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Monitoring Progress in Spelling Improvement

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Abstract

In this paper, we discuss the Spelling Sensitivity System (SSS), an accuracy metric based on the level of linguistic knowledge evidenced by student spellings. The procedure can be used by SLPs to baseline and monitor their students' progress associated with word-level literacy instruction. The SSS has the relative speed of a binary scoring system yet incorporates facets of the multilinguistic theory of spelling development. Use of the SSS system to represent baseline performance and monitor progress of the clinical case is illustrated.

The passage of the Individuals with Disabilities Education Improvement Act (IDEA) in 2004 resulted in a greater emphasis on the importance of carefully observing and documenting the effects of instruction on students' literacy performance. To meet IDEA's mandate, school-based specialists, including speech-language pathologists (SLPs), must first obtain well-grounded baselines of their students' abilities and then have reliable and valid assessments that can be used to measure their abilities across time in response to evidence-based intervention. As Brimo (2013) discusses earlier in this issue, norm-referenced tests are not optimally useful for determining treatment goals. This is particularly notable for norm-referenced spelling tests, partly because they do not include sufficient examples of important spelling patterns. Calhoun, Greenburg, and Hunter (2010) and Calhoun and Masterson (2011) presented evidence of important differences in base word spelling patterns and morphological characteristics both among widely used standardized tests, as well as within alternate forms of the same test. In essence, within and across tests, the same types and amounts of base word orthographic patterns (such as use consonant and vowel digraphs, r-controlled vowels, etc.) and morphological constructions (degree of similarity between derived words and their base forms) were not equivalent. Thus, comparisons between them could lead to misleading information.

In addition to the sampling limitations imposed by inconsistencies in patterns and constructions among and within tests, those same tests are limited by the use of a binary scoring system (i.e., correct or incorrect). Although binary scoring systems do have the benefit of being quick to complete, they have numerous drawbacks. Of primary importance for these articles in this *Perspectives* issue, not all incorrect spellings are equally inaccurate from a linguistic view. Spellings vary in the degree to which they reflect the components described in

our multilinguistic model (Apel & Masterson, 2001; Masterson & Apel, 2000, 2007). When one scores a misspelled word simply as incorrect, one risks missing out on potentially valuable diagnostic information. As an example, consider the following three misspelled words: tuck for “truck,” lit for “light,” and shoping for “shopping.” A binary scoring system would treat them equally. The multilinguistic approach advocated in this series of papers would argue that the first error represents difficulty with phonemic awareness, the second with orthographic pattern awareness, and the third with morphological awareness. Thus, any assessment system, whether it is used to develop a baseline for a student level of functioning, a means to determine intervention goals, or a means for monitoring progress in intervention, must have a way to highlight the linguistic awareness components that serve as the foundation of spelling.

The purpose of this paper is to provide a procedure for SLPs to monitor their students’ progress in multilinguistic spelling interventions similar to those described by Bell, Cron, Jones, and Borneman (2013) in this issue. Below, we discuss this method that can be used to optimally establish baseline performance for spelling, then track progress in a range of contexts. The system was designed to capture the relative speed of a binary scoring system with the theoretical view of the multilinguistic theory of spelling development. We note that this system is meant to complement an assessment, such as that discussed by Brimo (2013) in this issue, that is designed to develop intervention goals. That is, the system we describe below is meant to be used to monitor progress on goals, not to develop goals. However, because of its structure, it allows SLPs to monitor goal progress within the context of all linguistic components versus examining goal progress in isolation.

Spelling Sensitivity System

We recently introduced the Spelling Sensitivity System (SSS) for quantifying variations in linguistic accuracy (Masterson & Apel, 2010). One main goal for developing the SSS was to develop a scoring system that would be useful for quickly providing a “snapshot” of a student’s spelling abilities while staying within the multilinguistic approach we advocate. In the SSS, each target word is divided into spelling elements, which include phonemes in base words (or the stem or base component of a multimorphemic word), juncture changes (i.e., the point at which a suffix is added to the base, such as the “extra” t in *hitting*), and affixes (i.e., prefixes and suffixes). A student’s spellings are parsed or segmented into elements, aligned with the target elements, and scored on a 4-point scale representing linguistic accuracy. Target element spellings that are correct are given 3 points. All incorrectly spelled elements receive fewer points depending on the level of linguistic knowledge demonstrated via the spelling. Those misspellings that are orthographically legal or plausible indicate a degree of orthographic and/or morphological knowledge. For example, spelling *fight* as FITE or *admittance* as ADMITTENCE involve spelling patterns *ite* and *ence* that are accurate in other words (*bite*, *excellence*). Spellings in this category are given 2 points. In essence, a score of 2 suggests that the student has adequate phonological and orthographic and/or morphological knowledge, but likely needs more specific mental graphemic representational (MGR) knowledge for that particular word. In our colloquial terms, we view a score of 2 as an “MGR issue.”

