

Chapter 3

Phonics and Spelling: Learning the Structure of Language at the Word Level



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Abstract This chapter discusses why phonics in beginning reading and spelling is a critical component of instruction, but more complex and challenging to implement than commonly portrayed. It will argue that phonics is better characterized as an aspect of structured language teaching requiring explicit and systematic skill building within several levels of language organization (phoneme-grapheme correspondences, orthographic patterns, morphology, and etymology). Well-conceived practices supported by theory and research are contrasted with others that do not align with scientific evidence, in spite of their ubiquity. The chapter concludes with a set of well-supported recommendations to improve phonics, word reading, and spelling instruction.

3.1 Most Reading Difficulties Originate from Problems with Decoding and Word Recognition

Our national data continue to show that nearly a third of school children fail to become skilled readers by fourth grade (National Assessment of Educational Progress, United States Department of Education, 2017). This grim statistic has not changed substantially over the last 20 years. Reading failure is associated with costly social, economic, and health impacts for the affected individuals and for our society (Sweet, 2004). Yet one must ask, if reading is one of the most studied of all psychological skills (Rayner, Foorman, Perfetti, Pesetsky, & Seidenberg, 2001; Seidenberg, 2017), why do so many students still not learn to read? This puzzle has many pieces, but a major one is the enduring chasm between scientific research and typical practices in our schools. At the center of the debates regarding reading instruction, there continues to be dissention over whether or not to teach phonics, as well as how to teach phonics.

Cognitive science has shown beyond doubt that fluent, accurate word recognition is a hallmark of skilled reading with comprehension (Adams, 1990; Rayner et al., 2001) and that poor readers are almost always limited by their inability to

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use letter-sound skills (e.g., phonics skills) to identify unfamiliar words (Ehri, 1998; Rack, Snowling, & Olson, 1992) and, consequently, to establish a sight recognition vocabulary sufficient for fluent reading (Ehri, 2014; Miles & Ehri, Chap. 4, this volume). Accurate and automatic mapping of print to speech, and speech to print (Treiman, 2017), depends first on knowing both sounds and symbols. Interestingly, this apparently easy task—learning letters, sounds, and their connections—ranges from somewhat difficult to very difficult for at least a third of the population (Denton, Fletcher, Taylor, Barth, & Vaughn, 2014). It is the most common impediment standing in the way of normal reading development.

The importance of teaching foundational reading skills in the regular classroom and in intervention programs has been established by meta-analyses and expert reviews over several decades, and these foundational skills include phonological awareness, phonics, and fluent word recognition (Adams, 1990; Anderson, Heibert, Scott, & Wilkinson, 1985; Chall, 1967; Gersten et al. 2008; Foorman et al., 2016; National Institute of Child Health and Human Development, 2000; Snow, Burns, & Griffin, 1998). Teaching phonics and phonological awareness explicitly, systematically, and sequentially, with phoneme-grapheme correspondence as the core focus of instruction, is essential if the goal is preventing reading failure and enabling most students to read. Nevertheless, instruction in how to read words and how to spell them during text reading and writing is often insufficient, haphazard, misinformed, or dissociated from reading and spelling (Moats, 2017). Consequently, reading problems that could be identified, resolved, and/or reduced in severity beginning in kindergarten are left untreated (Torgesen, 2004, 2005).

This chapter will discuss why the subject matter of phonics in beginning reading and spelling is more complex than commonly portrayed. It will argue that this component of instruction would be better characterized as an aspect of structured language teaching at several levels of language organization. Well-conceived practices supported by theory and research will be contrasted with others that do not align with scientific evidence. The chapter concludes with a set of well-supported recommendations to improve phonics, word reading, and spelling instruction.

3.2 Students' Instructional Needs Differ, But How?

Students vary greatly in their literacy knowledge when they arrive at school, for reasons ranging from genetic predispositions or natural aptitudes for processing written language (Olson, Keenan, Byrne, and Samuelsson, 2014; Byrne, Olson, and Samuelsson, Chap. 9, this volume) to their life experiences prior to entering school. Learning to read, however, makes similar cognitive and linguistic demands on everyone. To read English, we must learn the letters, learn to identify the speech sounds that letters represent, and learn to map symbols to sounds very efficiently. If we name a printed word accurately, and know the meaning, we can instantly make sense of it (Rayner et al., 2001).

To spell, we invert this process: We analyze the sounds in words, conjure their meanings (if known), and recall the complete orthographic image or letter sequence of the word if we know it (Treiman, 2017). There is no bypass around the alphabetic coding process in learning to read or spell English. We do not learn words as visual wholes (see Kilpatrick & O'Brien, Chap. 8, this volume). Recognizing words by sight and spelling them is the end result of a multi-phase developmental process described in detail by Ehri (1998, 2014) and colleagues (Ehri, Cardoso-Martins, & Carroll, 2014; Miles & Ehri, Chap. 4, this volume).

It is poor readers who turn to context, guesswork, and pictures to determine the identity of whole words as they read (Adams, 1990; Gough & Tunmer, 1986; Rayner et al., 2001). Those behaviors signify inadequate knowledge of phonic correspondences, print patterns, and decoding strategies. Such students are sometimes mistakenly called “visual learners,” although there is no evidence that non-verbal, visual-spatial aptitudes are an asset for learning how to recode the alphabet into spoken language. Poor readers, in the beginning stages of learning to read, most commonly have a language-based learning problem that is interfering with progress in word recognition (Fletcher, Lyon, Fuchs, & Barnes, 2019; Lyon, Shaywitz, & Shaywitz, 2003).

Differentiation of instruction, therefore, should be predicated primarily on a student's levels of phonological awareness (Kilpatrick, 2015), knowledge of sound-symbol correspondences for reading and spelling, automaticity in word recognition, and language comprehension. The relative severity of students' problems in these areas should determine how instructional time is allocated, but phonics instruction will be one key component of effective intervention for the large majority of poor readers (Kilpatrick & O'Brien Chap. 8, this volume).

