

What Do Spelling Errors Tell Us about Language Knowledge?

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Like reading, spelling is a written language skill that draws upon an individual's repertoire of linguistic knowledge, including phonological awareness, and knowledge of orthography, vocabulary, morphological and semantic relationships; and mental orthographic images (Apel & Masterson, 2001; Apel, Masterson, & Niessen, 2004). Each of these areas of linguistic or "word study" knowledge contributes to spelling success (Treiman & Bourassa, 2000) and a deficit in any one of these areas of word study knowledge will manifest as a specific pattern of misspelling. Accordingly, the analysis of an individual's spelling errors can be used to identify underlying linguistic deficits.

The Language of Spelling

Phonological Awareness

Individuals rely upon the phonological awareness skills of phoneme segmentation, sequencing, discrimination, and identification during the spelling or "encoding" process. They use phonological segmentation skills when spelling by breaking down words into smaller units—such as syllables and phonemes—then linking these smaller units to their written forms. They use sound sequencing skills to map the letters to sounds in the correct order. They use phoneme discrimination and identification skills to perceive differences between speech sounds (e.g., between the short vowel *e* and short vowel *i* sounds) and to recognize that a difference in sound signals a difference in meaning.

Orthographic Knowledge

Individuals also draw upon their orthographic knowledge during the encoding process. Specifically, individuals draw upon their knowledge of sound-letter relationships and knowledge of letter patterns and conventional spelling rules to convert spoken language to written form (Ehri, 2000; Treiman & Bourassa, 2000). Orthographic knowledge includes knowledge of specific letter-sound relationships (e.g., the /k/sound can be represented by the letters *c*, *k*, *ck*, *cc*, *lk*, *ch*, *que*); knowing which letter patterns are acceptable (e.g., the /k/sound is almost always spelled with the letter *k* at the end of a word after a long vowel sound); and understanding sound, syllable, and word position constraints on spelling patterns (e.g., the /k/sound at the beginning of a word is never spelled with the letters *ck*, *cc*, *lk*).

Vocabulary

Individuals use vocabulary knowledge to accurately store and retrieve the correct spelling of words. The knowledge of word meaning is particularly important for the correct spelling of homophone words (e.g., *bare* and *bear*). Vocabulary knowledge is also helpful to correctly spell the *wh* consonant digraph because the /w/ sound at the beginning of question words (*what, where, when, why, which*) is always spelled with the letters *wh*.

Morphological Knowledge & Semantic Relationships

Individuals also rely upon their morphological knowledge and knowledge of semantic relationships when spelling inflected or derived forms of words (Carlisle, 1995). Specifically, individuals rely upon their knowledge of letter-meaning relationships of individual morphemes (i.e., suffixes, prefixes, base words, and word roots), their understanding of semantic relationships between a base word and related words, and their knowledge of modification rules when adding prefixes and suffixes.

Inflected words contain suffixes that provide information about time or quantity without changing the meaning or class of the words (e.g., *walk-walked; cat-cats*). Derived words contain affixes (prefixes or suffixes) that change the meaning and sometimes the class of words (e.g., *cycle-recycle; friend-friendly*). When an individual is required to spell an unfamiliar word (e.g., *exception*), knowledge of the base word (i.e., *except*) and certain word endings (e.g., *-ion*) can help the student spell the unfamiliar word correctly. An individual draws upon knowledge of rules for modifying base words to correctly spell inflected and derived forms of words. Individuals also draw upon knowledge of semantic relationships and rules for modifying words to spell irregular plural nouns, irregular past-tense verbs, contractions, and possessive nouns. The use of knowledge of word parts and related words to spell words becomes increasingly important as individuals begin to spell words of greater length and complexity.

Mental Orthographic Images

Individuals need to develop clear and complete mental representations of previously read words. These mental images of words, also known as mental orthographic images (MOIs), are stored in an individual's long-term memory after repeated exposure to them in print (Ehri & Wilce, 1982; Glenn & Hurley, 1993). Inadequate MOIs are often formed when individuals use inappropriate reading strategies such as partial cue analysis, a process whereby the student guesses the identity of a word after decoding only the first letter(s) of the word. Clearly and completely developed MOIs allow individuals to quickly recall and correctly spell words and word parts. Individuals must rely upon the mental image of a word when phonological awareness and knowledge of orthography, vocabulary, word parts, and related words are not sufficient to correctly spell a spelling pattern within a word (e.g., *rope* not *roap*, *bucket* not *buckit*, *actor* not *acter*).