Although element spellings that are not categorized as legal represent less orthographic or morphological knowledge, they do indicate an appreciation for the phonological structure of the word because each element is represented with a spelling. Consequently, misspellings in this category are given 1 point. If the element that is illegal is a letter(s) representing a morpheme (e.g., spelling the plural with a “z”), we then say a score of 1 is a “morphological awareness issue.” Similarly, if the element that is illegal is a letter(s) representing a phoneme (e.g., spelling a /b/ with a ‘d’), we then say in our colloquial way that a score of 1 is an “orthographic pattern awareness issue.” Finally, target element spellings that are not represented at all in the student’s spelling are given no points. A 0 score in our terms represents a “phonemic awareness issue.” These values or scores are given both for individual

spelling elements and for the spelling of each entire word. Various descriptive metrics (e.g., percentages; see tables below) then are derived to represent a student's spelling skills.

Masterson and Hrbec (2011) developed an automatized version, the Computerized Spelling Sensitivity System (CSSS). To use the CSSS, target spellings and associated user spellings are stored in a spreadsheet (typically Excel) in a comma-separated-value format. The file then is imported into the CSSS. The CSSS includes a dictionary of target words that have been parsed into spelling elements and contains lists of spellings for each element that are considered legal or plausible. The CSSS performs preliminary parsing of the student's spellings, and the user inspects each parsing and adjusts if necessary. Exact correspondences between target-user elements are counted as correct (3 points); the absence of a letter in the user spelling that is aligned with a target element is counted as omitted (0 points). If a user's element spelling is not an exact match with the target element, the dictionary list is consulted. If the spelling is in the list, it is counted as legal (2 points); if it is not, it is counted as illegal (1 point). The CSSS Dictionary may be modified by the user to account for differences in legal spellings associated with variations in pronunciation across dialects. For example, a rhotic dialect of English (i.e., the /r/ is pronounced regardless of whether it is followed by a vowel or not) is used in most parts of the United States, so the word march would have four spelling elements (m a r ch) in those regions. However, in some regions of the United States, as well as Great Britain and Australia, citizens may use a non-rhotic dialect of English (i.e., /r/ is pronounced only if it is followed by a vowel). In these areas, the word *march* would have only three spelling elements (m ar ch) since the /r/ would be silent. The CSSS Dictionary can be adjusted to reflect such differences.

Use of the Spelling Sensitivity System to baseline Michael's skills and monitor his progress across the intervention period is discussed in the next section. Note that the SSS was used *after* the goals were set for Michael's intervention. The SLP used the SSS, or in this case, the CSSS, to obtain a quick estimate of Michael's progress on the particular patterns she had targeted. She could have simply asked Michael to write a series of words that contained the particular target patterns and scored his use/non-use of those patterns in a binary fashion. However, by using the CSSS, she was able to examine his ability to spell those patterns within the context of all the linguistic components necessary for production of the words written, thus assessing his abilities in a more typical and natural environment.

Case Study

Michael's spelling skills were assessed by administering the *Spelling Performance Evaluation for Language and Literacy-2 (SPELL-2; Masterson, Apel, & Wasowicz, 2006)* and the results were used to determine treatment targets and approaches for intervention. After determining treatment targets, the clinician constructed short lists of probe words that contained the four specific treatment targets (i.e., short u and o, long vowel patterns, regular plural and past tense, consonant doubles). She also collected a short connected writing sample from Michael's teacher. His spellings for the *SPELL-2* words and his spellings for the probes and those used in the writing sample were combined and served as the baseline for future monitoring of progress. The file was uploaded for processing in the CSSS, and descriptive metrics were calculated from the results. Examples of the target words, spellings, associated parsings, and CSSS word and average element scores are shown in Table 1.