3.3 General Research Findings About Phonics Instruction

In 1998, the National Reading Panel (NRP) (National Institute of Child Health and Human Development (NICHD), 2000) was commissioned by Congress to resolve long-standing disputes about the best way(s) to teach reading. The report provided a comprehensive review and meta-analysis of scientific evidence on the teaching of reading accumulated to that date, much of it realized through research funded by the NICHD. At the time, 38 studies that met criteria for scientific rigor were included in the analysis of the effects of phonics instruction. The NRP found substantial support for systematic, sequential instruction in phonics, to include all the major letter-sound relationships of both consonants and vowels, and issued these summary recommendations:

- Systematic and explicit phonics instruction is more effective than non-systematic phonics instruction or reading instruction that includes no phonics component.
- Systematic and explicit phonics instruction significantly improves word recognition and spelling for kindergarten and first-grade students.

- Systematic and explicit phonics instruction significantly improves students' reading comprehension in the early grades.
- Systematic and explicit phonics instruction is effective for students from various socioeconomic levels. It helps students from various backgrounds make greater gains in reading than does non-systematic phonics instruction.
- Systematic and explicit phonics instruction is particularly beneficial for students who are having difficulty learning to read and who are at risk for developing future reading problems.
- Systematic and explicit phonics instruction is most effective when introduced early; instruction should start in kindergarten and first grade.
- Phonics instruction is not a complete reading program. Beginning readers should simultaneously be solidifying their knowledge of the alphabet, engaging in phonemic-awareness activities, and listening to stories and informational texts read aloud. They should also be reading texts as soon as possible and writing letters, words, messages, and stories.
- Phonics can be taught effectively to a whole class at once, in small groups, or to individual students.
- Approximately, two years of basic phonics instruction is sufficient for most students.

Motivated by unresolved questions of methodology and implementation, Brady (2011) subsequently reviewed relevant research on beginning reading instruction produced in the decade following the NRP. She found additional clear support for the practice of teaching phonics systematically and explicitly, with “advantages evident for complete analysis of the phoneme-grapheme composition of one-syllable words,” (p. 80) and that the advantage accrued for all first graders—not just students with reading disabilities. In addition, she found that comprehensive programs that include all other essential components named by the NRP—phoneme awareness, fluency, vocabulary, and reading/language comprehension—yield the best results.

More recently, a panel of researchers convened by the Institute for Education Sciences (Foorman et al., 2016) analyzed the literature on foundational reading skills instruction for K-3. Support for teaching phoneme awareness and explicit phonics was again found to be strong. Further, the report pointedly warned against methods and programs that teach children to guess at words from pictures and context, citing them as harmful and contrary to scientific evidence of effectiveness.

In spite of consistent, overwhelming evidence for the importance and value of code-emphasis instruction for all, and systematic, explicit remediation in phonic decoding for most students with reading difficulties, our schools continue to embrace methods and programs that ignore these recommendations. For example, Denton et al. (2014) reported that two-thirds of the teachers in their study used Guided Reading (Fountas & Pinnell, 1996), an approach with no systematic phonics instruction. Reading Recovery (Clay, 1991), an intervention with no systematic phoneme awareness or phonics instruction, continues to have adherents in spite of its demonstrated ineffectiveness with students who have reading disabilities (Chapman & Tunmer, 2011; Chapman, Greaney, & Tunmer, 2015). Leveled Literacy Intervention (LLI, Fountas

& Pinnell, 2008) is used to complement Guided Reading, but phonics instruction is minimal, implicit, non-systematic, uninformative, and often unrelated to the texts students are reading (Murray, Munger, & Heibert, 2014). Two recent studies of LLI indicated little or no carry over to general reading improvement on assessments not affiliated with the underlying techniques taught in LLI (Ransford-Kaldon et al., 2010, 2012).

Popular practices, overall, are not aligned with research evidence. Children at risk for reading difficulties often do not receive the kind of instruction they need. Perhaps one way to redirect educators' attention toward phonics and foundational skills is to give the subject matter a new identity—as an aspect of language that is inherently interesting, enjoyable to study, and linked closely to vocabulary, spelling, and reading comprehension. Reconceptualizing the foundations of literacy may help move us beyond fruitless debates of the past.

3.4 More Than Phonics: Word Reading and Spelling Involve Awareness of Language at Several Levels of Language Organization

Learning to decode is not a low-level association skill that must be learned by rote drills. Good readers establish printed word representations in memory (unitized whole word letter sequences that can be recognized by sight) when they can map phonemes to letters or letter combinations, and vice versa (Ehri, 2014; Harris & Perfetti, 2017; Miles & Ehri, Chap. 4, this volume) and when these associations connect to meaning. In addition, fully specified or high quality mental representations of words include all of their linguistic features (Adlof & Perfetti, 2014), from their pronunciation to their semantic properties. Each aspect of language discussed below is represented in the English writing system and should be addressed during formal instruction.

Phonological awareness. An alphabetic orthography or writing system represents individual speech sounds or phonemes. Thus, for sound–symbol mapping to occur in the mind of the learner, he or she must establish mental representations for the speech sounds that the orthography represents. Those phoneme representations will be the template onto which the print symbols are mapped (Miles & Ehri, this volume). But herein is an under-appreciated fact: phonemes are more than sound frequencies. Their distinctive identities include the articulatory movements required to produce them. To establish a mental representation for a phoneme, the learner must differentiate phonemes by their acoustic and articulatory features (Fromkin, Rodman, & Hyams, 2014; Liberman, Shankweiler, & Liberman, 1989).

For example, the difference between /ch/ and /j/ is voicing; /ch/ is unvoiced, spoken with no activation of vocal cords while /j/ is voiced, with the vocal cords resonating. Except for the feature of voicing, the two consonants are articulated exactly the same way, with the mouth puckered, the teeth together, and single push of breath. English

has nine pairs of consonant phonemes that differ only in voicing: /p/ /b/; /t/ /d/; /k/ /g/; /f/ /v/; /th/ /th/; /s/ /z/; /sh/ /zh/; /ch/ /j/; /wh/ /w/. Developing awareness of subtle differences among similar phonemes is challenging for students with phonological processing weaknesses, as their spelling errors attest (Bourassa & Treiman, 2014; Cassar, Treiman, Moats, Pollo, & Kessler, 2005; Moats, 2010).

