

Teaching Reading Is Rocket Science, 2020

What Expert
Teachers of
Reading Should
Know and Be
Able to Do

By Louisa C. Moats



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Table of Contents

Foreword: For the Love of Reading	2
By Randi Weingarten	
Executive Summary	4
Preface	6
Increasing Reading Achievement and Preventing Reading Failure: A Top Priority	8
Where We Are: Research-Validated Ideas That Should Drive Instruction	9
Where We Are: Taking Stock of Teacher Preparation in Reading.....	10
Can We Do Better?	13
Toward a Curriculum for Teacher Preparation and In-Service Professional Development	14
Reading Psychology and Development	14
Language Structure	17
Best Practices	20
Assessment That Informs Teaching.....	21
Where We Need to Go: Changing Teacher Preparation and Professional Development	23
Endnotes	26
Appendix	28

Foreword:

For the Love of Reading



Randi Weingarten, AFT President

I love to read, although these days I do much of it on a computer screen. As a child I remember my mother, who was a second-grade teacher, always making sure we had books at home—books like *The Hundred Dresses* by Eleanor Estes, *The Jazz Man* by Mary Hays Weik, and *The Story of Ferdinand* by Munro Leaf. Books I read as a teenager shaped my quest for justice and the fight against discrimination—books like Anne Frank’s *The Diary of a Young Girl* and Harper Lee’s *To Kill a Mockingbird*. And I will always be mesmerized by Emma Lazarus’ iconic poem, “The New Colossus” with such lyrical language as “The wretched refuse of your teeming shore.... I lift my lamp beside the golden door!”

Even as much of my time is devoted to fighting for our members, our students, and our communities, I try to make time for reading. Whether it’s for work or for pleasure, I read to stay informed, to spark new ideas, to renew my spirit, and to better understand others’ perspectives. I can’t imagine my life without the written word—and I’m grateful to the teachers, including my mother, who gave me the gift of reading when I was young.

Reading is not simply a desire; it is a fundamental skill necessary for virtually everything we do. And we need to ensure all of us, particularly our children, learn to read and read to learn so they too can do everything. That’s why the AFT is pleased to update and repub-



The science of reading is inextricably linked to the love of reading. To teach and inspire the next generation, we simply can't have one without the other.

The current state of reading research understands the importance of teacher professionalism and autonomy. Embracing the science is, fundamentally, about giving teachers the freedom to teach. Teachers' hearts break when students struggle to decipher words on a page and explain what they mean. Desperate to support those students, teachers spend countless hours searching online to supplement the inadequate materials and training they have been given. So much of what sounds persuasive on paper just doesn't work well in the classroom—or works well only for students who most easily master the art and science of reading. This report tries to fill that void.

Moats, who has dedicated her career to struggling readers, wrote the first version of *Teaching Reading Is Rocket Science*, which the AFT published in 1999. In it, she explained how children learn to read, the essential components of reading instruction, what causes reading difficulties and how to prevent or reduce them. In this new edition, she adds depth to the science and provides clarity on the challenge before us: taking action.

Teaching reading really *is* rocket science. Academic English is complex. Given this complexity, children need carefully planned instruction to become fluent readers, spellers, and writers. And, because of the enormous inequities in our society, providing each child an equitable opportunity to revel in an abundance of books in which they both see themselves and are introduced to the world is no small task.

Still, there is joy in this work—whether reading aloud stories and poems that delight young and old, or introducing the wonder of new words and ideas to children. Ultimately, the science of reading is inextricably linked to the love of reading. To teach and inspire the next generation, we simply can't have one without the other.

lish *Teaching Reading Is Rocket Science, 2020: What Expert Teachers of Reading Should Know and Be Able to Do*. This report, written by Louisa C. Moats (a teacher, psychologist, researcher, and professor who has been at the forefront of science-based reading instruction for five decades), translates the latest reading research into accessible language so that those of us who are not steeped in the pedagogy of reading can apply it to our own teaching and learning.

Let me tell you what the report does and doesn't do. It doesn't get us back into the reading wars, and it doesn't advocate for what we have found so disrespectful: scripted curricula or "teacher proof" programs. It does detail the expert-level knowledge of language necessary to teach reading, and it does support teachers in building that knowledge.

In disseminating effective practices grounded in research, everyone has a role to play. From teacher-preparation programs to school systems, from state officials to curriculum developers, we must move quickly to revamp the guidance and resources provided to educators. But I'm betting on our nation's teachers. As a profession, we have the drive and the passion to do the hard work of understanding and using the science of reading. And it is hard work, much harder than it should be since so few of the education publishers and professional development providers have cast aside their profitable-but-outdated materials and programs to create new resources that reflect the latest research.



Executive Summary



The most fundamental responsibility of schools is teaching students to read. Because reading affects all other academic achievement and is associated with social, emotional, economic, and physical health, it has been the most researched aspect of human cognition. By the year 2000, after decades of multidisciplinary research, the scientific community had achieved broad consensus regarding these questions: How do children learn to read? What causes reading difficulties? What are the essential components of effective reading instruction and why is each important? How can we prevent or reduce reading difficulties? Two decades later, hundreds of additional studies have refined and consolidated what we know about bolstering reading achievement, especially for students at risk.

Unfortunately, much of this research is not yet included in teacher preparation programs, widely used curricula, or professional development, so it should come as no surprise that typical classroom practices often deviate substantially from what is recommended by our most credible sources. As a result, reading achievement is not as strong as it should be for most students, and the consequences are particularly dire for students from the least advantaged families and communities.

This we know: reading failure can be prevented in all but a small percentage of children with serious learning disorders. It is possible to teach most students how to read if we start early and follow the significant body of research showing which practices are most effective. Students living in poverty, students of color, and students who are eligible for remedial services can become competent readers—at any age. Persistent “gaps” between more advantaged and less advantaged students can be narrowed and even closed. Fundamentally, these gaps are the result of differences in students’ opportunities to learn—not their learning abilities.

Although educators have long understood the importance of literacy, teaching children to read is very complex. Far too many children have trouble reading and writing. About 20 percent of elementary school students nationwide have serious problems learning to read; at least another 20 percent are at risk for not meeting grade-level expectations. For children growing up in underresourced communities and attending underresourced schools, the incidence of reading failure is astronomical and completely unacceptable. Students who are

This report is an update to the original *Teaching Reading Is Rocket Science* published by the American Federation of Teachers over 20 years ago and emerges from a collaboration between the AFT and the Center for Development and Learning. Together they acknowledge that, although some progress has been made in teaching reading effectively, too few at-risk, disadvantaged, and minority students become proficient readers. Insufficient emphasis has been placed on understanding the science of reading, which, when appropriately implemented, can enable these students to make significant reading and writing gains.



African American, Hispanic, learning English, and/or from impoverished homes fall behind and stay behind in far greater proportion than students who are white and middle class. The rate of weak reading skills in these groups is 60–70 percent, according to the National Assessment of Educational Progress (NAEP).

The tragedy here is that most reading failure is unnecessary. We now know that classroom teaching itself, when it includes a range of research-based components and practices, can prevent and mitigate reading difficulty. Although home factors do influence how well and how soon students read, informed classroom instruction that targets specific language, cognitive, and reading skills beginning in kindergarten enhances success for all but a very small percentage of students with learning disabilities or severe dyslexia. Researchers now estimate that 95 percent of all children can be taught to read by the end of first grade, with future achievement constrained only by students' reasoning and listening comprehension abilities.

A well-validated concept that should underpin the design of instruction is called the Simple View of Reading. It states that reading comprehension is the product of word recognition and language comprehension. Without strong skills in either domain, an individual's reading comprehension will be compromised. The implications of the Simple View of Reading should be self-evident: reading and language arts instruction must include deliberate, systematic, and explicit teaching of word recognition and must develop students' subject-matter knowledge, vocabulary, sentence comprehension, and familiarity with the language in written texts.

For best results, the teacher must instruct the majority of students directly, systematically, and explicitly to decipher words in print, all the while keeping in mind the ultimate purpose of reading, which is to learn, enjoy, and understand. To accommodate children's variability, the teacher must assess children and tailor lessons to individuals or groups. This includes interpreting errors, giving corrective feedback, selecting examples to illustrate concepts, explaining new ideas in several ways, and connecting word recognition instruction to meaningful reading and writing.

Toward a Curriculum for Teacher Preparation and In-Service Professional Development

A core curriculum on effective literacy instruction for pre-service and in-service teacher education can be divided roughly into the following four areas, each of which is elaborated on in the report:

1. Knowing the basics of reading psychology and development;
2. Understanding language structure for both word recognition and language comprehension;
3. Applying best practices in all components of reading instruction; and

4. Using validated, reliable, efficient assessments to inform classroom teaching.

This core will, of course, be supplemented and honed over time, but its goal is to bring continuity, consistency, quality, and comprehensiveness to the many different programs, organizations, and systems through which aspiring and current teachers receive information about how to teach reading.

Where We Need to Go: Changing Teacher Preparation and Professional Development

Educators who are equipped to ensure reading success in the vast majority of their students will feel empowered and rewarded. To achieve that goal, a range of initiatives needs to be considered; each of the following is discussed in the report.

1. Use research to guide the profession.
2. Establish core professional standards, curricula, and entry-level assessments for new teachers.
3. Align teacher education curricula, standards for students, and licensing requirements for teachers.
4. Create professional development institutes for professors and master teachers.
5. Press the developers of textbooks and instructional materials to improve their products.
6. Promote high-quality professional development for teachers.
7. Invest in teaching.