Table 1. Example of Words From SPELL-2 or Probe List and Associated Spellings. Each form is parsed into elements by CSSS and confirmed or revised by the user prior to analysis. Word score represents the linguistic accuracy of the word as a whole, and the mean element score is the average score given to the elements within each word.

Target	Target Elements	Spelling	Spelling Elements	Word Score	Average Element Score
appealing	a p p e a l i n g	appealing	a p p e a l i n g	3	3.00
attached	a t t a c h e d	attacht	a t t a c h t	1	2.60
baby	b a b y	babby	b a b b y	2	2.75
banged	b a n g e d	bangd	b a n g d	1	2.50
bass	b a s s	bas	b a s	2	2.67
better	b e t t e r	beter	b e t e r	2	2.75
bite	b iCe ¹ t	bit	b i t	1	2.33
blouses	b l o u s e s	blouces	b l o u c e s	1	2.60
bomb	b o m b	bom	b o m	2	2.67
bossed	b o s s e d	bust	b u s t	1	1.50
bottle	b o t t l e	bodaly	b o d a l y	1	2.25
bowl	b o w l	bole	b o l e	1	2.00
bucks	b u c k s	bocks	b o c k s	1	2.50
buds	b u d s	budz	b u d z	1	2.50
butter	b u t t e r	butter	b u t t e r	3	3.00
catch	c a t c h	ctch	c # ² tch	0	2.00
cattle	c a t t l e	catle	c a t l e	2	2.75
caught	c a u g h t	cought	c o u g h t	2	2.67
cause	c a u s e	cause	c a u s e	3	3.00
chain	ch a i n	chan	ch a n	1	2.33
chair	ch a i r	chir	ch i r	1	2.33
chimneys	ch i m n e y s	chimnes	ch i m n e s	1	2.67
choke	ch oCe k	choke	ch oCe k	3	3.00
church	ch u r c h	churh	ch u r h	1	2.33
cider	c i d e r	sider	s i d e r	2	2.75
club	c l u b	clob	c l o b	1	2.50
commendation	c o m m e n d a t i o n	comendation	c o m e n d a t i o n	2	2.88
commercial	c o m m e r c i a l	comertial	c o m e r t i a l	1	2.50
vine	v iCe n	vin	v i n	1	2.33
watched	w a t c h e d	watcht	w a t c h t	1	2.50

¹ Represents the *vowel-consonant-e* spelling pattern for long vowels

² Represents a deletion, or failure to represent a target element in the student's spelling

Word-Level Measures

Primary indicators of overall accuracy are provided in Tables 2 and 3. The results in Table 2 were calculated on the accuracy of the entire word, which is typically the level of analysis used in the classroom and on tests. Although Michael spelled almost half of the words inaccurately, the SLP used the SSS to document that almost all of the misspellings were either orthographically plausible or phonologically accurate. This knowledge is reflected in Michael's average word score of 2.13 (possible range of 0 to 3).

Table 2. Word-Level Indicators of Michael's Spelling Accuracy.

Percent Words Correct	51%
Percent Words Spelled Legally	12%
Percent Words Represented Phonologically	35%
Percent Words Characterized by Omissions	2%
Average Word Score	2.13

Element-Level Measures

The results shown in Table 3 provide additional detail about Michael's spelling because they reflect accuracy at the individual spelling element level. Such awarding of "partial credit" provides the SLP with even more insight into the degree of Michael's linguistic knowledge. Again, although he only spelled about half of the words correctly, Michael spelled 85.3% of the elements correctly. This level of element accuracy, and the associated average element score (2.70) indicate that Michael does indeed know a lot about English spelling, but there are specific gaps that need to be addressed.

Table 3. Element-Level Indicators of Michael's Spelling Accuracy.

Percent Elements Correct	85.4%
Percent Elements Spelled Legally	4.5%
Percent Elements Represented Phonologically	10.3%
Percent Elements Omitted	0.4%
Average Element Score	2.70

Intervention Patterns

Michael's accuracy on the spelling patterns identified for intervention are provided in Table 4, and these are the levels that are expected to increase with tailored intervention. Baseline accuracies for the targeted patterns ranged from 45% to 67%. It was not necessary to divide the inaccurate spellings into categories (legal, illegal, omitted) used in Tables 2 and 3 because the *SPELL-2* results had already indicated the nature of each error and associated type of treatment indicated.

