



Why Spelling Is Important and How To Teach It Effectively

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Introduction

Spelling is a code that uses letter sequences to represent specific words that have an associated pronunciation and meaning within the mental dictionary. Three kinds of codes contribute to spelling: a **phonological code** (coding and awareness of sounds in spoken words), an **orthographic code** (coding and awareness of letters in written words), and a **morphological code** (word parts at the beginning of words that modify shade of meaning and at end of words that mark tense, number, or part of speech). For example, the word “jumped” has five small sounds in it: /j/, /u/, /m/, /p/, and /t/ (these sounds are called phonemes). However, it has six letters. That is because the last two letters correspond to a word part (morpheme) that marks the past tense but corresponds to a single sound. In other words, that sound might be /d/ as in “named” or /ed/ as in “wanted.”

Other sources of knowledge also contribute to spelling. These include **vocabulary knowledge** (semantic features or meaning clues), **phonotactics** (permissible and probable sound sequences, patterns, and positions in spoken words), and **orthotactics** (permissible and probable letter sequences, patterns, and positions in written words). For example, in English, words do not begin with the /m/ sound followed by the /l/ sound or generally end with /h/. Also, u not a follows q and the letter x does not double at the end of words but l, f, and s may. Further complicating matters is that the same word pronunciation may be associated with multiple meanings, which linguists call polysemy. **Syntax** (part of speech for a particular word and the permissible word order of the language) provides the clues that help the writer clarify which of the multiple meanings for that pronunciation is intended (e.g., He wound the clock. The wound did not heal. The boy read the red book.)

Spelling knowledge may be expressed as rules, statistical patterns, or procedures and these different kinds of knowledge have various implications for instruction. Examples of English **spelling rules** include generalization about (a) when to double final consonants in syllables as a function of accent patterns (e.g., when the accent is on the second syllable, double the last consonant in the second syllable, but when the accent is on the first syllable, do not double the last consonant). This rule is shown when “refer” becomes “referring” but not when the accent is on the first syllable as in “secret” which becomes “secretive” not “secrettive”) or (b) when to drop or add letter(s) to the end of a base word when a derivational suffix beginning with i is added (e.g., final silent e is dropped when adding “ing” as in “tamee” becomes “tameing”) (Dixon & Englemann, 2001). French spelling rules specify that certain consonants double in certain positions but

vowels do not double (Pacton, Perruchet, Fayol, & Cleeremans, 2001). **Phonotactics** and **orthotactics** are based on abstracted statistical patterns that capture the sound sequences in spoken words or letter sequences in written words. The abstraction takes place through self-teaching (Share, 2004) in implicit memory outside conscious awareness as children repeatedly encounter words in different codes (Pacton et al., 2005b; Pacton et al., 2001). Although some of these statistical patterns can be articulated like doubling f, l, and s at the end of words, many cannot be but yet influence spelling knowledge. Mapping across different units of spoken and written words is *procedural knowledge* learned best in conscious memory as children apply knowledge of procedures for spelling single words from dictation.

The contrasting instructional implications of these different kinds of knowledge will now be considered. Rules are articulated *declarative knowledge*, applied at the metacognitive level in guiding, self-checking, or revising spelling. Teachers verbalize these rules and ask children to verbalize them too. *Linguistic awareness* is not acquired by verbalizing rules but rather by conscious reflections and operations on phonological, orthographic, and morphological word-forms and their parts in conscious memory. For example, children may engage in word sorts in which they have to reflect about common and unique sounds or morpheme patterns in written words as they classify them into categories. Little is known about how to teach children to abstract statistical patterns related to sound sequencing or letter sequencing, however, it may help to draw their attention to these patterns by playing games in which children judge whether scrambled sequences of sounds in spoken words sound like words in their language or scrambled sequences of letters look like written words in their language. Using anagrams in which they unscramble the letters to spell a real word may also benefit their spelling. Research reported later shows how specific procedures can be taught through modeling for helping children generate word spellings at the levels of phoneme-grapheme correspondences, onset-rimes, and whole words. Not all of the necessary spelling knowledge can be taught as declarative knowledge or rules.