In addition, English has sounds that are not represented by unique alphabet letters, and many letters are used in more than one way to represent various phonemes. Knowing letter names, while helpful for developing phoneme awareness, is not enough to learn the identity of the speech sounds. Children must become aware of phonemes for which there are no single visual symbols. For example, the consonant phonemes, including /ng/ as in *sing*, /zh/ as in *vision*, /th/ as in *them* or *bathe*, and a number of the 18 vowel phonemes, including /aw/ as in *saw*, /oo/ as in *book*, /oi/ as in *boy*, /ou/ as in *out*, /er/, /ar/, and /or/ are not consistently spelled with a single letter, or even the same letter(s).

Phoneme awareness eludes many students, moreover, because the identity of phonemes in connected speech is obscured by the properties of the speech stream (Fromkin et al., 2014; Liberman et al., 1989; Moats, 2010). Phonemes in words are not spoken individually, but rather are *co-articulated* in natural speech. Co-articulation means speaking together or saying a string of phonemes as one linguistic unit, usually organized around the central vowel in a syllable. Because phonemes are co-articulated, their phonetic properties (the way they are actually spoken) can vary, sometimes rather dramatically. Say the following words: *desk*, *dress*, *ladder*, *educate*. Each has the letter *d* but only in the first word, *desk*, does the mouth articulate a pure /d/. The phoneme /d/ in *dress* and *educate* is affricated or spoken more like /j/ because of the influence of the phoneme /r/ in *dress* and the hidden phoneme /y/ in the /yū/ in *educate*. The /d/ in *ladder* becomes a tap of the tongue against the back of the upper teeth. These variations are particularly problematic for students trying to spell words by the way they sound, who often produce attempts such as JRS (*dress*) and EJUKAT (*educate*) (Treiman, 2017; Moats, 2010).

These realities of spoken language suggest that the phonological awareness strand of literacy instruction should enable students to identify the 25 consonant phonemes and the 18 vowel phonemes of English (Table 3.1), plus schwa (the indistinct vowel, like the *a* in *about* or the last vowel in *wagon*). The ability to quickly map print to speech depends on it. Furthermore, this aspect of language instruction should be distinguished from learning about the alphabet and learning orthography because phonological awareness requires oral language analysis independent of print. Finally, as Boyer and Ehri (2011) demonstrated, instruction should reference mouth forms and articulatory features of phonemes, and acknowledge the phenomenon of co-articulation.

Phoneme-grapheme correspondences. One reason to teach phonics through encoding, or phoneme-grapheme correspondence, is that the logic of sound to symbol recapitulates history. Letters and graphemes do not “make sounds,” as teachers often say, but rather, written symbols were invented over millennia to represent speech. Speech is the start point for understanding orthography. Second, English has a limited set of 44 speech sounds, including schwa, for which there are about 80–120

Table 3.1 Inventory of common consonant graphemes used to spell English phonemes

Phoneme	Word examples	Graphemes for spelling
/p/	pat, spa, stomp	p
/b/	but, brought, stubble	b
/m/	milk, bomb, autumn	m, mb, mn
/t/	tent, putt, missed	t, tt, ed
/d/	desk, summed	d, ed
/n/	neck, know, gnaw	n, kn, gn
/k/	cot, kettle, deck, chorus, unique, quit	k, c, ck, ch, que, q
/g/	get, ghost	g, gh
/ng/	rang, dank	ng, n
/f/	staff, asphalt, rough	f, ff, ph, gh
/v/	very, give	v, ve
/s/	suit, pass, scent, psycho	s, ss, sc, ps
/z/	zen, fuzz, rise, his, xerox	z, zz, se, s, x
/th/	thing, bath, ether	th
/th/	that, seethe, weather	th
/sh/	shawl, pressure, sugar, chagrin, conscious, spatial, mission, special	sh, ss, s, ch, sc, ti, si, ci
/zh/	measure, seizure, vision, rouge	s, z, si, -ge
/ch/	cheese, sketch	ch, tch
/j/	jam, fudge, page	j, dge, ge
/l/	lice, pill, bubble	l, ll, le
/r/	rat, wrist	r, wr
/y/	<u>y</u> our, <u>e</u> uro, <u>u</u> nique, <u>o</u> nion	y, (u, eu), i
/w/	want, question	w, (q)u
/wh/ ^a	whale	wh
/h/	harm, whose	h, wh

^aThe phoneme /wh/ is disappearing in American English; for many speakers, /w/ and /wh/ are identical sounds, so the sound represented by wh must be taught as a “phonics fiction.”

teachable spellings (Moats, 2010). The smaller number of phonemes provides an easier organization for code-based instruction than the large number of letters and letter combinations that often serve multiple functions (e.g., *ea* in *meat*, *head*, and *great*). Third, there is evidence that a strong encoding (sound to symbol) component increases the effectiveness of beginning reading lessons (Weiser & Mathes, 2011).

The sound-symbol correspondence system in English uses both single letters and letter combinations to represent phonemes. The term *grapheme* means any letter or letter combination that represents a phoneme. Some graphemes are more than two letters, such as *igh* for /i/ in *sight*, and *igh* for /ā/ in *weigh*. Letter combinations are necessary because English has only 26 Roman alphabet symbols to represent

44 sounds. Further, the long historical evolution of English spelling, combined with changes of pronunciation, resulted in several ways to represent many phonemes (Venezky, 1999). The five single vowel letters *a*, *e*, *i*, *o*, and *u* can stand for short or long vowel sounds. Vowel phonemes, especially long vowels, are often represented with several graphemes. The unglided long u, /ū/, for example, can be spelled oo (*moon*), u (*truth*), ue (*blue*), u_e (*rude*), ou (*soup*), ough (*through*) and ew (*stew*). These complexities require several years to teach thoroughly, and certainly cannot be addressed by teaching students that “each letter makes a sound.”

The most common graphemes that represent phonemes in English are listed in Table 3.1 (consonants) and Table 3.2 (vowels).