The fact that teachers need better preparation, professional development, and resources to carry out deliberate instruction in reading, spelling, and writing should prompt action rather than criticism. It should highlight the chronic gap between what teachers need and what they have been given. Just about all children can be taught to read and deserve no less from their teachers. Teachers, in turn, deserve no less than the knowledge, skills, and supported practice that will enable their teaching to succeed. There is no more important challenge for education to undertake.



Preface

The most fundamental responsibility of schools is teaching students to read. Because reading affects all other academic achievement and is associated with social, emotional, economic, and physical health, it has been the most researched aspect of human cognition. By the year 2000, after decades of multidisciplinary research, the scientific community had achieved broad consensus regarding these questions: How do children learn to read? What causes reading difficulties? What are the essential components of effective reading instruction and why is each important? How can we prevent or reduce reading difficulties?

Two decades later, hundreds of additional studies have refined and consolidated what we know about bolstering reading achievement, especially for students at risk. Nevertheless, widespread misunderstanding and misapplication of scientific evidence continues in the majority of our teacher preparation programs, commercially available reading programs, and—largely as a result—districts and classrooms. These realities, along with other factors, are contributing to stagnant or declining scores on the National Assessment of Educational Progress and on international comparisons.

This report is an update to the original *Teaching Reading Is Rocket Science* published by the American Federation of Teachers more than 20 years ago and emerges from a collaboration between the AFT and the Center for Development and Learning. Together they acknowledge that, although some progress has been made in teaching reading effectively, too few at-risk, disadvantaged, and minority students become proficient readers. Insufficient emphasis has been placed on understanding the science of reading, which, when appropriately implemented, can enable these students to make significant reading and writing gains.

For the past five decades, research studies in classrooms and clinics have repeatedly and consistently found that explicit teaching in foundational skills (phonological awareness, phonics, oral reading fluency, spelling) provides students with a clear learning advantage.¹ Much of this research was synthesized by the National Reading Panel and the National Early Literacy Panel.² Before and after these landmark research reviews, the AFT published a series of articles and papers summarizing key research findings for practitioners. From phoneme awareness, decoding, spelling, reading fluency, vocabulary, and oral language development to text comprehension and written

The Center for Development and Learning, based in Metairie, Louisiana, brings advances from the fields of education, psychology, and medicine into the classroom and home to assist children, their families, teachers, schools, universities, and the community by delivering comprehensive, evidence-based professional learning for teachers, principals, parents, and other professionals who serve children, and by mobilizing public engagement through summits, forums, newsletters, and an information-rich website (www.cdl.org).

expression, the AFT explained and promoted solid information about how each of the critical components of literacy instruction could best be taught. Many articles in *American Educator*, as well as the substantive coursework offered by the AFT, have connected educators with well-established, highly effective instructional strategies and recommendations emanating from comprehensive, international, interdisciplinary research efforts.

Moreover, since the first version of *Teaching Reading Is Rocket Science* was published in 1999, many of its recommendations have become “settled” science—that is, researchers are no longer debating the importance of systematic multiyear phonics and word analysis instruction or of a large academic vocabulary. Research centers now work to refine theoretical models, such as the Simple View of Reading (see page 9), that are broadly embraced. Reading in languages beyond English is the focus of international, coordinated research efforts. Scientists use increasingly sophisticated technology that can picture the brain’s activation patterns or measure split-second reactions to speech or print. New statistical methods can document the complicated interactions of many factors as students develop reading skills. Fine-grained analyses illuminate the nature of individual differences and individual responses to instruction. These advanced investigative techniques have confirmed and extended the bedrock findings about reading and effective teaching of reading that were known 20 years ago. Evidence to guide our practices is stronger than it has ever been.

Unfortunately, much of this research is not yet included in teacher preparation programs, widely used curricula, or professional development, so it should come as no surprise that typical classroom practices often deviate substantially from what is recommended by our most credible sources. As a result, reading achievement is not as strong as it should be for most students, and the consequences are particularly dire for students from the least advantaged families and communities. In many school districts, students who need added supports, including those with language differences, dyslexia, or other reading disabilities, still lack access to professionals who have been prepared with the expertise needed to teach them. Unfamiliarity with the findings of research, insufficient knowledge of critical content, and philosophical opposition to theories and practices grounded in evidence are still too common.

This we know: reading failure can be prevented in all but a small percentage of children with serious learning disorders. It is possible to teach most students how to read if we start early and follow the significant body of research showing which practices are most effective. Students living in poverty, students of color, and students who are eligible for remedial services can become competent readers—at any age. Persistent “gaps” between more advantaged and less advantaged students can be narrowed and even closed. Fundamentally, these gaps are the result of differences in students’ opportunities to learn—not their learning abilities.

Evidence to guide our practices is stronger than it has ever been. The preparation and professional development of teachers must be better aligned with decades of reading science.



This paper argues that the preparation and professional development of teachers who teach reading and writing must be more rigorous and better aligned with decades of reading science. It reviews and describes the knowledge that undergirds successful instruction, whether delivered by a veteran or a novice. It concludes with recommendations for the professional preparation of all teachers of reading, which, if implemented, could ensure that many more students become proficient and almost none do not attain functional literacy. In so doing, this paper also provides teachers with the foundational information they need to dive deeply into the science of reading and therefore empowers them to improve their practices—even if they do not receive the systemic supports they deserve. In the final analysis, it is our nation’s dedicated teachers and their excellent teaching that will bring the rocket science that is research-based reading instruction to schools and classrooms across the country and will unlock the power and joy of reading for our children.

Increasing Reading Achievement and Preventing Reading Failure: A Top Priority

In today's literate world, academic success, secure employment, and personal autonomy depend on reading and writing proficiency. Although educators have long understood the importance of literacy, teaching children to read is very complex. Fortunately, hundreds, if not thousands, of studies over several decades go a long way in illuminating the chain of cause and effect that supports the development of literacy. Convergent findings of interdisciplinary, high-quality research have clarified how children learn to read and what must be done to ensure that they do.³

Beyond doubt, reading early allows students to build success on success. Enjoyment of reading, exposure to the language in books, and attainment of knowledge about the world all accrue in greater measure to those who have learned to read before the end of first grade.⁴ Difficulty with the first steps of reading, in contrast, eventually undermines vocabulary growth, general knowledge of the world, mastery of academic language, and skill in writing. Once behind in reading, few children catch up unless they receive intensive, individual, and expert instruction—a scarce (and expensive) commodity in many schools.

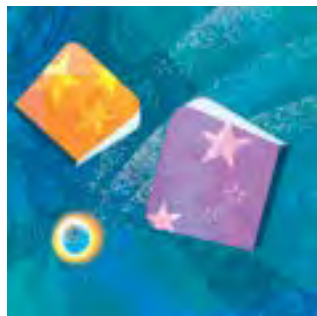
Far too many children have trouble reading and writing. About 20 percent of elementary school students nationwide have serious problems learning to read; at least another 20 percent are at risk for not meeting grade-level expectations.⁵ Among those who struggle throughout life—school dropouts, incarcerated individuals, underemployed and unemployed adults, and those experiencing chronic physical and emotional ill health—are high percentages of people who cannot read. Beginning in the 1970s,

the social and economic costs of reading difficulties prompted the National Institutes of Health to invest heavily in longitudinal, interdisciplinary, high-quality research to understand and address the problem.⁶

For children growing up in underresourced communities and attending underresourced schools, the incidence of reading failure is astronomical and completely unacceptable. Students who



are African American, Hispanic, learning English, and/or from impoverished homes fall behind and stay behind in far greater proportion than students who are white and middle class. The rate of weak reading skills in these groups is 60-70 percent, according to the National Assessment of Educational Progress (NAEP).⁷ This figure alone explains much about the lower average academic achievement of minority students and why they are underrepresented in professions that depend on higher education.



The environment outside of school, however, does not explain all. Education matters. Many children from more economically advantaged households have trouble learning to read, and many children from high-risk environments do learn to read quite well when they receive good instruction. One-third of weak readers nationwide are from college-educated families (who presumably value literacy and expose their children to reading in the home). In international comparisons of literacy rates, the United States is doing less well than many other industrialized societies.⁸

The tragedy here is that most reading failure is unnecessary. We now know that classroom teaching itself, when it includes a range of research-based components and practices, can prevent and mitigate reading difficulty. Although home factors do influence how well and how soon students read, informed classroom instruction that targets specific language, cognitive, and reading skills beginning in kindergarten enhances success for all but a very small percentage of students with learning disabilities or severe dyslexia. Researchers now estimate that 95 percent of all children can be taught to read by the end of first grade, with future achievement constrained* only by students' reasoning and listening comprehension abilities.⁹

It is clear that students in high-risk populations need not fail at the rates that they do. When placed into schools with effective principals, strong curricula, and well-supported teachers, virtually all students can learn to read as well as the most advantaged students. Further, students who lack prerequisites—such as awareness and knowledge of sounds, symbols, sound-symbol connections, vocabulary, and/or oral language—can develop all the knowledge and skills they need for reading success. Teachers, however, must incorporate these critical skills into direct, systematic, engaging lessons. While parents, tutors, and the community can contribute to reading success, classroom instruction is the

*It is important to note that students' reasoning and comprehension abilities can also be enhanced through informed instruction. As students' subject-matter knowledge and vocabulary grow, so will their capacity to think critically.