Past views that spelling goes through sequential stages from phonological to orthographic to morphological (e.g., Templeton & Bear, 1992) are being reconsidered based on research showing that first graders have not only phonological but also orthographic (Cassar & Treiman, 1993; Pacton et al., 2001; Treiman, 1993) and morphological (Carlisle, & Nomanbhoy, 1993; Pacton et al., 2005b; Treiman & Cassar, 1996) knowledge that they apply to spelling. Both beginning spelling and developing spelling, when words are longer and morphologically more complex (Carlisle & Fleming, 2003), draw on phonology, orthography, and morphology (Berninger, Garcia, & Abbott, in press; Silliman, Barr, & Peters, 2006; Walker & Hauerwas, 2006). Woodcock Johnson Third Edition (WJ III) Spell Sounds *Subtest* (Woodcock, McGrew, & Mather, 2001) assesses phonological spelling with pseudowords. Process Assessment of the Learner, Second Edition (PAL II) Word Choice *subtest* (Berninger, 2007) uses real words and pseudohomophones to assess orthographic spelling. PAL II Find the Fixes (Berninger, 2007) uses real words with common spelling units that are true affixes (e.g. reread) and foils (e.g., ready) that are spelled like a real prefix or suffix but are not morphemes to assess morphological spelling.

Spelling instruction is still important in the computer age, even with spell checks for self-monitoring and revising spelling. Most spelling instruction research has focused on word frequency and words children use frequently in their writing at specific grade levels *and* the role of alphabetic principle taught in the phoneme-to-grapheme direction. However, the role of specific words (Largy, Cousin, Bryant, & Fayol, 2007) and rules (Fayol, Thévenin, Totereau & Jarousse, 1999) in learning to spell continues to be debated. During spelling instruction children have to coordinate phonological, orthographic, and morphological codes in working memory; through instruction and practice, children create a mental dictionary with spellings of written words in long-term memory. Instruction should teach spelling strategies and provide practice in applying them to develop automatic spelling, which is fast, effortless retrieval of word-specific spelling (Steffler, Varnhagen, Friesen, & Treiman, 1998).

Different modes of spelling instruction can be differentially beneficial, for example, keyboarding is better for writing letters and sometimes words in sentences; but pen is better for composing essays (Berninger, Richards, Stock, Abbott, Trivedi, Altemeier et al., 2007). Spelling is not the inverse of reading (Read, 1981), but word reading and spelling share reciprocal relationships (Ehri, 1992, 2000; Holmes, & Carruthers, 1998) and teaching spelling may transfer to reading (Treiman, 1998). Although good spellers tend to be good readers and poor spellers tend to be poor readers, about four percent of French children have good reading and poor spelling and about four percent of French children have good spelling and poor reading (fluency) (Fayol, Zorman, & Lété, 2008).

Key Research Questions and Findings

1) Is explicit instruction in mapping spoken words onto written words at specific unit sizes or rules effective in teaching spelling?

In large, randomized controlled studies different instructional approaches to teaching conscious procedural knowledge for mapping units of spoken words onto units of written words were compared. Both lexical mapping (naming each letter in a written word in sequential order and then pronouncing it) and onset-rime mapping (naming the onset grapheme[s], making the corresponding sounds for phoneme[s], naming the letters in the rime unit and finally, pronouncing the remaining part of the syllable) were effective in learning to spell taught and new one-syllable words. However, alphabetic principle mapping (naming each one- or two- letter unit and then saying the corresponding phoneme) resulted in more accurate spelling during composing (Berninger, Vaughan, Abbott, Brooks, Abbott, Reed et al., 1998). The results supported teaching mapping procedures for the whole word, onset-rime, and alphabet principle to at-risk second grade spellers.

Half the children reached grade level and maintained gains at beginning and end of third grade. The other half received additional spelling instruction in third grade that included the three mapping procedures for spelling two-syllable words with and without syllable awareness training; they also wrote sentences from dictation. All reached average range for grade and maintained gains at end of third grade; syllable awareness training showed an advantage for silent-e words (e.g., became) (Berninger, Vaughan, Abbott, Brooks, Begay, Curtin et al., 2000). Spelling mastery of practiced words was

achieved only when specific words were spelled in dictated sentences in each of the 24 lessons during the study (see Dreyer et al., 1995, for role of practice in improving long-term spelling retention).