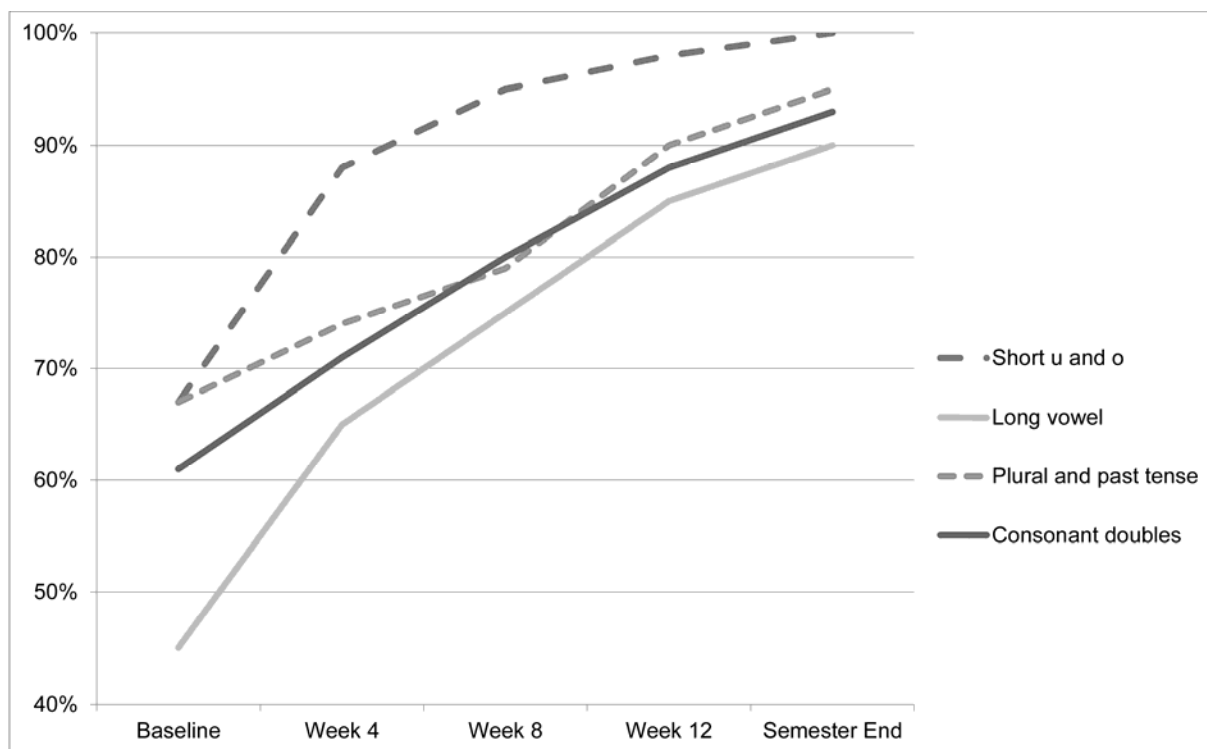
Table 4. Baseline Percent Accuracy of Patterns Chosen as Goals.

Short u and o	67%
Long vowel	45%
Plural and past tense	67%
Consonant doubles	61%

Progress Monitoring

The SLP saw Michael each week for two sessions in a group with other students in the fifth and sixth grades. She also visited his classroom at least once a week to coach Michael in applying the knowledge he was gaining in sessions with her to his academic activities and assignments. The SLP and Michael’s teachers determined that it would be appropriate to document his spelling performance every 6 weeks to determine his level of progress. They decided that the teacher would provide a sample of Michael’s writing and the SLP would administer the same probes representing the four word-study goals. Michael’s spellings would be analyzed via the CSSS to yield the measures charted at baseline and results would be compared across each of the four sampling periods. As can be seen in Figure 1, Michael demonstrated real progress across the semester. By the semester end, he was demonstrating above 90% accuracy on all four goals and, as discussed by Bell et al. (2013), had moved on to other goals.

Figure 1. Michael’s accuracy on words representing targeted spelling patterns elicited via probes and used in classroom writing samples across the semester.