Table 3.2 Inventory of vowel graphemes most often used to spell English vowels

Vowel phoneme	Examples of words	Most common vowel graphemes
ē (long e)	happy, me, see, meat	y, e, ee, ea
ī (short i)	itch, granite, gym	i, i_e, y
ā (long a)	acorn, date, pay, pail	a, a_e, ay, ai
ě (short e)	echo, dead	e, ea
ǎ (short a)	apple	a
ī (long i)	ride, idol, cry, night	i_e, i, y, ight
ō (short o)	octopus	o, a
ū (short u)	up, cover	u, o
aw	lost, call, saw, audio	o, al, aw, au
ō (long o)	open, toe, boat, throw	o, oe, oa, ow
oo	put, book, could	u, oo, ou
ū (unglided long u)	duty, rude, noose, chew, blue	u, u_e, oo, ew, ue
yū (glided long u)	unicorn, cute, few	u, u_e, ew
oi	boil, boy	oi, oy
ou	ouch, cow	ou, ow
er	her, fur, sir, cellar, doctor	er, ur, ir, ar, or
ar	star, are, heart	ar, a_e, ear
or	sport, chore	or, ore
schwa (/ə/)	circus, about, wagon, effect, commit	u, a, o, e, i (any vowel spelling)

Orthographic patterns. English orthography also encompasses many redundant patterns, conventions for letter sequences, and constraints on the placement of graphemes (beginning, middle, end; before or after other letters). For example, due to historical influences, no English word ends in the letters *v* or *j*. Words such as *have*, *give*, *dodge*, and *college* follow these constraints. The letter combinations *ng*, *ck*, *ll*, *ff*, *ss*, and *dge* occur right after vowels that are usually short, but never in the beginnings of syllables. Certain letters such as *h*, *i*, *x*, and *y* are never doubled. From their first exposure to print, children notice these patterns (or graphotactic characteristics) of orthography (Treiman, 2017). One characteristic of students who fail to automatize word recognition is their inattention to and poor memory for print patterns and the likelihood of their occurrence, referred to as statistical learning (Seidenberg, 2017).

At another level of representation, English orthography uses conventions known as written syllable types to represent vowel sounds in longer words. Familiarity with the six basic syllable-spelling conventions (Table 3.3) can help students decode longer words by breaking them into decodable chunks (Bhattacharya & Ehri, 2004) and can help them remember spellings. Notice that these written chunks do not correspond to the natural breaks in spoken word pronunciation—vocal pauses that tend to come after a vowel no matter what kind of vowel it is. Written syllable conventions are for representing pronunciation of a vowel sound.

Morphology and etymology. Morphemes are the smallest units of meaning. Words may contain one morpheme or many. A single morpheme may be one syllable (*bat*), or more than one (*tiger*; *banana*). Some morphemes are single phonemes, not pronounceable syllables, such as plural *s*, /s/ (*cats*) or /z/ (*dogs*), or two forms of the past tense *-ed*, /t/ (*wished*) or /d/ (*hummed*). Advanced decoding lessons should recognize the differences between syllables and morphemes. It is insufficient to call them all “word parts” as is common in superficial instruction.

Written forms of words often reveal their underlying morphological structures. We spell by sound–symbol correspondences and meaning. For example, *bookkeeper* has two *k*’s because it is a compound; *attach* has two *t*’s because it has a Latin prefix *at* (a variation of *ad*, “to” or “toward”) and a Latin root *tach*. The word *mnemonic* begins with *mne* because that was the base of the Greek word for memory. To explain why words are spelled the way they are, a teacher must call students’ attention to linguistic features beyond the basic alphabetic code.

Instruction in morphology is more meaningful if it is linked to word origin or etymology. Modern English is an amalgam of Anglo-Saxon, Latin, and Greek, and to a lesser extent, includes spellings from French, German, Italian, and Spanish. Each of these languages contributed spelling conventions that within the language of origin were predictable but that violate the patterns of another. For example, *ch* is used to spell /ch/ in Anglo-Saxon words such as *chair*; it is used to spell /k/ in Greek-derived words such as *chorus*; and it spells /sh/ in French-derived words such as *charade* and *machine*. Classes of morphemes in English are listed in Table 3.4 in relation to their language origin.

Learning to recognize morphemes helps students to decode morphologically complex words more quickly, to learn word meanings, and to spell (Carlisle & Goodwin, 2014).

3.5 More Than Phonics: A Multi-linguistic Approach Makes Sense

What are the implications of these linguistic realities for teaching students to read and spell words? First, the term *phonics* is insufficient for capturing the substance and nature of printed word learning. A better term, such as *structured language*, would signify the relevance and interconnectedness of all aspects of language represented in our orthography and the importance of explaining words from several angles.

Second, isolating phonics as a component of instruction has invited a piecemeal, incidental, and cursory approach to teach word identification that is often disconnected from other aspects of literacy. The separation of components diminishes the vital role that phonological awareness and linguistic awareness in general play in

Table 3.3 Six types of written syllables in English orthography

Syllable type	Examples	Definition
Closed	dap -ple hos -pital bev -erage	A syllable with a short vowel spelled with a single vowel letter ending in one or more consonants
Vowel-C-e (“Magic e”)	com- pete in- vite	A syllable with a long vowel spelled with one vowel + one consonant + silent <i>e</i>
Open	pro -gram ta -ble re -cent	A syllable that ends with a long vowel sound, spelled with a single vowel letter
Vowel team	aw -ful train -er con- geal re- coil in- sight	Syllables with long or short vowel spellings that use two to four letters to spell the vowel. Diphthongs <i>ou/ow</i> and <i>oi/oy</i> are included in this category
Vowel-r (r-controlled)	in- cur con- sort char - ter irk -some	A syllable with er , ir , or , ar , or ur . Vowel pronunciation often changes before /r/
Consonant-le	drib- ble bea- gle bat- tle ma- ple	An unaccented final syllable containing a consonant before /l/ followed by a silent <i>e</i> . Also, known as the stable final syllable
Non-conforming: Odd and Schwa syllables	dam- age act- ive na- tion	Usually, final, unaccented syllables with odd spellings. Many are spellings for derivational suffixes such as -ive, -age, -ine, and -tion