Teaching mapping procedures for alphabetic principle improved children's spelling of function words (conjunctions, prepositions, articles, and pronouns that glue words together in sentences but have no meaning of their own) (Berninger, Vaughan, Abbott, Begay, Byrd, Curtin, et al., 2002). Teaching orthographic strategies for imaging words in the mind's eye improved spelling (Berninger, Abbott, Rogan, Reed, Abbott, Brooks, et al., 1998; Berninger, Winn, Stock, Abbott, Eschen, Lin et al., 2007, Study 1) and normalized brain activation during an fMRI spelling task (Richards, Aylward, Berninger, Field, Parsons, Richards, et al., 2006). Explicit instruction in phonological (Nunes, Bryant, & Olson, 2003) and morphological spelling rules is also effective (Fayol, Thévenin, Jarousse, & Totereau, 1995; Nunes & Bryant, 1995; Nunes et al., 2003).

For evidence-based instructional tools and strategies for explicit spelling instruction, see Berninger and Abbott (2003, Lesson Sets 4, 5, 7, and 10); Dixon and Engelmann (2001; Fry (1996); Graham, Harris, and Loynachan (1996); Henry (2003); Masterson, Apel, and Wasowicz (2002); Nunes and Bryant (2006); and Schalagar (2001). Also see readings at end for teachers to expand their knowledge of the role of phonology, orthography, morphology, vocabulary knowledge, phonotactics and orthotactics, and syntax in spelling. Research has shown that teachers' knowledge of language processes is as important as the instructional tools they use in increasing their students' literacy skills including spelling.

2) Are reflective activities for developing phonological, orthographic, and morphological awareness effective in teaching spelling?

Children acquire much spelling knowledge in implicit memory outside conscious awareness (e.g., Nation, Angell, & Castles, 2007; Pacton, Perruchet, Fayol, & Cleeremans, 2001; Share, 2004). Explicit instruction that brings those knowledge sources into conscious awareness also improves spelling (e.g., Dreyer et al., 1995; Berninger et al., 1998, 2000, 2002, 2007; Graham, Harris, & Chorzempa, 2002). Explicit instruction does not have to be knowledge telling or direct instruction. It can include activities such as word sorts that help children discover, through insight, awareness of (a) alternations in English alphabet principle (Venezky, 1970, 1999) such that different one- (e.g., c and k) and two-letter (e.g., ck or ch) graphemes spell the same phoneme (e.g., /k/) (Berninger et al., 2002), (b) morphological awareness (Arnbach & Elbro, 2000), and (c) interrelationships among phonology, orthography, and morphology (Berninger, Nagy, Carlisle, Thomson, Hoffer, Abbott, et al., 2003).

In languages such as French or English in which the same letter or letter group is not always pronounced the same and semantic access is not direct: spelling, decoding, and semantic access (to word meaning) are mediated by morphology (Pacton, & Fayol, 2005a). For French and English spelling, it is necessary to learn orthographic and morphological regularities (Pacton et al: 2001, 2005b) and some lexical items (see Martinet, Valdois, & Fayol, 2004). For example, in French it helps to find most silent

letters placed at end of words (bavard has a final d because we can produce bavarde; Pacton & Deacon, in press). For French, morphology for marking singular and plural forms must be taught because most of the marks (-s for plural nouns and adjectives; -nt for plural verbs) have no phonological counterparts (Fayol, Largy, & Lemaire, 1994; Fayol, Hupet, & Largy, 1999; Fayol, Thévenin, Jarousse, & Totereau, 1995). In English, correspondences between sounds and letters alone do not assure access to morphological structure, which must be parsed and coordinated with phonological encoding (e.g., the vowel in nation is transformed when the suffix -al is added to transform a noun into an adjective).

3) Does explicit instruction in spelling transfer to improved composing skills?

Training mapping procedures at three unit sizes (whole word, onset-rimes, and phoneme-grapheme correspondences) improved word-spelling and transferred to longer compositions (Berninger et al., 1998). Composing activities using grade-appropriate high frequency words (Graham, Harris, & Loynachan, 1993, 1994) improved spelling and composing (Berninger et al., 2000). Graham et al.'s (2002) spelling instruction also transferred to improved composition. Therefore, evidence is growing for the benefits of teaching spelling on another writing skill, namely, composition.