The SLP found the use of the CSSS helpful in a number of ways. First, given that the process had been automated, particularly after the specific words for Michael had been entered and specific elements parsed, subsequent documentations of progress were relatively quick while maintaining adherence to the SLP's desire to examine Michael's progress through a multilinguistic lens. Second, by using the same probe words, she had confidence that any changes were due to progress in learning and not differences on individual words.

Summary

As Westby, Stevens-Dominguez, and Oetter (1996) argued, the goal of assessment is more than screening, determining whether a disorder exists, and establishing a baseline and goals for intervention. Assessment also involves measuring changes that occur during and as a result of that intervention. In the case of spelling, this can be a challenge if one relies solely on norm-referenced measures, as these instruments often fail to align with current theories of spelling development and employ all-or-none binary scoring systems. In this paper, we advocated for the use of the SSS, which allows the SLP to establish a baseline of a student's spelling ability for specific orthographic patterns or morphological constructions, and then monitor progress with those patterns or constructions over time with relative ease.

We see several inherent values in the use of the SSS. First, its use aligns with current theory, a practice we believe fits what clinical scientists do (Apel, 1999). Second, as we have presented it, SSS can be used within an application (e.g., Excel) that is easily accessible and relatively well-understood, thus requiring minimal new learning. SLPs also could conduct the same analysis (SSS vs. CSSS) by hand on a piece of paper (as we did in the early stages). It may be that this option would be conducted with less words; however, with a carefully selected set of words, perhaps a sample that contained words not used within the intervention, a snapshot of progress could still be obtained with relatively minimal time and effort. Finally, it has the potential, as SLPs share their results with others, of allowing SLPs to educate others on the linguistic underpinnings of spelling (and word-level reading) that may help to inform more broadly educational practices in the classroom. That is, when SLPs begin to share their knowledge about what students' spellings tell them about the students' linguistic knowledge, other educators and specialists will learn.

General Summary to Perspectives Issue

As research partners, we have been investigating and writing about spelling for more than 13 years. When we first started, several of our colleagues questioned why we, as SLPs, were interested in studying spelling. Even more colleagues inquired why we would be discussing spelling as part of the SLP's roles and responsibilities. The answer, actually, is the same and is one that has been repeated in every paper within this particular *Perspectives* issue. Spelling is a language skill. We both have been intrigued about language since our first steps into this profession. For us, spelling is the ultimate measure of language. Not only is it language itself, it also requires active, conscious thought of so many different components of language: phonology, orthography, semantics, and morphology. It also involves thinking about how one has stored the images of written language: mental graphemic representations (MGRs).

Our intent for this issue was to provide the reader with at least a basic understanding of how spelling is a language skill and the linguistic awareness components that serve as its foundations. Speech-language pathologists are likely the most qualified professionals to understand these foundational components, simply because of their educational backgrounds. Using their knowledge of those components, SLPs are well-armed to assess students to determine exact causes for spelling deficits. The important point to keep in mind is that because spelling and reading are so intertwined, the deficiencies leading to spelling difficulties are likely the same that are causing struggles in reading as well. With a thorough, prescriptive

spelling assessment, SLPs then can provide the type of intervention that leads to optimal improvements in spelling and, likely, other literacy skills as well.

We end this paper with one final thought. It is not unusual for us to hear some colleagues lament that “SLPs don’t do spelling.” We think this statement arises for several reasons. First, it likely is uttered because spelling was not part of many SLPs’ pre-professional curriculum (it wasn’t part of ours!) and so they are not familiar at all with why SLPs should be targeting spelling and how they should go about assessing and intervening. We hope this particular issue of *Perspectives* has helped in that area. Second, we believe we hear that statement because for many, spelling means “the Friday Test.” We also hope that this set of papers has helped dispel that notion of what spelling is, or rather, what it isn’t. Finally, we think that, sometimes, we hear that SLPs don’t do spelling because some individuals feel that they now will have to incorporate “one more thing” into their practice. We would argue, however, that spelling intervention, or rather word study, actually has great benefits that stretch beyond just improving spelling. As others in this *Perspectives* issue have mentioned, when we draw students’ attention to the linguistic underpinnings of words, the benefits are wide, including improvements in word-level reading, reading comprehension, and writing (e.g., Apel, Brimo, Diehm, & Apel, 2013; Bowers, Kirby, & Deacon, 2010; Wolter, 2009).

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