Informed classroom instruction that targets specific language, cognitive, and reading skills beginning in kindergarten enhances success for all but a very small percentage of students.

critical factor in preventing reading problems and must be the primary focus for change.¹⁰ To be clear: although the day-to-day work is teachers' responsibility, students' reading success is our shared responsibility. From preparation programs to standards and assessments to curricula and professional development, the policies and systems currently impacting how reading is taught need to improve—dramatically and rapidly. Teaching reading *is* rocket science. But it is also established science, with clear, specific, practical instructional strategies that all teachers should be taught and supported in using.

Where We Are: Research-Validated Ideas That Should Drive Instruction

A well-validated concept that should underpin the design of instruction is called the Simple View of Reading.¹¹ It states that reading comprehension is the product of word recognition and language comprehension. Without strong skills in either domain, an individual's reading comprehension will be compromised.

A reader's recognition of printed words must be accurate and automatic to support comprehension. The development of auto-



matic word recognition depends on intact, proficient phoneme awareness, knowledge of sound-symbol (phoneme-grapheme) correspondences, recognition of print patterns such as recurring letter sequences and syllable spellings, and recognition of meaningful parts of words (morphemes).¹² Young readers progress by gradually learning each of these ways that our print system represents language, and then applying what they know during ample practice with both oral and silent reading. If reading skill is developing successfully, word recognition gradually becomes so fast that it seems as if we are reading “by sight.” The path to that end, however, requires knowing how print represents sounds, syllables, and meaningful word parts; for most students, developing that body of knowledge requires explicit instruction and practice over several grades.¹³ While some students seem to figure out how the print system works through incidental exposure, most do not.

Language comprehension, the other essential domain that underlies reading comprehension, depends on background knowledge, vocabulary, ability to decipher formal and complex sentence patterns, and recognition of the devices that hold a text together.¹⁴ Furthermore, language comprehension is facilitated by metacognitive skills such as monitoring whether reading is making sense and choosing to act if it does not. The language comprehension factor in overall reading achievement becomes more and more important from about fourth grade onward.¹⁵ From preschool through high school, students gain vital exposure to a variety of text forms, language patterns, background knowledge, and vocabulary both by listening to text read aloud and by reading itself.

The implications of the Simple View of Reading should be self-evident: reading and language arts instruction must include deliberate, systematic, and explicit teaching of word recognition and

must develop students’ subject-matter knowledge, vocabulary, sentence comprehension, and familiarity with the language in written texts. Each of these larger skill domains depends on the integrity of its subskills. In proficient reading, subskills are employed rapidly and below conscious analysis. They also bolster and influence one another. For example, phoneme awareness supports vocabulary development, knowledge of morphemes supports spelling and word recognition, sentence writing facilitates reading comprehension, and so forth. Many relationships between speech and print are reciprocal and interactive, so that gains in one domain can have positive effects on other aspects of language processing.¹⁶ Beyond general knowledge of the world, the common denominator for learning to read and write is the ability to recognize, analyze, and produce language in all its forms.

Where We Are: Taking Stock of Teacher Preparation in Reading

Surveys of teacher preparation programs in English language arts and reading have exposed an unfortunate misalignment between what is typically taught to prospective teachers and what is consistent with research.¹⁷ In teacher preparation courses, essential components of a comprehensive approach are often given short shrift. Moreover, textbooks and course content often include theories and practices that are directly contradicted by research but very resistant to change.¹⁸ There are several reasons why this might be the case, as discussed below.

The Complexity of Teaching Is Underestimated

Learning to read is a complex achievement, and learning to teach reading requires extensive knowledge and skills across the components of word recognition, language comprehension, spelling, and writing. Consider what the classroom demands of the teacher. Children’s interest in reading must be stimulated through regular exposure to interesting books and through discussions in which students respond to many kinds of texts. For best results, the teacher must instruct the majority of students directly, systematically, and explicitly to decipher words in print, all the while keeping in mind the ultimate purpose of reading, which is to learn, enjoy, and understand. To accommodate children’s variability, the teacher must assess children and tailor lessons to individuals or groups. This includes interpreting errors, giving corrective feedback, selecting examples to illustrate concepts, explaining new ideas in several ways, and connecting word recognition instruction to meaningful reading and writing. No one can develop such expertise by taking one or two college courses or attending a few one-shot, in-service workshops.

Although reading is the cornerstone of academic success, prospective teachers’ coursework may include only 6–9 credit hours in reading, including beginning-level and content-area reading. Even if well taught, a single course in either early elementary or content-area reading is only the beginning. To learn about language struc-

ture, the specific techniques of lesson delivery, the development of reading, children’s literature, or the management of a reading program based on assessment requires 12–15 credit hours in total. The demands of competent reading instruction, and the training experiences necessary to learn it, have been seriously underestimated by universities and by those who have developed and approved licensing programs.

The Mental Processes Involved in Learning to Read Are Hidden

What drives the mind of the reader is neither self-evident nor easy to grasp. Consequently, many years of interdisciplinary scientific inquiry have been necessary to expose the mechanisms of reading acquisition. On the surface, reading appears to be a visually based learning activity, when in fact it is primarily a language-based learning activity.¹⁹ Proficient reading requires unconscious and rapid association of spoken language with written alphabetic symbols.²⁰ For adults who are skilled readers and who learned to read long ago, relying on introspection, intuition, or logic to understand how reading is taking place can be misleading.

Reading requires sufficient visual acuity to see the print, but the act of translating alphabetic symbols into meaning is only incidentally visual.²¹ Rather, the recognition of printed words depends first on awareness of the speech sounds (phonemes) that the alphabetic symbols represent and then on the brain’s ability to map sounds to letters and letter combinations (graphemes). As reading develops, the mapping of speech to print includes recognition of letter sequences, including syllable patterns and meaningful units (morphemes). The reading brain gradually builds neural networks that facilitate rapid processing of symbol-sound and sound-symbol connections. Once these networks for mapping speech to print are developed, the brain can recognize and store images of new printed words with little conscious effort.

Superficial visual characteristics of printed words, such as their outline or configuration, have no bearing on this process. That is why we can read many fonts and many kinds of handwriting. Printed words are not learned as wholes but rather as letter sequences that represent speech sounds and other aspects of language. What appears to be whole-word learning or whole-word retrieval is, under the surface, dependent on a rapid, letter-by-letter and sound-by-sound assembly of linguistic elements.

Skilled reading happens too fast and is too automatic to detect its underlying processes through simple introspection. We read, but we cannot watch (or intuit or deduce) how our minds make sense out of print. Once we can read, the linkage of sounds and symbols occurs rapidly and unconsciously. The linguistic units that compose words—the single speech sounds (phonemes), syllables, and meaningful parts (morphemes)—are automatically matched with writing symbols (graphemes and their combinations) so that attention is available for comprehension. Because our attention is on meaning,

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we are not aware of the code translation process by which meaning is conveyed. Until we are faced with a class of children who are learning how to read symbols that represent speech sounds and word parts, we may never have analyzed language at the level required for explaining and teaching it. Similarly, we may not know how a paragraph is organized or how a story is put together

until we teach writing to students who do not know how to organize their thoughts. Thus, to understand printed language well enough to teach it explicitly requires disciplined study of its systems and forms, both spoken and written.

Few Teachers Have Been Taught the Structure of Language

When adults are evaluated on knowledge of language, even those who are well educated typically demonstrate major gaps in understanding. This should not be surprising—most adults have not had the opportunity to study the structure of language.²² Surveys measuring experienced teachers’ abilities to identify speech sounds, spelling patterns, word structures, and sentence structures also reveal gaps in understanding. For example, the concept that a letter combination can represent one unique speech sound (*ch, wh, sh, th, ng*) is unclear to a substantial number of elementary school teachers. Many identify these units by rote but are unable to differentiate conceptually between these spelling units (digraphs) and two letters that stand for two distinct sounds (consonant blends such as *cl, st,*



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middle and upper grades but may not understand that proficiency in basic reading skill must be attained (through systematic instruction and practice) before students will progress. Moreover, after the early grades, foundational skills include awareness of word relationships, sentence structures, figurative language, cohesive devices, and genre characteristics—all of which can be

explicitly taught but which require a knowledgeable teacher. Without instruction and practice, teachers are unlikely to develop the questioning techniques, text analysis, and discussion strategies that promote thoughtful reading by groups of children.*

Meaningful and Consistent Professional Standards Are Absent

Other complex and demanding professions insist on much more stringent training and preparation than that required of teachers. Pilots, engineers, optometrists, and art therapists, for example, must learn concepts, facts, and skills to a prescribed level, must conduct their practice under supervision, and must pass rigorous entry examinations that are standardized across the profession. Continuing education to stay abreast of the most effective practices is mandated. The public interest is protected by professional governing boards that monitor the knowledge base and oversee the competence of these licensed professionals. We, the consumers of these professional services, should be able to trust that any person holding a license has demonstrated competence and is accountable to their professional board of governance.