Both children and adults use these different types of language knowledge throughout spelling development (Treiman & Bourassa, 2000). The amount that each area contributes to spelling development differs depending on an individual's literacy experiences and the complexity of the words needing to be spelled. Initially, phonological awareness skills play a large role in early spelling development, yet other linguistic knowledge, such as orthographic knowledge and rudimentary morphological knowledge, may also be contributing factors (Treiman & Bourassa, 2000). With additional experiences and learning, spelling development may be positively affected through a deeper understanding and increased use of orthographic, morphological, and semantic knowledge and a larger number of clear mental orthographic images. At any point in spelling development, an individual's spelling reflects his or her linguistic knowledge and literary capabilities at that moment in time. Accordingly, an individual's misspellings are the "window" to underlying linguistic deficits.

Spelling Errors Reveal Linguistic Deficits

It is possible to identify an individual's linguistic deficits through spelling error analysis because a specific pattern of misspelling is associated with each specific type of linguistic deficit. Analysis of an individual's spelling errors reveals underlying deficits in phonological awareness, and in knowledge of orthography, vocabulary, morphological and semantic relationships, and mental orthographic images.

Phonological Awareness

When phonological awareness skills are weak or underdeveloped, spelling is negatively affected in very predictable ways. Typically, individuals with poor phonological segmentation skills will delete letters and syllables, usually omitting letters for less salient phonemes, especially those that occur in internal locations and in unstressed syllables, (e.g., *pat* for *past*, *relize* for *realize*). Individuals with poor sound sequencing skills commonly reverse the sequence of letters when spelling. Letters reversals most commonly occur for liquids and nasals in a word or syllable sequence (e.g., *flod* for *fold*, *bets* for *best*). Individuals with poor phoneme discrimination and identification skills are likely to spell distinct vowel sounds with the same letter (e.g., *bet* and *bit* both spelled *bet*), and add letters for phonemes that do not occur in a word (e.g., *ment* for *met*).

Orthographic Knowledge

Individuals whose orthographic knowledge is deficient often spell words incorrectly because they fail to recognize accepted spelling conventions. As such, the misspellings of individuals with orthographic knowledge deficits are predictably characterized by "illegal" substitutions (e.g., *cas* for *catch*), non-allowable letter sequences (e.g., *jrum* for *drum*; *kween* for *queen*), phonetically possible spellings that violate "rules" (e.g., *ran* for *rain*; *coatch* for *coach*), and violation of word position constraints (e.g., *fuj* for *fudge*).

Vocabulary

Individuals who have trouble applying vocabulary knowledge will confuse the spelling of homophone words (e.g., *bear* for *bare*) and parts of other words in which the correct spelling is determined by word meaning (e.g., the / w / sound at the beginning of question words *what*, *where*, *when*, *why*, *which* is misspelled as *w*).

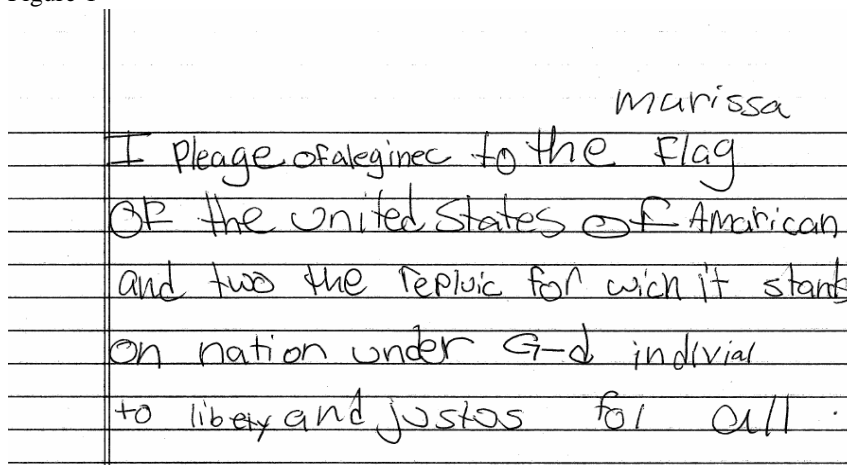
Morphological Knowledge & Semantic Relationships

Deficits in morphological knowledge and knowledge of semantic relationships present their own predictable patterns of misspellings. The misspellings of individuals with these types of deficits are characterized by omission of morphemes (e.g., *walk* for *walked*), phonetic spelling of morphemes (e.g., *walkt* for *walked*, *musishun* for *musician*), failure to use spelling of the semantically related base word to correctly spell the inflected or derived form (e.g., *ascend* but *assension* for *ascension*), and misspelling of modifications when spelling inflected and derived forms of words (e.g., *calfes* for *calves*, *crazyness* for *craziness*).