Table 3.4 Classes of morphemes in English, classified by language of origin

Language of origin	Type of morpheme	Example words
Anglo-Saxon	Base words	chair, father, love, night
	Compound words (base words combined)	highchair, turtledove, fishcake
	Inflectional suffixes <i>-ed, -s, -es, -er, -est, -ing</i>	climbs, climbed, climbing, higher, highest
	Prefixes such as <i>fore-, be-</i>	beforehand, foreman, begotten
	Derivational suffixes such as <i>hood, -ward, -en, -less</i>	neighborhood, backward, beholden, fatherless
Romance, Latin-based	Prefixes such as <i>ad, re, ex, com, in (im)</i>	admit, revise, exert, commend, innate
	Roots such as <i>duct, tract, port, vert, vis(vid)</i>	conduct, extract, import, revert, vision
	Suffixes such as <i>-tion, -ize, -ity, -al</i>	nation, nationalize, nationality, natural
Greek	Combining forms such as <i>bio, logy, lex, graph, neuro, psych, archos</i>	biology, lexicon, lexicographer, neuropsychology, architecture, monarch

processing the written word, for reading, spelling, and vocabulary development. It is common for programs to purport to teach phonics but to omit entirely any effective work on the phonological skills enumerated in Kilpatrick (2015) or any systematic application of phonics to reading, spelling, and understanding words in context.

Third, we should counter more vigorously the negative connotation held by the word *phonics* that is reinforced in schools of education and education textbooks (Binks-Cantrell, Washburn, Joshi, & Hougen, 2012; Joshi, Binks, Hougen, et al., 2009b; Joshi, Binks, Graham, et al. 2009a; Walsh, Glaser, & Dunne-Wilcox, 2006). Teachers may dislike and avoid teaching phonics because they have no background in the psychology of reading or the structure of language (Brady et al., 2009; Cunningham, Zibulsky, Stanovich, & Stanovich, 2009). Our experience has been that once teachers are introduced to information about spoken and written language necessary for explaining how the code works and why words are spelled the way they are, they are much more likely to embrace good teaching practices (Moats, 2004).

3.6 Structured Literacy in Practice

While this chapter cannot address or describe all the complexities of structured language and literacy teaching, some examples can illustrate the content and methods of the approach. Higher-quality programs of instruction that are linguistically informed are likely to have features such as these.

1. *Phonological awareness instruction* that progresses from early, to basic, to advanced (Kilpatrick, 2015). Lessons will teach students to identify 40–44 phonemes, taught cumulatively and systematically. Phoneme identification activities will include reference to articulation within the system of distinguishing phonetic features (voiced/unvoiced; continuous or stop; placement of the tongue, lips, and teeth).
2. *Pedagogical distinction between letter names and the sounds they represent.* The program will recognize that letter sounds and letter names such as /w/ and “Y”, and /y/ and “U” may be confused, that some phonemes have no unique spellings, and that letters are used in various ways to represent speech sounds.
3. *Routines for introducing sound–letter correspondences.* Lessons will be structured so that students learn letter names, letter sounds, and letter formation in a coordinated sequence. Strong programs include sound–symbol association cards with picture mnemonics.
4. *Regular practice blending all the sounds in words, left to right.* Children may not develop the habit of sounding a word out from start to finish unless they are taught how and are given consistent practice applying this skill. Systematic programs begin with a limited set of sound–symbol correspondences—a few consonant letters (*b, f, h, j, k, m, p, t*) and one or two vowel letters (*a, i*) so that words can be built right away. Other consonants and vowels are added gradually to those already known. Once a correspondence is learned (e.g., /ɛ/, short e, is spelled with e), looking at graphemes and blending them to make whole words (*pet, red, hen*) should be routine.
5. *Phoneme–grapheme mapping.* This type of activity enhances students’ attention to the internal structure of words, in both speech and spelling, and supports whole word identification. Students use grid paper (“sound boxes”) or movable grapheme tiles to map graphemes to phonemes (Grace, 2007). For example, if a grid is used, each box stands for one phoneme in the word to be mapped. Words with digraphs and blends would be mapped in this way:

Word	1st sound	2nd sound	3rd sound	4th sound	5th sound
Champ	ch	a	m	p	
Brisk	b	r	i	s	k
Fresh	f	r	e	sh	
Sting	s	t	i	ng	
Croak	c	r	oa	k	

6. *Practice for automaticity.* What is taught must be practiced. Lesson routines will contain many kinds of practice, including word sorts, using words in fill-in-the-blank activities, and above all, reading phrases, sentences, and connected text that is decodable—that is, it contains a high percentage of words and patterns that have been explicitly taught.

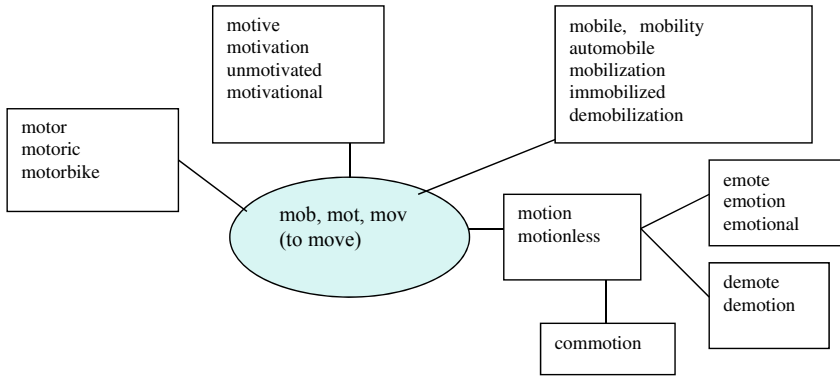


Fig. 3.1 Morphological Word Family Map

3.7 Beyond the Basic Code

To consolidate word recognition, students must become adept at deciphering longer words. Students need strategies for recognizing syllable chunks and common morphemes such as those discussed by Henry (2010). Beginning in late first or early second grade, students should practice combining syllable chunks and dividing words into pronounceable units. As their competence with decoding grows, students in grade three and beyond can enjoy discovering how many words there are in a morphological word family, and thereby expand their vocabularies (Fig. 3.1).