A few states are adopting rules or standards to ensure that teachers who instruct children in reading have been introduced to the relevant knowledge base and acquired the necessary skills to enter the classroom. More typically, within large universities that prepare hundreds of teachers every year, what a teacher candidate learns may depend solely on the individual professor's knowledge, beliefs, or philosophy. Courses in reading may be taught by adjunct faculty who receive little guidance about what to teach. Thus, preparation for teaching reading often is more grounded in ideology than evidence. While the academic freedom that professors often invoke has a place in teacher education, its claim is not as absolute as it may be in the humanities. Professional preparation programs have a responsibility to teach a defined body of knowledge, skills, and abilities that are based on the best research in the field. This is no less important in reading than it is in medicine or law.

*A related problem is that teachers of specific subjects—like history or biology—are rarely taught the relationships between subject-matter knowledge, domain-specific vocabulary, and reading comprehension. Among both strong and weak readers, one critical way to boost listening and reading comprehension in a particular subject is to build students' background knowledge and vocabulary in that subject.

pr) or silent letter spellings that retain the sound of one consonant (*kn-*, *wr-*, *-mb*). Likewise, few adults can explain common spelling patterns that correspond to pronunciation and word meaning, such as why we double the consonant letters in words like *misspell*, *dinner*, and *accommodate*. A deeper, more explicit knowledge of language is not necessary to be a skilled reader, but it is necessary to be an effective teacher—to give students accurate explanations of the English language, including spelling, how spelling is related to meaning, pronunciation, and where the words came from.²³

Some children learn language concepts and their application very easily in spite of incidental teaching, but others never learn unless they are taught in an organized, systematic, efficient way by a knowledgeable teacher using a well-designed instructional approach. Children of average ability might learn enough about reading to get by if their instruction is haphazard; with systematic research-based instruction, those students could achieve much more, such as the appreciation for language structure that supports learning words from context, perceiving subtle differences in meaning, or refining language use. Yet teachers are seldom given opportunities to study the language they teach or how its form carries its message.

In addition, relatively few teachers have opportunities to learn about the relationships among the basic skills of reading and reading comprehension. They may see that children read poorly in the

Good Information Is Hard to Get

Few of today's most popular textbooks for teacher preparation in reading contain information about the known relationships between linguistic awareness, word recognition ability, and reading comprehension, although more good textbooks have been published in the last decade.²⁴ Texts may not include information about essential concepts—such as the differences between speech sounds and spellings, the fact that every syllable in English is organized around a vowel sound, and the existence of meaningful units (morphemes) in the Latin layer of English. Widely used textbooks still do not contain accurate information about the role of phonology in reading development, or why many children have trouble learning to read or what to do about it. Teachers are often given inaccurate and misleading information based on unsupported ideas. For example, for the past several decades, one of the most common misconceptions has been that knowledge of the phonic system can be finessed with attention to sentence structure and meaning, and that new words should be deciphered by predicting them from pictures and context.²⁵

Textbooks for teachers must attain a much higher standard of accuracy, currency, depth, clarity, and relevance if teachers are to be well prepared to teach reading. University courses are our best opportunity to engender understanding of the “why” and “what” of effective teaching, setting the stage for the “how” of classroom practice.

Widely Used Programs Are Uninformative or Misleading

Inadequately prepared novice teachers often find themselves dependent on the information given in the teachers' manuals that accompany virtually all commercially available reading programs to learn about spoken and written language concepts and to generate strategies for teaching students to read. Many of the most widely used classroom teaching manuals and materials in language arts omit systematic teaching about speech sounds, the spelling system, or how to read words by sounding them out. The most popular programs being used today are relatively strong on literature, illustrations, cross-disciplinary thematic units, and motivational strategies for children, but very weak or simply wrong when it comes to the structure of the English language and how children actually learn to read the words on the page.²⁶ Ideally, students should be asked to apply code-based skills during reading, spelling, and writing, and there should be sufficient time prescribed for instruction in all essential components.

Can We Do Better?

At this writing, Mississippi and the District of Columbia were the only states/jurisdictions to make substantial progress in fourth-grade reading on NAEP since 2002.²⁷ However, many districts (for example, Upper Arlington, Ohio; Oakland, California; Rapides Parish, Louisiana; Brownsville, Texas) have committed to rigorous teacher training and support; as a consequence, they are seeing improvement in reading outcomes. In these initiatives and others,

teachers' knowledge and classroom practices are prioritized over mandated materials or programs that alone are not sufficient to produce change.

Courses and workshops in these states and districts that are improving avoid the old practice of offering teachers a smorgasbord of activities and encouraging teachers to pick what they like based on a personal philosophy. Specifically, teachers must understand how the brain learns to read, how students move through the phases of reading development, how strong readers differ from weak readers, how the English language is structured in spoken and written form, and the validated principles of effective reading instruction. Cultivating expertise in designing and delivering lessons to academically diverse learners, selecting validated instructional methods and materials, and using assessments to tailor instruction are all central goals for long-term, continuous improvement in teacher practice.





Toward a Curriculum for Teacher Preparation and In-Service Professional Development

A core curriculum on effective literacy instruction for pre-service and in-service teacher education can be divided roughly into the following four areas, each of which is elaborated on below:

1. Knowing the basics of reading psychology and development;
2. Understanding language structure for both word recognition and language comprehension;
3. Applying best practices in all components of reading instruction; and
4. Using validated, reliable, efficient assessments to inform classroom teaching.

This core will, of course, be supplemented and honed over time, but its goal is to bring continuity, consistency, quality, and comprehensiveness to the many different programs, organizations, and systems through which aspiring and current teachers receive information about how to teach reading.

1. Reading Psychology and Development

A. Basic Facts about Reading

If the findings²⁸ of research psychologists, educators, and linguists were better known, the risk of unfounded and even harmful teaching practices would be reduced. Learning to read is not natural or easy for most children. Unlike spoken language, which is learned with almost any kind of contextual exposure, reading is an acquired skill. If learning to read were as natural as acquiring spoken language, human beings

would have invented writing systems many thousands of years before we did, and everyone would learn reading as easily as ducks learn to swim. The prolonged, gradual, and predictable progression of acquiring skill in print translation attests to the difference between processing spoken and written language. Although surrounding children with books will support reading development, and a “literature-rich environment” is highly desirable, it is not sufficient for learning to read. Neither will exposure to print ordinarily be sufficient for learning to spell, unless organized practice is provided. Thus, teachers must be reflective, knowledgeable, and intentional about the content they are teaching—that is, the symbol system (orthography) itself and its relationship to meaning.

Good readers do not skim and sample the text when they scan a line in a book. They process the letters of each word in detail, although they do so very rapidly and unconsciously. Those who comprehend well accomplish letter-wise text scanning with relative ease and fluency. When word identification is fast and accurate, a reader has ample mental energy to think over the meaning of the text. Knowledge of sound-symbol mapping is crucial in developing word recognition: the ability to sound out and recognize words accounts for about 80 percent of the variance in first-grade reading comprehension and continues to be a major (albeit diminishing) factor in text comprehension as students progress through the grades (and



Learning to read is not natural or easy for most children. Good readers process the letters of each word in detail, although they do so unconsciously.

bles, grammatical endings, and meaningful word parts (morphemes). Awareness of these linguistic elements in spoken language is essential for making sense of print because our alphabetic writing system represents language at all these levels. When students cannot rapidly associate the sounds, syllables, and/or morphemes in spoken words with printed symbols, they will not be able to store words in their mental dictionaries. Conversely, a new word that is decoded accurately through phonological analysis can be pronounced and remembered, even if its meaning is not yet known. Skilled reading presents a paradox: those who can most easily read nonsense—or decode any new word—are also those who are most likely to comprehend a text. Children who comprehend well when they read also do better at tasks such as reading words taken out of context, sounding out novel words, and spelling nonsense words. Intelligence and verbal reasoning ability do not predict reading success in the beginning stages as well as these specific linguistic skills.

The term *dyslexia* refers to a reading problem characterized by inaccurate and/or slow development of skills in printed-word reading and spelling. The origins of dyslexia are typically within the phonological system of language processing. Phoneme awareness, rapid automatic naming of symbols, phonic decoding, spelling, written expression, and automatic word reading (reading words seemingly “by sight”) are the core problems in dyslexia.³²

About half of students with dyslexia or word-level reading problems, however, experience other problems with language comprehension and use. Many of these problems with language comprehension can be identified early in reading development, even though the impact on reading comprehension may not be apparent until the intermediate grades.³³ Understanding word meanings and word relationships, deciphering complex sentence structures, and tracking the structure of informational and narrative texts may be challenging and undermine reading comprehension. About 10 percent of all weak readers demonstrate a specific weakness in language comprehension even though their word recognition skills are strong.³⁴

The key takeaway is that not all reading difficulties are alike. The content and emphasis of instruction should vary according to each student’s language, reading, writing, and cognitive profile. Preparation for teaching must be broad and substantive enough to allow instructional problem-solving.³⁵

C. The Relationships among Components of Reading and Writing

Although the purpose of reading is to comprehend text, teachers should also appreciate the relationships among reading components in order to teach all components well—in connection to one another and with the emphasis needed at each phase of development. A child cannot understand what he cannot decode, but what he decodes is meaningless unless he can understand it. If this relationship is realized, a teacher will teach linguistic awareness and phonics deliberately, while linking skills to application in context as much as possible.

students’ background knowledge and vocabulary become ever-larger factors in comprehending academic texts).²⁹

The ability to sound out words is, in fact, a major underpinning that allows rapid recognition of words. (This recognition is so fast that some people mistakenly believe it is happening “by sight.”) Before children can easily sound out or decode words, they must have at least an implicit awareness of the speech sounds that are represented by symbolic units (letters and their combinations). Children who learn to read well are sensitive to linguistic structure, recognize redundant patterns, and connect letter patterns with sounds, syllables, and meaningful word parts quickly, accurately, and unconsciously. Effective teaching of reading entails these concepts, presenting them in a sequence from simple and consistent to complex and variable.