Recent Research Results

A longitudinal writing study (grades one to seven) showed that spelling at one grade level contributes to spelling and often written composition at the next grade level (manuscript in preparation). Orthographic, phonological, and morphological awareness showed significant growth from grades one to two to three with continued morphological awareness growth thereafter (submitted manuscript). At grades two, four, and six, a second-order factor underlying these three kinds of linguistic awareness explained unique variance in spelling and fit the model better than if each factor (code) was considered alone (Berninger, Raskind, Richards, Abbott, & Stock, 2007). The instructional application is that spelling benefits from instruction not only in each of the three codes but also in their interrelationships. An example of instruction that teaches the interrelationships is word sorting in which children sort words using suffixes to mark number into these categories: plural pronounced /ez/ (e.g., busses), plural pronounced /s/ (e.g., cats), plural pronounced /z/ (bees), or no suffix (e.g. miss).

Future Directions

More research is needed on phonotactic and orthotactic knowledge and their influences on word storage and access in the mental lexicon. Fast mapping, which involves whole spoken and written words that are learned quickly in one exposure or a few exposures, is likely to be influenced by phonotactic and orthotactic knowledge.

With increasing globalization and immigration and more than one language spoken at work and in the home, multi-lingualism is increasing and requires greater research attention to spelling across languages: (a) transfer of spelling from one's first language to one's second language; (b) similarities and differences in spelling related to how

phonology and morphology/syntax are represented in the orthography; (c) dialects within the same language (e.g. Kohler, Bahr, Silliman, Apel, & Wilkinson, 2007; Treiman, & Barry, 2000); and (d) word-origin influences such as English words that derive from French, Latin, or Greek origins and constitute the vast majority of words in English texts used in schools in grades four and above (Henry, 2002).

Conclusions

Effective spelling instruction (a) facilitates abstraction of phonological, orthographic, and morphological regularities in words (e.g., deciding which spoken or written pseudoword resembles a real French or English word), (b) models explicit strategies for mapping different units of spoken and written words, (c) teaches explicit spelling rules, (d) designs reflective activities that foster phonological, orthographic, and morphological awareness, (e) offers metacognitive guidance in self-checking and revising spelling if necessary; (f) provides sufficient practice with specific words to develop automatic spelling; and (g) couples spelling with vocabulary instruction aimed at fostering love of and play with words (Stahl & Nagy, 2005).

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Additional Reading

- To learn more about phonological codes in spelling, see Berninger, Cartwright, Yates, Swanson, and Abbott (1994), Treiman, Berch, Tincoff, and Weatherston (1993), Varnhagen, Varnhagen, and Das (1992), and Varnhagen, Boechler, and Steffler (1999).
- To learn more about orthographic coding in spelling, see Berninger, Yates, Cartwright, Rutberg, Remy, and Abbott (1992), Caravolas, Kessler, Hulme, and Snowling (2005), Holmes and Davis (2002), Jaffre and Fayol (2006), Johnson (1986), Olson, Forsberg, and Wise (1994), Seymour (1997), Pacton, Fayol, and Perruchet (2005b), and Varnhagen et al., (1992, 1999).
- To learn more about morphological coding in spelling, see Bourassa, Treiman, and Kessler (2006), Carlisle (1994), Derwing, Smith, and Wiebe (1995), Green, McCutchen, Schwiebert, Quinlan, Eva-Wood, and Juelis (2003), Jaffré and Fayol (2006), Leong, (2000); Nagy, Berninger, and Abbott (2006), Nagy, Berninger, Abbott, Vaughan, and Vermeulen (2003), Nunes, Bryant, and Bindman (1997), Pacton et al. (2005b), Treiman and Cassar (1996).
- To learn more about the role of vocabulary knowledge in spelling, see Berninger et al. (1992, 1994) and especially Stahl and Nagy (2005).
- To learn more about the role of phonotactics in spelling, see Apel, Wolter, and Masterson (2006), Bernstein and Treiman (2001), Kessler and Treiman (1997), and Treiman, Kessler, Knewasser, Tincoff, and Bowman (2000),
- To learn more about the role of orthotactics in spelling, see Apel et al. (2006) and Pacton et al. (2005).
- To learn more about the role of syntax in spelling, see Bryant, Nunes, and Bindman (1997, 2000), Fayol, Totereau, and Barrouillet (2006), and Muter and Snowling (1997).

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