3.8 Explicit, Systematic, Code-Based, and Sequential Reading Instruction: What It Is and What It Is not

Identifying programs and approaches that embody the principles of instruction supported by extensive scientific research is not a simple matter for the consumer. After the National Reading Panel report, almost every publisher and author claimed to have a research-based program. More insidiously, authors and publishers would use the terms systematic, sequential, and explicit to describe visual and context-driven word recognition strategies (e.g., Fountas & Pinnell, 1996, 2008; Hall & Cunningham, 2003). Instead of teaching students to map a whole printed word to its sounds, teachers are coached to correct student errors by drawing attention to meaning, syntax, and visual cues. Sounding out a word is a strategy of last resort, after looking at pictures, thinking about the whole sentence, or looking at the first letter and guessing at something that would make sense. In Guided Reading, the optional component of “word work” merits one or two minutes per day (Fountas & Pinnell, 1996). In contrast, beginning reading programs that get the best results devote 30–45 minutes per day to teaching the code and its application to word reading out of context and

in context (Al Otaiba & Torgesen, 2007; Denton et al., 2014; Foorman et al., 2006; Torgesen, 2004; Torgesen et al., 2001).

Explicit versus non-explicit teaching. To be explicit, the instructor explains how a pattern or correspondence works and leaves little to chance (Archer & Hughes, 2011; Christensen & Bowey, 2005; Connor et al., 2011; Rosenshine, 2012). He or she assumes that decoding is challenging and minimizes exercises where students must intuit the code on their own. Guesswork is discouraged. Table 3.5 illustrates the differences between the instructional dialogue of explicit teaching and the instructional dialogue typical of non-explicit phonics instruction in a lesson on the long-*i*, Vowel-Consonant-*e* (VCe) spelling pattern.

The underlying assumptions of non-explicit approaches such as Reading Recovery, Balanced Literacy, Leveled Literacy Intervention, and Guided Reading are that students do not need to know sound-symbol correspondences to decode unknown words, and that words will be learned globally as visual wholes during meaning-emphasis instruction. These underlying but inaccurate assumptions were promoted under the “whole language” umbrella by Goodman (1986) and Smith (1979) in the 1980s. In spite of overwhelming evidence to the contrary, such assumptions are alive and well in our classrooms.

Table 3.5 Examples of explicit and non-explicit explanation of a phonics pattern

Example of explicit instruction	Example of non-explicit instruction
<p><i>Teacher:</i> “Today we will study another Vowel-Consonant-<i>e</i> or VCe pattern, this one for /ī/ or ‘long i.’ We’ve already learned the VCe pattern for /ā/ as in <i>cake</i>, <i>safe</i>, and <i>tape</i>.”</p> <p>“First, let’s listen for the sound. If you hear /ī/ in the word I say, put thumbs up (<i>ride</i>, <i>hike</i>, <i>made</i>, <i>fit</i>, <i>bite</i>, etc.). Look in the mirror as you say the vowel /ī/. What is your mouth doing?”</p> <p>“A letter pattern that represents long vowels is VCe: one vowel letter, a single consonant, and a silent <i>e</i> at the end.”</p> <p>“Let’s say the sounds in the word <i>side</i>. /s/ /ī/ /d/.” Teacher writes three lines or moves blocks into three sound boxes as students say the three sounds, raising a finger for each sound.</p> <p>Teacher writes the word <i>side</i> on the lines or in the boxes. “Look at the word <i>side</i>. How many letters are there?” (Four.) “How many sounds?” (Three)</p> <p>“Which letter represents no sound by itself? (<i>e</i>). The letter <i>e</i> does not get its own box [or its own line] because it does not represent a vowel sound by itself. Its job is to reach back over the consonant, tap the vowel, and make it say its own name.” (Teacher draws arrow from the silent <i>e</i> back to the sounded vowel letter)</p>	<p>While reading a leveled book, students read <i>hid</i> for <i>hide</i> in the sentence, <i>We played hide and seek</i></p> <p>The teacher asks, “Does that sound like a game you know? Read that again and think of a game you know.”</p> <p>Students say, “It’s hide and seek.”</p> <p>Teacher later writes these words on the board or chart paper: <i>hide</i>, <i>ride</i>, <i>side</i>, <i>tide</i>, and leads students in choral reading of the word list.</p> <p>Teacher says, “These words are all part of the <i>ide</i> family. If you can read <i>ride</i> you can read <i>hide</i>.”</p>

During text reading, if the instruction is implicit, students typically are asked to decode words in context on the basis of the meaning of the sentence, passage, or accompanying illustrations. This strategy is known as a “cueing systems” approach. For example, in a context-based, non-explicit approach based on a cueing systems strategy, teachers encourage students to follow these steps when they come across an unknown word:

- (1) Think about what would make sense here.
- (2) Skip the word and read the whole sentence.
- (3) Look at the pictures for help.
- (4) Look at the first letter; what sound?
- (5) Sound out the whole word.

In contrast, an explicit, code-based word recognition routine, for use while reading text, follows these steps:

- (1) Look carefully at the whole word. [Name the letters, if necessary.]
- (2) Sound it out, left to right.
- (3) Check it; does the word make sense here?

The first approach, the “cueing systems” strategy, conveys to the student that he or she need not know exactly how the correspondences work and that guessing from the meaning or syntax is a productive way of approaching unknown words. The second approach depends on whether the student has—or should have—learned the major correspondences that can be relied upon to recover a reasonable pronunciation from the print.

One of the reasons why contextual guessing is the strategy of choice in programs like Leveled Literacy Intervention (LLI) is that the texts that accompany a “word study” lesson often contain few or no words with the phonics pattern that presumably has been taught. Murray et al. (2014) documented that the texts used in Leveled Literacy sometimes had no words with the phonics pattern. Further, the lesson texts contained many multi-syllabic words that the students could not yet read. Contextual guessing is the only strategy available in LLI because students cannot rely on what they have learned when they attempt to read the words.

Systematic versus non-systematic decoding instruction. The term *systematic* has two connotations: instruction that is carried out through step-by-step procedures or routines; instruction that explicates the system of correspondence between speech and print (Ehri, Nunes, Stahl, & Willows, 2001).