B. Basic Facts about Reading Difficulties

Contrary to appearances and intuition, reading and writing depend primarily on language proficiencies, not generic visual attention, visual-spatial memory, visual-motor coordination, or visual sequencing skills. A student may be adept at mechanics, puzzles, drawing, or graphic design, but have great difficulty remembering or producing the letters in printed words. Conversely, a student might be an accomplished speller but a weak visual artist. Vision therapies are, for the most part, disproven as valid treatments for reading difficulties.³⁰

The word-recognition component of reading is most closely dependent on the phonological aspect of language processing.³¹ Phonological language skills include awareness of bits of speech or linguistic elements within words: consonant and vowel phonemes, spoken syllable

Beginning reading instruction of necessity will focus on teaching students how to read and write words, following a systematic and logical sequence. When appropriate, the emphasis will shift to increasing reading volume. Combining research on reading, cognitive science related to the role of knowledge in thinking, and practice-based wisdom, it appears that opportunities for wide reading are best provided within a knowledge-building curriculum in which text readings are linked by a theme or topic.³⁶ Ironically, while background knowledge can be gained from reading, it is also true that those who already know more about a topic make better inferences and retain meanings better than those who know little about it. Therefore, reading practice should be linked to or embedded within the study of subjects including science, history, literature, and the arts. Interpretive strategies that facilitate comprehension—including summarizing, questioning, predicting outcomes, and monitoring one’s own understanding—are best used in the service of learning defined curricular content.³⁷ Moreover, writing in response to reading is one of the best ways to enhance reading comprehension.³⁸

A focus on language comprehension can—and should—begin long before children can read text on their own. Reading aloud to children from well-written text serves to develop their vocabularies and knowledge, their familiarity with academic language, and their appreciation for the pleasures of the written word.



D. How Reading and Spelling Develop

Longitudinal studies of reading and spelling development have shown that the vast majority of students who read well in high

school learned by the end of first grade to sound words out and read new words with ease.³⁹ That is, they gained the insight that letters in our writing system more or less represent segments of speech (phonemes) and used this knowledge to increase their reading vocabularies. Moreover, emergent reading and spelling follow a predictable course regardless of the speed of reading acquisition.⁴⁰ The learner progresses from global to analytic processing, from approximate to specific linking of sounds with symbols, and from context-driven to print-driven reading as proficiency is acquired. For reading and spelling, awareness of letter sequences, speech sounds, and morphology develop in a reciprocal fashion as soon as basic phonological awareness and letter knowledge are gained. Effective teachers will recognize where their students are in reading and writing development and will tailor instruction accordingly.

The signs of each phase are readily apparent to a teacher who is a trained observer. In the very beginning of learning to read, children do not understand that letters represent the sounds in words, although they do know that print represents spoken messages. Pre-alphabetic students may also know a lot about how print is supposed to look, for example, that it goes from left to right and that certain letter sequences are common. Next, children use their knowledge of letters and rudimentary awareness of speech sounds to attempt spelling and reading by sounding out parts of words, often the prominent consonants of a word (as in KR for *car* and HP for *happy*). Skill at sounding out words and at spelling them phonetically unfolds gradually as the child becomes aware of all the speech sounds in a word to which letters need to be matched.

With appropriate instruction, children learn how print patterns represent speech. For example, they know that ck is used at the ends of words, that letters can be doubled at the ends of words but not at the beginnings, and that words typically contain a vowel letter and sound. They learn in phases that *-ed* spells the past tense but is pronounced

Teachers who know the basics of reading psychology and development can answer questions like these:

Why is it useful to know if a student can read nonsense words such as *flep*, *tridding*, and *pertollic*?

The ability to read nonsense words depends on rapid and accurate association of sounds with symbols. Strong readers do this easily so they can decipher new words and attend to the meaning of the passage. Weak readers usually are slower and make more mistakes in sounding out words. Their comprehension suffers as a consequence. Weak readers improve if they are taught in an organized,

systematic manner how to decipher the spelling code and sound words out.

What does it mean if a 5-year-old child writes “pez tak me yet u” (Please take me with you)?

This is early phonetic or letter-name spelling, showing fairly well-developed awareness of speech sounds (phonological awareness) but little knowledge of standard spelling. Over the next year, the child needs to be taught how to read and spell single consonants,

short vowels, and regular word patterns with those elements, as well as a few high-frequency, irregular words at a time. Practice with decodable text is appropriate at this stage.

Which words do good readers skip as they read along at a good pace?

Almost none. Good readers process every letter of almost every word when they read. It is weak readers who skip words and try to make sense by relying on pictures or other cues.

three different ways: /t/ as in *raked*, /d/ as in *played*, and /ed/ as in *painted*. More advanced students will decipher words such as *synchronous* by larger chunks, reading by analogy to known words with the prefix *syn-*, the root *-chron*, and the suffix *-ous*. At that point, mapping of speech to orthography—at the level of phonemes, syllables, morphemes—should be rapid and efficient, and should support the reader’s ability to quickly decipher, remember, and retrieve new words from the mental dictionary.

Effective teaching, matched to the students’ current levels of reading development, requires knowledge of word structure so that print conventions can be explained, identified, classified, and used for the higher purposes of efficient word recognition and vocabulary development. The methods of any lesson will be chosen according to the learner’s current level of skill development. Teaching children about sounds is appropriate early on; emphasizing morphemes is appropriate later on. At every level, teachers need to connect the teaching of these skills with the joy of reading and writing, using read-alouds and the motivating activities associated with a rich, knowledge-building curriculum. Expert teachers will have the knowledge, strategies, and materials to judge what to do with particular children, not on the basis of ideology, but on the basis of observation, evidence for what works, and knowledge of the science of reading, child development, and content.

2. Language Structure

A. Teachers’ Knowledge Must Be Deep

Expert teaching of reading requires knowledge of language structure at all levels.⁴¹ Without such knowledge, teachers are not able to respond insightfully to student errors, choose examples for concepts, explain and contrast words and their parts, or judge what focus is needed in a lesson. Suppose that the teacher wants the students to read and spell words such as *pin* and *pen*, *will* and *well*, and *miss* and *mess* without confusing them. Lecturing or singing about short vowels is unlikely to prevent the errors children often make. Knowing that these vowels are similar in articulation might help the teacher emphasize how the vowels feel and look in the mouth when they are spoken. Anticipating the difficulty of these vowels, a teacher would provide frequent, short opportunities for students to contrast similar words and to read and spell words with /i/ and /è/ in the context of phrases, sentences, and stories.

What if, in the middle grades, the word *deceive* is to be read, spelled, or understood? To help children who may not know the word or who may misread or misspell it, the teacher could draw upon the following information about the word:

- *deceive* has two syllables and two meaningful parts (morphemes), a prefix *de-* and a root *-ceive*;
- the word is a verb related to the nouns *deceit* and *deception*;

While background knowledge can be gained from reading, those who already know more about a topic make better inferences and retain meanings better.

- the same root and derivational pattern can be found with *receive*, *conceive*, and *perceive*;
- the vowel spelling follows the “*i* before *e* except after *c*” spelling rule (although that rule does not always work!);
- the word ends with an *e* because no word in English ends in a plain *v* spelling for the /v/ sound;
- the /s/ phoneme is spelled with a “soft” *c* followed by *e*; and
- the accent of such Latin-based words is almost always on the root morpheme.

With a coherent series of lessons, the teacher can deepen students’ word knowledge by calling their attention to any of these features in a lesson. The nature of exploration may vary from a “word a day” discussion, to finding *-ceive* words in a literature selection, to using several of the *-ceive* words in a written composition in their various forms (*receiving*, *reception*, *receptivity*).

B. How to Teach Language Structure

Few teachers, however, are sufficiently well prepared to carry out such instruction—not through any fault of their own—but because their preparation programs, instructional materials, and teaching environments have not asked them to understand the structure of the English language with any depth or specificity. The table on pages 18–19, “Knowledge of Language Structure and Examples of Application to Teaching,” illustrates the knowledge teachers should have and how that knowledge may be applied in teaching reading.

