development of Language, Reading, and Writing.” Chapter in J. von Braun (Ed.), *Risks and Opportunities for AI for Children: A Common Commitment for Safeguarding Children.* Vatican: Pontifical Academy of Science.

Wolf, M. (2018). *Reader, Come Home: The Reading Brain in a Digital World*. New York: Harper.

Wolf, M. (2007). *Proust and the Squid: The Story and Science of the Reading Brain.* New York: Harper.

Young, N. & Hasbrouck, J. (2024). *Climbing the Ladder of Reading and Writing.* New Rochelle, N.Y.: Benchmark.