Step-by-step routines and procedures are customary in systematic code-based approaches. These typically employ learned hand gestures, signals, or response formats that enable students to respond quickly and frequently during teacher-led instruction. The lesson structure proceeds from teacher explanation and modeling, to guided practice, to independent practice monitored by the teacher.

A system for explicit teaching usually follows a format for introducing a new phonics concept, such as the following:

- Identify the target phoneme in spoken words
- Pronounce and describe articulatory features of the phoneme, with mirrors
- Write letter(s) that are used to represent the phoneme
- Learn a mnemonic or keyword for the sound–symbol correspondence
- Decode and spell words with the correspondence
- Read decodable text with words and patterns that have been taught during the phonics instruction.

A systematic approach to the content means that any explicitly taught concept about language or orthography is situated within a system that has a defined and overarching conceptual structure. The teacher can place each element of the system in relation to language organization as a whole. In reading and spelling, systematic instruction places each linguistic element (sound, syllable, morpheme, word, phrase, or sentence) within a larger category or in relation to a general principle of oral or written language organization.

For example, a lesson about the suffix *-ful* would do more than state its pronunciation. It would explain that *-ful*, like all suffixes, does not stand alone as a word. It is a morpheme, or meaningful part, related to but not the same as the Anglo-Saxon word *full*. The suffix *-ful* begins with a consonant, and therefore does not change the spelling of a base word when it is added. Doubling a final consonant or dropping a final e when we add *-ful* to a base word is unnecessary, as in *harmful*, *spiteful*, *useful*, or *cupful*. Within the whole system of printed English, *-ful* is one of many suffixes that mark words as adjectives (as in *graceful* and *beautiful*) or nouns (as in *hatful* or *handful*).

Non-systematic programs lack detailed, organized, teacher-led lessons on the specifics of the orthographic code. In the absence of a systematic approach, students are left to infer how orthography works from random exposure to words in print. Information about phonics, syllabification, orthographic conventions, and morphology is scarce and often inaccurate. Some non-systematic programs include a phonics workbook or phonics activities but instruction in decoding remains incomplete, incidental, and disconnected from the reading and writing components of the program.

For example, students might have a lesson on “short o” (as in *hot*), but then be asked to read a leveled book that uses the words *from*, *of*, *one*, *rope*, and *off*—none of which have the sound of /ɒ/. Or, instruction might begin with rote memorization of 50–100 words as wholes, on flash cards. The emphasis is not on print-to-speech or speech-to-print correspondences.

To summarize, non-systematic programs:

- teach concepts “as they come up”—during reading and writing;
- do not teach the entire system of sound–symbol correspondences or other aspects of word structure in relation to a complete framework;
- do not follow established teaching routines in each lesson;
- do not categorize concepts or place them within language systems. For example, *igh* may be taught in a family of *ight* rhyming words, but students are not taught that it is a low frequency, Old English, three-letter grapheme that is one of at least six spellings for the long vowel /ī/; and

- do not provide practice materials, such as decodable books, that offer children the opportunity to apply what they are learning about letter–sound relationships. The reading materials these programs do provide for children are selected according to other criteria, such as their topic.

Sequential reading instruction. Print-to-speech concepts and correspondences range from simple to complex, from transparent to elusive, and from highly reliable (e.g., *-ck* occurs immediately after a short vowel) to highly variable (e.g., sounds represented by *ough*). While there is no single, superior pathway through this content, well-designed programs follow a progression from easier to more difficult language constructs. For example, simple syllables without consonant blends are easier for learners to process than words with blends (Bourassa & Treiman, 2014). Learners who cannot easily learn print-to-speech correspondences must learn them cumulatively, with one building on the next.

Table 3.6 provides a general outline for a sequence of instruction that is typical of an organized, code-emphasis program (Birsh, 2010; Moats & Hall, 2010).

Table 3.6 A general sequence for beginning phonics instruction

Phonics concept	Example graphemes or patterns	Example words
Single, highly reliable consonants and a short vowel	b, s, t, d, m	sad, mat, mad, bat
More single consonants	r, l, f, z, v, g, p, n	red, fit, got, zip, pup
Short vowels/ <i>ă</i> / <i>ō</i> / <i>ī</i> / <i>ū</i> / <i>ē</i> , introduced gradually	a, o, i, u, e	wag, top, zip, rub, jet
Consonant digraphs	th, ch, sh, ng, wh, also <i>-ck</i>	thing, chunk, shop, when
Consonant blends	st, lk, mp, br, cl	stop, milk, camp, bran, must
Inflections	<i>-s</i> , <i>-ed</i> , <i>-ing</i>	wishes, wished, wishing
VCe for long vowels	a_e, i_e, o_e, u_e	lake, ride, rope, cute
Odd consonants	x, qu	box, quit
“Floss” pattern	<i>-ff</i> , <i>-ll</i> , <i>-ss</i> , <i>-zz</i>	stuff, well, grass, jazz
Vowel teams	ee, ea, oa, ai, ay	meet, heap, boat, mail, play
Vowel-r patterns	er, or, ur, ar	her, for, fur, star
Complex consonants	ge/dge, ch/tch, hard and soft c and g	wage, dodge; church, catch; cell, city, gem, gym
Multi-syllable words, gradual introduction	(six syllable types)	napkin, playground, compete

3.9 What About Irregular Words?

Students must learn to recognize and remember some high-frequency words that do not follow regular correspondence patterns in English. Many of these are grammatical function words necessary to form sentences that are among the oldest in the language (*do, does, were, are, was, of, said, any, who, what*). Irregularly spelled words, however, comprise no more than a quarter of the most frequent 300–500 words. The rest have regular sound–symbol correspondences (*when, is, he, them, day, us, for, not, with*) or conform to orthographic patterns that can be taught (*have, by, will, all, most, year, good*). Even the so-called irregular words usually have some correspondences that are predictable. Therefore, students can be taught most high-frequency words either by including them in a lesson on predictable correspondences and patterns (*he, she, we, be, the*), by using a spelling pronunciation to aid memory (*said = say + ed*), or by contrasting the letters with the word’s pronunciation (“*was = /w/ /ă/ /s/... but we don’t say /w/ /ă/ /s/, we say /w/ /ŭ/ /z/*”).