Mental Orthographic Images

When mental orthographic images are weak or not fully developed, spelling is negatively affected in very predictable ways. The misspellings of individuals with weak or “fuzzy” mental images of words are characterized by “legal” substitutions (e.g., *hed* for *head*, *roap* for *rope*, *lugh* for *laugh*), misspelling of unstressed vowel sounds (e.g., *buckit* for *bucket*, *acter* for *actor*, *bottle* for *bottle*), and homophone confusions (e.g., *bear* vs. *bare*, *won* vs. *one*, *which* vs. *witch*).

Figure 1



The writing sample in Figure 1 was collected from Marissa, a seventh-grade student. It reveals a variety of linguistic deficits, including deficits in phonological awareness (e.g., *repluc* for *republic*, *indivial* for *individual*, *American* for *America*), vocabulary

knowledge (e.g., *two* for *to* and *wich* for *which*), morphological knowledge (e.g., *justos* for *justice*), and mental orthographic images (e.g., *pleage* for *pledge*).

Conducting an Error Analysis of Misspelled Words

Using carefully constructed word lists that represent specific types of spelling knowledge used throughout the spelling-acquisition process and a theoretically grounded error analysis methodology, it is possible to collect and analyze an individual's spelling for patterns of errors and to determine the linguistic deficits that are interfering with that individual's spelling and reading. Once the linguistic deficits are identified, the professional has a clear roadmap for systematic instruction or remediation of spelling and related linguistic skills. This prescriptive method of assessment--also called a "multiple linguistic repertoire analysis"--is very different from standardized spelling tests such as *The Test of Written Spelling-4* (TWS-4; Larsen, Hammill, & Moats, 1999) or the *Wide Range Achievement Test-4* (WRAT-4; Glutting & Wilkinson, 2005), which quantify spelling performance relative to peers. It is also very different from Stage Theory and spelling inventories (e.g., Bear, Invernizzi, Templeton, & Johnston, 2000) that describe what letter patterns a student can and cannot spell. A prescriptive assessment goes beyond these other measures by using error analysis to determine *why* a student misspells words (i.e., what are the underlying linguistic deficits) and precisely what *type* of word study instruction is needed.

The multiple linguistic repertoire analysis method described here was first published by Masterson and Apel (2000). The method was further developed and subsequently republished by Apel, Masterson, and Niessen (2004). This method of assessment is implemented in the SPELL and SPELL-2 software assessment programs (Masterson, Apel, & Wasowicz, 2002; Masterson, Apel, & Wasowicz, 2006). Software programs save valuable time and enormously simplify the tedious task of conducting a prescriptive assessment. A criterion validity study (Masterson & Mooney, 2006) conducted with 135 students in grades 1-6 compared participants' performance on SPELL to their performance on two subtests of the *Woodcock Diagnostic Reading Battery* (Woodcock, 1997) and the *Test of Written Spelling-4* (TWS-4; Larsen, Hammill, & Moats, 1999). Pearson-r correlations and multiple regression analysis indicate SPELL validly measures students' spelling abilities, decoding skills, and identification of sight words and that SPELL can be used to identify word study goals in a variety of grades and settings. However, a software program is not required to conduct a prescriptive spelling assessment. The principles and methods of the prescriptive assessment described in Steps 1-4 below can be applied by hand to identify an individual's specific language deficits and to create an individualized intervention plan.

There are four basic procedural steps for completing the prescriptive assessment.

Step 1: As with any other measure of assessment, it is imperative that you begin with an adequate sample of the individual's spelling errors so that the error analysis yields valid results. To do so, you must collect an adequate sample of

spelling for each spelling pattern (e.g., short vowel *a*, s-clusters, silent consonants, unstressed vowels, inflected words) within the individual student's developmental spelling level. The domain of spelling patterns in the English language is quite large and several exemplars of each pattern must be collected to obtain a representative sample of the student's spelling ability. A minimum of three exemplars for each spelling pattern is recommended. Depending on the developmental spelling level of the student, this may require a spelling sample of 80-185 words.