Knowledge of Language Structure and Examples of Application to Teaching

Key Concepts and Skills by Domain	Examples of Application to Instruction
<p>1. Phonetics and Phonology</p> <p>Understand that speech sounds are not letters, and letters do not make sounds—they represent them.</p> <p>Know that consonant and vowel phonemes can be grouped into classes with similar properties (e.g., <i>stops, nasals</i>, etc.).</p> <p>Learn that English has 25 consonant phonemes and 18 vowel phonemes; these do not correspond directly to 26 letters of the alphabet.</p> <p>Recognize phoneme substitutions in students' speech, reading, and spelling.</p> <p>Appreciate that phonology encompasses all aspects of speech processing and production, including stress placement and memory for new words.</p>	<p>Instead of asking "What sound does each letter make?," use accurate language and focus on a specific sound, asking, "What letter(s) represent /er/ in <i>first</i>?"</p> <p>Help children focus on sounds by saying things like, "<i>/m/, /n/, and /ŋ/</i> are the three 'nosey' sounds in English; hold your nose to feel how these sounds go through the nose."</p> <p>The 18 vowel phonemes in English are represented by five letters, <i>a, e, i, o,</i> and <i>u</i>, singly and in combinations of two, three, and four letters (e.g., <i>ie, igh, eigh</i>).</p> <p>A student who writes <i>KOG</i> for <i>coach</i> may not distinguish /j/ (as in letter name "g") from /ch/, which are two consonant sounds that differ only in voicing.</p> <p>During vocabulary and spelling instruction, ask students to pronounce words slowly and accurately, with appropriate syllable stress.</p>
<p>2. Phoneme Awareness</p> <p>Produce speech sounds accurately during reading, vocabulary, and spelling instruction.</p> <p>Reference the feel and appearance of phoneme articulation as phonemes are introduced.</p> <p>Identify, match, and select appropriate examples of words containing specific phonemes.</p> <p>Select contrasting pairs of words that differ only in one phoneme for the purpose of teaching speech-sound awareness.</p> <p>Recognize that speech sounds are produced with variation because of coarticulation and dialect.</p> <p>Understand and follow a developmental continuum for phonological skills when designing instruction, continuing through advanced levels of phoneme proficiency.</p>	<p>Say /t/ crisply, not <i>tuh</i>.</p> <p>Say, "Look in the mirror; what is your mouth doing as you say /th/?"</p> <p>In teaching awareness of the phoneme /sh/, use words including <i>shoe, chef,</i> and <i>sugar</i>. (Listen for the sound; don't confuse the task with spelling or phonics.)</p> <p>Use sound boxes and tokens or colored blocks to show what sound has changed, one word at a time: <i>leaf</i> to <i>leave</i>, <i>leave</i> to <i>cleave</i>, <i>cleave</i> to <i>clean</i>, <i>clean</i> to <i>clown</i>.</p> <p>Recognize that for some students, <i>pin</i> and <i>pen</i> sound the same, as do <i>Don</i> and <i>Dawn</i>.</p> <p>Gradually progress through early, basic, and more advanced phoneme awareness tasks, as outlined in a scope and sequence, by devoting a few minutes daily until students gain proficiency.</p>
<p>3. Morphology</p> <p>Identify morphemes (the smallest meaningful units of language) and distinguish them from syllables.</p> <p>Identify the meanings of common Latin and Greek prefixes, roots, and suffixes, so as to improve word recognition, spelling, and vocabulary.</p> <p>Recognize that spellings of morphemes are often stable even when pronunciation varies in words with a common root; as a result, spelling can be a clue to meaning.</p> <p>Teach inflectional suffixes (<i>-ed, -s, -ing, -er, -est</i>) early; they are necessary for changing tense, number, and degree, but they are linguistically challenging.</p> <p>Build knowledge of families of morphologically related words when teaching reading, vocabulary, and spelling.</p> <p>Encourage students to use morpheme recognition, context, and the dictionary to decipher and/or refine their knowledge of words' meanings.</p>	<p>The word <i>interchangeable</i> has five syllables and three morphemes: <i>inter, change, able</i>.</p> <p><i>Attractive</i> has three Latin-based morphemes: <i>at</i> (ad) meaning to or toward; <i>tract</i> meaning to pull; and <i>ive</i>, an ending that marks the word as an adjective.</p> <p><i>Express, expression; legal, legislate; inspire, inspiration; nature, natural</i>.</p> <p>The past tense <i>-ed</i> has three pronunciations, /t/, /d/, and /ed/, depending on the last sound of the word to which it is added.</p> <p>Begin with a Latin root, such as <i>vers</i> and <i>vert</i> (to turn): <i>reverse, inverse, perverse, vertigo, versatile, incontrovertible</i>, etc.</p> <p><i>Cite</i> is related to <i>citation</i>; <i>site</i> is related to <i>situation</i>; <i>sight</i> is related to <i>seeing</i>.</p>

Key Concepts and Skills by Domain	Examples of Application to Instruction
<p>4. Orthography</p> <p>Appreciate that the English alphabet and alphabetic writing is a recent development in evolutionary time.</p> <p>Understand that letters and letter combinations (graphemes) represent sounds but are not the same as sounds.</p> <p>Show students that English orthography is variable and complex but predictable.</p> <p>Use a comprehensive scope and sequence that includes instruction in digraphs, blends, silent letter combinations, vowel teams, diphthongs, and the six common syllable types.</p> <p>Adopt and learn a systematic approach for teaching decoding and spelling.</p>	<p>Although some children learn to read with less instruction than others, children’s brains are not “wired” to read! Expect that they need to be explicitly taught.</p> <p>The phoneme /f/ is represented by <i>f</i>, <i>ff</i> (<i>stuff</i>), <i>gh</i> (<i>tough</i>), and <i>ph</i> (<i>phone</i>).</p> <p>Teach that most words can be decoded using knowledge of phoneme-grapheme correspondences, syllable patterns, morphemes, orthographic rules, and word origin. For example, words like <i>have</i> and <i>love</i> have a silent <i>e</i> because no word in English ends in plain <i>v</i>.</p> <p>Explicit instruction in the written code should extend at least through grade 3 when syllables and morphemes in longer words are tackled.</p> <p>A lesson routine or format typically takes 30–45 minutes daily, progressing through the introduction of a concept, guided practice, more independent practice, and application to reading and writing.</p>
<p>5. Semantics</p> <p>Teach word meanings in relation to other word meanings.</p> <p>Recognize that word knowledge may be superficial or deep.</p> <p>Understand that new word meanings are learned and deepened through repeated exposure in context as well as formal study.</p> <p>Adopt a routine for teaching unfamiliar word meanings to students.</p> <p>Select words for explicit teaching that are central for understanding a text.</p>	<p>Include antonyms, synonyms, associations, analogies, and categorical relationships on vocabulary tasks.</p> <p>Strive to teach selected words in depth, with discussion of connotation and pragmatic use.</p> <p>Use classroom discussion, independent reading, content-area learning, reading aloud, and grouped and independent writing to expose students to many new words.</p> <p>Provide a student-friendly definition, many examples, and opportunities for students to say and use new words.</p> <p>Reserve in-depth vocabulary instruction for a few words that are important for understanding the text and subject matter at hand.</p>
<p>6. Syntax and Text Structure</p> <p>Appreciate that texts have structures that can be represented with graphic organizers (e.g., narrative and informational texts organized as compare/contrast, argumentation, description, cause/effect, etc.).</p> <p>Identify cohesive devices such as pronoun references, connecting words, word substitutions, parallel sentence structure, and paragraph organization.</p> <p>Use diagrams, charts, or other visual supports to portray the structure of simple, compound, and complex sentences.</p> <p>Identify, paraphrase, and interpret challenging or problematic sentence structures found in academic text.</p>	<p>Identify and illustrate for students the purpose of a given text and its logical structure.</p> <p>Help students identify how a text hangs together and how to follow the connections among ideas as meaning is constructed.</p> <p>Emphasize the function of words within sentence structures: Which words tell who? Did what? To what/whom? Why? Where? When?</p> <p>Be alert for double negatives, passive voice, long-distance dependencies between nouns and verbs, and other aspects of sentence structure that need to be broken down and rephrased with students.</p>



Teachers need to connect the teaching of skills with the joy of reading and writing, using read-alouds and motivating activities with a rich, knowledge-building curriculum.

3. Best Practices

A. Use of Validated Instructional Practices

Children—particularly those who are not strong readers—are routinely subjected to teaching practices that have not been shown to be effective for children like themselves. These include teaching students to rely on context, pictures, and guesswork to decipher new words, instead of decoding the sound-symbol relationships. In far too many classrooms, a great deal of time is allocated to practices—like drilling children on hundreds of “sight” words on flash cards and drawing outlines around words as if a word’s silhouette would help identify it—that are less effective than practices based on the latest research. There is now a large body of evidence indicating the content and the methods of instruction most likely to help the weaker students come up to par.

Experts agree that children who initially are at risk for failure are saved, in most cases, by instruction that directly teaches the specific foundational language skills on which proficient reading depends.⁴² Effective teachers of reading raise awareness and proficiency through every layer of language organization, including sounds, syllables, meaningful parts (morphemes), phrases, sentences, paragraphs, and various genres of text. Their teaching strategies are explicit, systematic, and engaging.⁴³ They also balance language skill instruction with its application to purposeful daily writing and reading, no matter what the skill level of the learner. Middle- and upper-grade children who are weak readers can be brought up to grade level with appropriate instruction (although the time, effort, and emotional strain for children and teachers involved is considerably greater than that required to teach younger children, so offering research-based instruction in the early grades must remain a top priority).

Well-designed, controlled comparisons of instructional approaches have consistently supported these components and practices in reading instruction:

- Direct teaching of decoding, comprehension, and literature appreciation is necessary from the beginning; as students develop, the emphasis, content, pacing, and complexity of lessons will change.
- Phoneme awareness instruction, when linked to systematic decoding and spelling (encoding), is a key to preventing reading failure in children who come to school without the ability to identify, separate, and manipulate individual speech sounds.
- It is better to teach the code system of written English systematically and explicitly than it is to teach it indirectly, incidentally, or with an as-needed, just-in-time approach. The focus for instruction (sound, syllable, morpheme, word) will be chosen on the basis of curriculum-based measurements showing where, in a scope and sequence, the student should be

practicing phoneme awareness, phonics, word analysis, spelling, and text reading.