Irregular words should be introduced gradually, perhaps three to five per week in first grade. The recent advisory on foundational reading skills published by the Institute for Education Sciences (Foorman et al., 2016) encourages the teaching of irregular words using whole word methods, including tracing and saying the letters until the word can be memorized or reciting words from flash cards. Current theories of word learning processes (Miles & Ehri, this volume; Kilpatrick & O’Brien, this volume), however, do not support the idea that so-called visual learning of orthography is independent of phonology or sound–symbol mapping. While repeated exposure to these words may be necessary, initial presentation and practice routines can place those words in relation to regularities in the orthography.

3.10 Barriers to Better Implementation

Let us return to the question posed at the beginning of this chapter: Why do so many students continue to struggle with reading and spelling when so much research has been done on the prevention and amelioration of these difficulties? Clearly, the promise of research—to enable early identification of reading difficulties and to promote informed, effective instruction—remains unrealized in many schools.

One well-documented reason for this gap between scientific findings and common practices is simply that teachers and school psychologists (Nelson & Macheck, 2007) are not prepared to understand or deliver explicit, systematic instruction in foundational reading skills. Teachers’ preparatory courses often do not address the essential components of instruction (Greenberg, McKee, & Walsh, 2013; National Council on Teacher Quality, 2016). Neither do they require any coursework in language structure or language development. Likewise, their professors may not themselves know the structures of language, the scientific literature on reading development or reading difficulties, or the evidence regarding best practices (Binks-Cantrell et al., 2012).

Reading education textbooks contain errors such as confusion of phonics and phoneme awareness, and fail to provide information that would enable effective teaching of foundational reading skills (Joshi, Binks, Graham, et al., 2009b). This state of affairs means that teachers can only learn what they need to know after they have entered the profession, through courses, workshops, and the instructional materials they are given. Such professional development is uncommon.

A second and related issue is that acquiring the knowledge necessary for informed, structured, language-based literacy instruction is a protracted process that cannot be accomplished in one or two workshops. Phoneme awareness, for example, is often written and talked about as if it should be simple to understand and simpler to teach. In contrast, teachers typically score very low on surveys of their knowledge of phoneme awareness and phonics (Cunningham, Perry, Stanovich, & Stanovich, 2004; Moats, 1994, 2009; Spencer, Schuele, Guillot, & Lee, 2008) and in our experience, need at least six to ten hours of instruction and practice to learn the English phonemes, to accurately segment English words, and to understand more advanced ideas such as co-articulation and allophonic variation. We need at least another ten hours of coursework to educate teachers about English orthography and how to teach it. Learning the structure of language is not much easier for teachers than it is for younger students; the content and concepts are challenging and should be treated as such. Nor is having a scripted program sufficient for educators to acquire the requisite knowledge base or overcome a lack of knowledge pertaining to language and reading (Piastra, Connor, Fishman, & Morrison, 2009).

Third, some widely used instructional materials and programs are not designed in accordance with current recommendations from the research community (e.g., Foorman et al., 2016). These include Balanced Literacy, Four Blocks, Reading Recovery, Leveled Language Intervention and others. Objective analyses and critiques of these approaches abound (Chapman & Tunmer, 2011; Chapman, Greaney, & Tunmer, 2015; Denton et al. 2014; Kilpatrick, 2015; Moats, 2017; Seidenberg, 2017) but critiques from scientists seem to have little impact on the choices that district administrators make with regard to programs of instruction. As long as this trend continues, rates of reading and overall literacy failure will be higher than they need to be.

Fourth, guidelines for implementation of the Common Core State Standards minimized the importance of foundational reading and writing skills toward meaning-emphasis instruction beginning in kindergarten (Common Core, Inc., 2012). The organization of the standards document spoke volumes: foundational reading skills were relegated to the back of the English Language Arts section in favor of comprehension-focused literature standards, from kindergarten onward. The lofty goals for comprehension and composition have overshadowed the necessity of teaching students to recognize and form letters, identify speech sounds, decode words using phonics, establish a sight vocabulary, and formulate grammatical sentences.

And finally, while the shortcomings of teacher training have been well documented, the training of principals, school psychologists, and curriculum specialists has neglected to address the science of reading. Knowledgeable leadership is essential if we are to do better for students who struggle with literacy.

3.11 Recommendations

1. School psychologists, curriculum directors, and other leaders are encouraged to consult reliable, scientifically informed sources before investing in instructional programs and other services. Better sources include the consensus reports referenced here; the practice guides published by the Institute for Education Sciences; and public interest white papers by reading researchers from the Society for the Scientific Study of Reading, the American Psychological Association, the American Speech Hearing and Language Association, the International Dyslexia Association, among others.
2. Structured literacy or explicit teaching of phonics, augmented by attention to other aspects of language, should be bedrock practice in every school, in regular classrooms *and* in intervention programs. Characteristics of the most effective approaches for building foundational skills for reading and writing are:
 - explicit, sequential, systematic instruction in phoneme awareness, phonic decoding with sound blending, recognition of print patterns in words, and spelling;
 - explication of language structure at the level of speech sounds, graphemes, syllables, morphemes, and whole words;
 - error correction that calls attention to sound–symbol correspondence first, not the context or pictures, and that discourages guessing;
 - inclusion of spelling instruction and coordination of spelling with reading;
 - application of skills to read fully decodable text;
 - supervised text reading practice to build fluency.
3. Instruction must be sufficiently intensive to help students in the lower third of the population accelerate their growth. Effective instruction of foundational reading and spelling skills should take at least 30–40 minutes per day in first grade, and somewhat less time as proficiency increases. Studies of successful interventions typically call for 80–120 hours of instruction if students are to gain in relative standing. Older students from third grade onward need even more intensive instruction to close the reading gap (Calhoon & Petscher, 2013; Torgesen et al., 2001).
4. Phonics and basic language instruction must be augmented by vocabulary and language comprehension instruction, through read-alouds and oral language activities if necessary.
5. Teachers and others require and deserve substantial training and support to implement programs with these characteristics.

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