Step 2: Examine the student's spelling of each spelling pattern to identify which spelling patterns are most frequently misspelled. These are the spelling patterns that will be targeted with explicit word-level instruction to remediate specific language deficits. Spelling patterns that are infrequently misspelled (greater than 60% accuracy) are more appropriately addressed by facilitating and reinforcing the student's consistent application of language knowledge when writing, and by developing the student's self-monitoring and proofing of his or her own written work in authentic writing tasks.

Step 3: For each spelling pattern identified and selected in Step 2, carefully analyze the nature of the individual student's spelling errors. This detailed error analysis determines if the misspelling of a particular spelling pattern is caused by a deficit in phonological awareness, and/or in knowledge of orthography, vocabulary, morphological and semantic relationships, or mental images of words. A step-by-step flowchart is publicly available on the internet (www.learningbydesign.com) to assist the clinician in conducting this detailed error analysis by hand and a detailed, case-study example of how to complete the SPELL prescriptive assessment is presented in Wasowicz, Apel, and Masterson (2003).

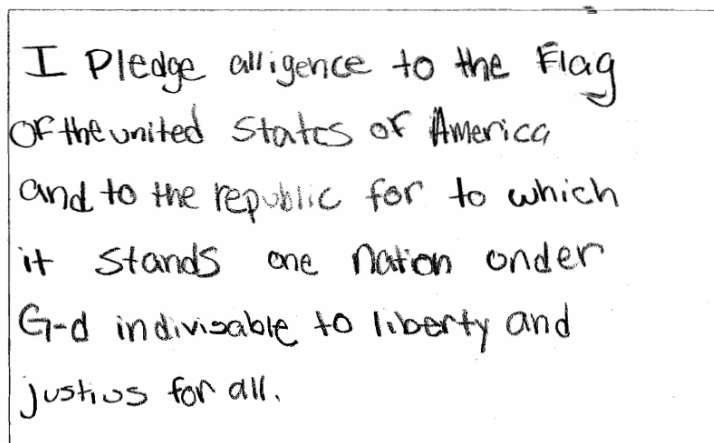
Step 4: Write an instructional goal for each selected spelling pattern, indicating the most appropriate instructional method for the individual student for each spelling pattern. For example, "Student will improve spelling of the short vowel *a* sound by developing the skills to discriminate among vowel sounds and to map letters to sounds in words containing this spelling pattern. Student will improve spelling of derived words by developing knowledge of letter-meaning relationships for derivational suffixes and rules for modifying words when adding suffixes."

This method of assessment has been successfully performed using the SPELL software with individuals as young as seven years of age, and with a variety of clinical populations including individuals with language impairments, severe speech and physical impairments, and hearing impairments; as well as with students who are in general education (Apel, Masterson, & Hart, 2004; Hart, Scherz, Apel, & Hodson, 2006; Kelman & Apel, 2004; Yakey, Wilkerson, & Throneburg, 2006). When done properly, this type of analysis may even be more sensitive than standardized measures of linguistic competencies. In other words, a student may score within normal limits on the more

general measure associated with the standardized test, yet linguistic deficits can be uncovered through spelling error analysis.

Once the linguistic deficits are identified, the clinician has a clear roadmap for systematic instruction or remediation of spelling and related linguistic skills. Research indicates that a multiple-linguistic approach to spelling instruction, as prescribed by SPELL and SPELL-2, leads to significant improvement in spelling performance and word-level reading ability (Kelman & Apel, 2004). When compared with traditional spelling instruction, the multiple-linguistic approach to spelling instruction, as prescribed by SPELL and SPELL-2, is significantly more effective (Apel, Masterson, & Hart, 2004).

Figure 2



The writing sample in Figure 2 was collected from Marissa after one year of multiple-linguistic spelling instruction prescribed by the SPELL method of assessment. In comparison to her previous writing sample, a smaller number of spelling errors occurred and the misspellings are qualitatively different. This writing sample reflects Marissa's phonological competency coupled with more robust mental orthographic images of words after receiving multiple-linguistic spelling instruction.

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