- Vocabulary is best taught with a variety of complementary methods, both direct and incidental, designed to explore the relationships among words and the relationships among word structure, origin, and meaning.

A rich and meaningful curriculum, in which students are exposed to a variety of texts as they learn concepts in science, literature, social studies, history, the arts, and culture, should provide the context for developing reading and writing skills. Comprehension strategies should not be taught in isolation but used as necessary to enhance understanding of text assigned for content learning. Useful comprehension strategies to embed in content reading include prediction of outcomes, summarizing, clarification, questioning, and visualization; these can be modeled explicitly by the teacher and practiced overtly if students are not comprehending well or if they approach reading comprehension passively. Of course, children also benefit from access to full libraries and incentives to read independently.

B. Opportunities for Coaching and Supervised Experience

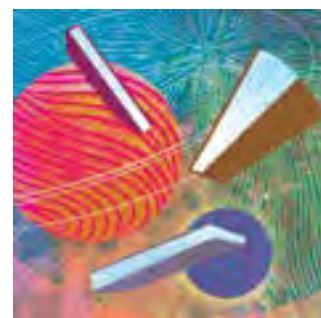
Knowing what should be done in the classroom is necessary but not sufficient for developing practical teaching skills. Translating knowledge into practice requires experience with a range of students. Teachers seldom have the experience of watching various experts at work or receiving on-site coaching or supervision on a regular basis.

However, the repertoire of practical implementation skills to be learned is extensive, and the time needed to hone those skills is substantial. Internship programs should be designed to allow new teachers to collaborate with peers and with mentor teachers, and to support the development of skills new teachers need to manage the range of reading levels and instructional challenges they will encounter in their classrooms.

4. Assessment That Informs Teaching

Teachers typically receive inadequate preparation in the selection and use of formative assessments to inform their practice. Rather than teaching teachers to use unreliable screening and diagnostic assessments of questionable validity, training should be focused on the use of measures and observation tools that have been thoroughly vetted through research.

The science of prediction and early identification is quite advanced and several tools are available for determining which students in K-3 are at risk for having difficulty in learning to read.⁴⁴ These are efficient, valid, reliable, and of minimal cost. They enable teachers to focus on intervention *before* students fall behind. Screening assessments with excellent ability



Teachers who know about reading development and understand language structure and its application can answer questions like these:

What sounds will children confuse with /p/ and what can the teacher do to help children avoid confusion?

Sounds that are articulated similarly are most likely to be confused. The /b/ is articulated exactly like the /p/, except that it is voiced—the vocal cords get involved right away with /b/. Sometimes children confuse /p/, /b/, and /m/, again because they are all produced with the lips together. A teacher should call attention to subtle pronunciation differences and then have them practice identifying, saying, reading, and spelling these sounds in contrasting words such as *bike*, *Mike*, and *pike*.

Why do children often spell *dress* with a *j* or *g* in the beginning?

Because we pucker before the /r/ and make a sound more like /j/ or soft *g* than the /d/ in *desk*. Children can be asked to think about this and watch what their mouths do before practicing the recognition and spelling of *dr* (and *tr*) words.

Are *love*, *dove*, *have*, and *give* “exception” words in English?

No, they are completely predictable. English doesn’t permit its written words to end in one *v* letter alone. The *e* is necessary to keep it company and prevent the word from ending in a *v*. These words can be taught as a group that does follow a pattern.

How many meaningful parts (morphemes) are there in the word *contracted*?

Three. The prefix *com*, meaning *with*, was changed to *con* so that it would match up with the *t* in *tract* for easier pronunciation. The other morphemes are the root *tract* meaning *to pull* and the past tense inflection *ed*. During instruction, *contract* should be grouped with *retract*, *intractable*, *traction*, and other words that share its root.

The science of early identification is quite advanced. Several tools are available for determining which students in K–3 are at risk for having difficulty in learning to read.

to predict reading difficulties should be given as soon as students enter kindergarten, if not before, and repeated three times per year until students are reading fluently.

Progress-monitoring is an essential kind of assessment that should serve as the basis for forming instructional groups of students with similar needs. It, too, should be brief and efficient. Curriculum-based measures, especially oral reading fluency and accuracy, are often used for this purpose.

Language comprehension is less easily measured by teachers, who must rely on classroom work samples, unit tests, vocabulary measures, and comparison of what students comprehend while listening with what they comprehend by reading.

Teachers who understand the assessment of classroom reading and writing skills can answer questions like these:

What specific skills that should be present at the end of kindergarten are the best predictors of later reading achievement?

Essential skills consist of the ability to segment the phonemes in simple words, to name alphabet letters presented randomly, to produce the sounds represented by most consonants and the short vowels, to spell simple words phonetically, and to demonstrate age-appropriate vocabulary development.

Are running records or oral reading tests reliable or valid indicators of reading ability?

The reliability of oral reading tests and running records is lower than the reliability of more structured, specific measures of component reading skills. Teacher judgment of the cause of specific oral reading errors (e.g., miscue analysis) tends to be unreliable, and the category of “visual” errors is misnamed. On the other hand, timed, brief oral reading tests that measure words read correctly per minute are excellent predictors of future reading from about mid-first grade onward.

When are children typically expected to spell *trapped*, *offered*, *plate*, *illustrate*, and *preparing*?

Plate: end of first grade when the most common long vowel spelling is learned.

Trapped: end of second grade when the basic doubling rule for endings beginning with vowels is learned.


Preparing: end of fourth grade when students expand their knowledge to Latin-based words with prefixes, roots, and suffixes.

Illustrate: end of fifth grade when more complex words with prefixes, roots, and suffixes are learned.

Offered: end of sixth grade when patterns involve prefixes, roots, and suffixes and more complex spelling changes.

Why is it important to test comprehension using several different types of assessments?

Several assessments will lead to a more accurate picture of students’ comprehension because the outcome of comprehension tests depends on many variables, including the student’s prior knowledge of the topics in the passages, decoding ability, and vocabulary; the response format; the length of the texts; and so forth.



Where We Need to Go: Changing Teacher Preparation and Professional Development

Every year, about 13 percent of the teacher workforce retires or leaves their jobs and must be replaced. Turnover is higher in the United States than many other developed countries. Perhaps if clearer standards, substantive courses of preparation, and better instructional resources and supports were available, more teachers would sustain a commitment to their profession. Educators who are equipped to ensure reading success in the vast majority of their students will feel empowered and rewarded. To achieve that goal, a range of initiatives needs to be considered.

1. Use Research to Guide the Profession

Teacher educators must be more informed about the vast scientific research base that can inform our profession. Colleges of education would do well to collaborate with research centers and/or to participate in higher education consortia that provide ongoing education for college faculty.

Teachers are often not in a position to make decisions regarding school district reading curricula and/or reading texts. Nevertheless, teachers who understand the foundations of their discipline will be better prepared to argue against the wholesale district adoption of irresponsible fads and market-driven changes in teaching philosophy. Teachers who know better can countermand the proliferation of appealing but unsupported ideas that have been harmful influences for several decades. Examples of enduring myths and misconceptions that are still embedded in popular programs, articles, and textbooks⁴⁵ include:

- reading instruction is only needed until third grade;
- competent teachers do not use published reading programs;
- avoiding published reading programs empowers teachers and enhances the professional status of teaching;
- teaching phonics, word attack, and spelling skills directly to children is harmful;
- reading a lot is the best way to overcome a reading problem;
- children should be taught to guess words on the basis of meaning and syntax; and
- skills must always be taught in the context of literature.

With no accountability system to check their dissemination, unsupported ideas such as these fill the void left by weak pre-service and in-service programs. Perhaps the dubious quality of past educational research has justified the prevalent cynicism among educators, who are often told that research exists to support any point of view. However, reading is actually one of the most studied aspects of human behavior, and a large body of work based on sound principles of objective inquiry exists that could be informing the field. Indeed, our best reading studies test competing hypotheses with well-defined groups of children, employ designs that allow the studies to be replicated, and yield results obtained with methodological sophistica-

A core curriculum for preparing teachers of reading is needed to guide the learning experiences offered across preparation programs.

tion. Independent peer review is part of the scientific process that attempts to control for the biases of investigators. Even our best studies will be flawed, however, and no single study will have all the answers we seek, so converging findings from multiple studies should drive the profession.

2. Establish Core Professional Standards, Curricula, and Entry-Level Assessments for New Teachers

Following the example of several states, the knowledge and abilities important for competent delivery of comprehensive reading instruction must be defined. Such standards should form the basis of the reading curriculum for teacher candidates and should inform the assessments used for licensing.⁴⁶

Some states have chosen to mandate specific coursework for teachers; others delineate competencies and allow colleges of education to redesign programs to meet them. A core curriculum for preparing teachers of reading is needed to guide the assemblage of learning experiences offered to teachers across preparation programs. The core curriculum will, of course, change over time in response to new research and needs, but it should remain a stable center around which the profession evolves.

Although a sufficient body of research on reading instruction exists to guide practice, more studies of preparation for teaching reading are needed. It would be useful to know both how much and what kinds of supports help a novice teacher become comfortable teaching the major components of a reading lesson. Is it best to start with a script from which the more seasoned teacher can depart? Is it best to begin with practical experience and then move to theory and research? Should a novice teacher begin by instructing only one student? What kind of observation is most helpful to a new teacher?

Is there a sequence of coursework and experience that is most efficient and productive for learning what to do? Such questions merit systematic investigation if we are to dramatically improve teacher preparation in the long run.

3. Align Teacher Education Curricula, Standards for Students, and Licensing Requirements for Teachers

Teacher education programs should be accountable for the quality and effectiveness of their programs. For too long, universities have underinvested in income-producing programs, such as teacher education, without concern for the preparedness of their graduates. States, under pressure to bring more adults into the teaching profession and to increase diversity in the teacher corps, have been reluctant to impose stringent criteria for preparedness. The expectations for teacher candidates are often low within colleges of education where clear standards derived from objective measurement have not been upheld. Professors in education programs, who are usually paid less than other academics in higher education, typically have a heavy teaching load and few incentives for spending time with teachers in schools. Collaborative partnerships between schools and universities must be nurtured so that there will be better alignment between what teachers learn pre-service and what they must teach once they are in the classroom. Consistency among university core curricula for teachers, state standards and curriculum frameworks for schoolchildren, and teacher licensing standards could eliminate the confusing and contradictory learning experiences that teachers often encounter.

4. Create Professional Development Institutes for Professors and Master Teachers

Are professors of education currently able to provide instruction in the core curriculum suggested in this paper? The state of Mississippi recently confronted that question head-on, and found that deep, substantive changes were needed in university course content and design before teachers would be well prepared. Consequently, university professors have participated in a statewide course of study that is radically changing what aspiring teachers learn. With these changes and a statewide effort to change what practicing teachers know and do, Mississippi was the only state to show significant fourth-grade reading progress on the last NAEP.

Individual professors often do commendable work under adverse circumstances, but many are not familiar with the basic disciplines that might inform reading education and are insulated from scientific progress in fields that have an impact on their own. Professors and staff developers deserve opportunities and incentives to attend professional development institutes to keep abreast of advances in fields such as linguistics, neuropsychology, developmental psychology, cognitive experimental psychology, and multidisciplinary intervention research.

5. Press the Developers of Textbooks and Instructional Materials to Improve Their Products

Enormous amounts of money are spent yearly by schools on vendors' products. Publishers should be responsible for publishing textbooks and instructional materials that advance concepts, content, and teaching practices validated by research. Unfortunately, in this country, no such accountability for publishers exists other than that sometimes imposed by state-led review panels. Ill-conceived and ineffective programs and practices abound. Independent reviews by people who know the content, who know the evidence for and against specific practices, and who can evaluate the outcomes associated with the product are sorely needed.⁴⁷

6. Promote High-Quality Professional Development for Teachers

Every teacher who currently teaches reading would benefit from high-quality education about reading development, language structure, and recent research findings. Validated instructional programs should be accessible to every teacher, along with consultation and demonstration of their effective use. Teachers need ongoing professional development that has topical continuity, practical application, and opportunities for collaboration with peers, such as the courses and resources offered by the AFT. These professional development experiences should be linked to continuous in-class coaching. State boards can target the use of state monies to support those professional development programs that meet criteria for quality, currency, effectiveness, and alignment with achievement standards. Most of all, school systems must value and defend the time necessary for working teachers to continually improve their practice.

7. Invest in Teaching

Strong teacher candidates are far more likely to enter and stay with the profession if their working conditions improve. First and fore-

most, candidates must be equipped to do the task at hand before they are put into classrooms to manage on their own. Amenities that many of us take for granted, such as access to telephones and copy machines, time to eat lunch or plan with colleagues, freedom from menial chores, assistance within the classroom, and access to validated instructional materials, should be available to all teachers—especially to teachers serving students with the greatest needs. Teachers who know they can achieve results because their programs and training have prepared them are likely to stay in the profession, experience a high degree of job satisfaction, and rebuild respect for public education.

In Sum

The fact that teachers need better training to carry out deliberate instruction in reading, spelling, and writing should prompt action rather than criticism. It should highlight the chronic gap between what teachers need and what they have been given. It should underscore the obligation of licensing programs to combine coursework with practice on a range of predefined skills and knowledge. The deficiencies in teacher preparation represent both a misunderstanding of what reading instruction demands and a mistaken notion that any literate person should be able to teach children to read. We do not expect that anyone who appreciates music can teach music appreciation, or that anyone who can balance a checkbook can teach math.

Just about all children can be taught to read and deserve no less from their teachers. Teachers, in turn, deserve no less than the knowledge, skills, and supported practice that will enable their teaching to succeed. There is no more important challenge for education to undertake.



Where Can I Learn about the Science of Reading?

Here is a sampling of institutional and independent training programs providing professional development for teachers that is aligned with current scientific reading research.

AIM Academy (Conshohocken, PA):
www.aimpa.org

American Federation of Teachers
(Washington, DC): www.aft.org

Barksdale Reading Institute (Jackson, MS):
www.msreads.org

Center for Development and Learning
(Metairie, LA): www.cdl.org

Consortium on Reaching Excellence in
Education (Oakland, CA):
www.corelearn.com

Cox Campus at the Rollins Center for
Language & Literacy (Atlanta, GA):
www.coxcampus.org

HILL for Literacy (Woburn, MA):
www.hillforliteracy.org

LETRS Professional Development, Voyager
Sopris Learning (Dallas, TX): [www.voyager
sopris.com/professional-development/letrs](http://www.voyager
sopris.com/professional-development/letrs)

Literacy How (Trumbull, CT):
www.literacyhow.org

Mayerson Academy (Cincinnati, OH):
www.mayersonacademy.com

Neuhaus Education Center (Bellaire, TX):
www.neuhaus.org

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Appendix: AFT's Literacy Resources

Professional Learning Courses for Educators

The American Federation of Teachers provides professional learning opportunities at events throughout the year and also works with state federations and local affiliates to deliver coursework locally. For more information and support, contact the AFT national office: edissues@aft.org or 800-238-1133, ext. 8636. For the full course catalog, which contains the following courses on literacy (and much more!), visit www.aft.org/sites/default/files/plcatalog2017.pdf.

- **Beginning Reading Instruction**

This course focuses on how children learn to read and the best ways to teach reading from kindergarten to the end of the primary grades. The course presents a synthesis of the research consensus for beginning reading instruction, and it provides the most effective instructional strategies—aligned to that research—to help students develop print awareness, phonemic awareness, knowledge of the alphabetical system, phonics/decoding skills, fluency, vocabulary, and comprehension.

- **Reading Comprehension Instruction**

This course focuses on the research and exemplary practices that help students acquire strong reading comprehension skills. It is appropriate for all K–12 teachers and support staff who need to help increase their students' comprehension of text. The course provides participants with a synthesis of the research base on reading comprehension instruction and vocabulary development.

- **Accessible Literacy Framework**

How does one provide reading instruction to students with developmental or intellectual disabilities, such as autism, cerebral palsy, or Down syndrome? This course is designed specifically for educators and school staff who are responsible for providing and/or adapting materials for students with disabilities who have complex communication needs, use assistive technology to access curriculum, or require adaptive materials to participate in a learning environment.

- **Colorín Colorado Introductory Workshop for ELL Educators**

When English language learners are placed in mainstream classrooms, it can be a huge challenge for the students and for the educators. This workshop highlights resources, materials, and the latest research to help educators reach out to ELL families and learn more about literacy skills, academic content, and English language acquisition. The workshop also introduces participants to the free online materials available on Colorín Colorado's website, www.colorincolorado.org, developed by the AFT and PBS station WETA, which provides preK–12 educators of ELLs of all language backgrounds a high-quality, research-based resource.

Literacy Resources for Families

The following literacy resources are part of a larger collection of free supports for families, all of which are available at www.aft.org/education/publications/resources-parents.

- **Literacy: The Keys to Success**

These resources help explain what your child should know and be able to do while reading and writing. The suggestions offer examples of how families can support children's learning at home. Also included are links to helpful websites where families can find more information and resources, including videos.

- Tips for Elementary School Parents (Grades K–2)
- Tips for Elementary School Parents (Grades 3–5)
- Tips for Middle School Parents

- **PreK–3 English and Spanish Reading Tip Sheets for Parents**

Reading, and a love for reading, begins at home, and research has shown that children who have a solid foundation in their first language have an easier time learning to read in English. These one-page reading tip sheets, available in English and Spanish, offer easy ways for parents to help their children become successful readers—even if parents don't speak English!

- Tips for Parents of Preschoolers
- Tips for Parents of Kindergartners
- Tips for Parents of First Graders
- Tips for Parents of Second Graders
- Tips for Parents of Third Graders

On-Demand Webinar for Educators and Families

Spotlight on Morphology: The Immense Power of Owning Words

Unleash the power of morphology through word study and word play to help students build a stronger vocabulary. This session is ideal for teachers and parents looking for easy-to-implement strategies and tips to improve students' literacy skills in morphology.

This webinar is free, but registration is required. For details, visit <https://bit.ly/39Ddx8A>.

“This we know: reading failure can be prevented in all but a small percentage of children with serious learning disorders. It is possible to teach most students how to read if we start early and follow the significant body of research showing which practices are most effective.... It is our nation’s dedicated teachers and their excellent teaching that will bring the rocket science that is research-based reading instruction to schools and classrooms across the country and will **unlock the power and joy of reading for our children.**”

—Louisa C. Moats,
Teaching Reading *Is* Rocket Science, 2020



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