TUTORIAL

The Link between Language and Spelling: What SLPs and Teachers Need to Know

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ABSTRACT

Purpose

Speech-Language Pathologists (SLPs) working within the paediatric field will find themselves working with school-aged children and consequently collaborating with teaching staff. Knowledge of the links between language, speech, and literacy can support and inform successful collaboration between the SLP and teacher and their shared goal of facilitating the school-aged child in accessing the curriculum. To facilitate and develop the collaborative working practices of SLPs working with school-aged children and teaching staff it is helpful, to both parties, to develop and extend their explicit understanding of the link between language, speech, and spelling.

Method

In this paper I describe how verbal and written speech and language skills are inextricably linked and key to spelling development and progress. In this tutorial I will: a) discuss the complexities of spelling in the English language b) describe the links between language, speech and spelling c) propose a linguistically informed approach to spelling intervention.

Conclusion

SLPs have expertise in the key speech and language domains such as phonology, morphology, and semantics and are therefore well placed to play an important role in supporting learners in making links between these domains in relation to spelling development and intervention.

Introduction

Within any education system written expression is a major communication channel. Further, written expression forms the basis for the school-aged learner to express their knowledge and learning in the classroom. Essentially, the written form is a vital step in allowing a child to progress from internal thought and opinions to the written expression of these. A key component of success in written expression is accurate spelling (Kohnen, Nickels, and Castles, 2009). Given that difficulties in spelling are more common than difficulties in decoding (Temple, 1997) it is surprising that spelling has received less attention in the literature than its counterparts reading both decoding and comprehension. Support for greater focus on spelling comes from research and practice, which has shown a reciprocal relationship between reading (i.e. decoding) and spelling (Graham & Santangelo, 2014). In addition, there is evidence to show that spelling intervention can induce positive changes in reading and vice versa (Brunsdon, Coltheart, and Nickels, 2005; Kohnen, Nickels, Brunsdon, and Coltheart, 2008a, 2008b; O'Connor and Jenkins, 1995) with positive effects most likely to flow from spelling to reading (Kohnen, Nickels, and Coheart, 2010). Consequently, given its key role in written expression, there is a need to incorporate spelling, to the same degree as reading, into instruction and intervention. For the sake of clarification within this tutorial the term reading will relate to decoding (the orthographic counterpart to spelling) unless stated otherwise.

There is a growing list of researchers and clinicians (Apel & Masterson 2001; Bahr et al., 2012; Berninger et al., 2008; Berninger, V. W., Abbott, R. D., Nagy, W., & Carlisle, J. 2010; Bourassa & Treiman, 2001; Daffern, T. 2017; Garcia, Abbot, & Berninger, 2010; Masterson & Apel, 2010a, 2010b, 2013b; Nunes et al., 2003; Quick, & Erickson, 2018; Silliman et al., 2017) who are raising the profile for a metalinguistic approach to spelling assessment and

intervention. Meta-analysis (Graham & Santangelo, 2014) and synthesis of data (Wanzek et al., 2006; Sayeski, 2011) indicate that to improve spelling skills explicit formal instruction in spelling strategies and opportunities for practice are central. Further, Galuschka et al., (2014) suggest both phonemic instruction and phonics instruction need to be implemented in conjunction with each other, to increase spelling performance.

This tutorial has three primary aims. Firstly, to be a useful addition to the growing literature on the links between language and spelling. Secondly, to bridge the gap between SLP's depth of knowledge regarding speech and language and teachers' expertise in teaching practices including phonics. Finally, to bring this literature and knowledge together to inform and support classroom instruction and intervention for the novice or struggling speller. To this end, this tutorial puts forward a metalinguistic spelling approach to spelling assessment and intervention within a metacognitive framework. I refer to this approach as metapractice. The links between language and spelling are captured in Figure 1: The Links between Language and Spelling Framework. Here I pull together not only the linguistic but also the sensory and motor aspects involved in spelling. Once the multiple linguistic levels and motor and sensory processes involved in the spelling process are considered, as in Figure 1 one cannot fail to be impressed by the achievements of most young spellers as they work towards mastery.

Figure 1- The Links between Language and Spelling Framework

By the end of this tutorial the reader will be able to identify the linguistic sources implicated in different errors found in English school-age children's spellings and provide a process for the practice of spelling intervention. A case study is used, aimed at enabling the school based SLP to support teaching staff working with the struggling speller. To this end, this tutorial discusses and describes the underlying linguistic influences involved in spelling development and progress. In this tutorial I will: a) discuss the complexities of spelling in the English language b) continue the themes from the first section and describe the links between language, speech, and spelling and c) propose and describe the metapractice approach to spelling assessment and intervention.

For the busy school based SLP spelling assessment, instruction, and intervention may be considered more suited to teaching staff. This tutorial sets out to highlight, for SLPs, that their unique depth of knowledge of key linguistic domains places them in an ideal situation to provide support and intervention for teaching staff and their school-aged children who

present with spelling difficulties. For the school based SLP, who has received limited training in spelling development and disorders, this tutorial makes explicit how they can capitalize on their linguistic knowledge in the domain of spelling. Finally, for the SLP and teaching staff, awareness of the links between language, speech, and spelling could inform and enrich collaborations in goal setting, classroom instruction, and intervention.

Complexities of spelling in the English language

A language is said to be transparent when there is a highly regular relationship between phoneme (sound) and grapheme (a letter or group of letters). If only one grapheme regularly represents a single phoneme the orthography would be considered completely transparent. A small minority of writing systems, for example Spanish, Finnish, Italian, Greek, and Turkish, have relatively transparent orthographies (Serrano and Defior, 2008). For these languages, there is high consistency and transparency in phoneme-grapheme correspondence. From the perspective of the novice learner, developing spelling skills within a transparent orthography; (Apel, 2011; Serrano and Defior, 2008; Zourou, Ecalle, Magnon and Sanchez, 2010) is the ideal, as the phoneme grapheme correspondences are highly consistent thereby aiding the spelling process. Consequently, for the novice speller learning spelling in a transparent language has its advantages. Cross linguistic studies demonstrate that basic spelling skills are acquired faster in languages that are transparent (Caravolas and Bruck, 1993) relative to irregular and inconsistent languages. The English alphabetic system is considered a highly irregular and inconsistent orthography and is categorised as opaque, in the sense that phoneme to grapheme correspondences are not obvious to the learner. Consequently, for the novice or struggling speller, learning to spell, in an opaque language such as English, can be a challenging and complex task as Figure 1 suggests. Therefore, the task of spelling is deemed more challenging in some languages (opaque languages) than others (transparent languages). The increased complexity of spelling within an alphabetic language such as

English presents the speller with challenges that arise from several sources: process; multiple spelling options, the context of spelling, and learning ability.

The Challenge of Spelling

The process of spelling requires acts of production and recognition (Ise and Schulte-Korne, 2010). Production, from a motoric sense, means that the writer must automatically and fluently form each letter in the correct sequence with correct letter formation (i.e. correct start and finish point when forming letters). This ensures that letters and words are correctly formed and distinguishable from each other. In addition, the writer has to recall the appropriate phoneme/s, select from a range of options the correct grapheme/s to represent these phoneme/s; hold the information in their short-term memory whilst they assemble and organise the letters in the correct sequence; and in many cases draw on auditory and visual sequential memory to support and ensure all graphemes for the target phoneme/s are written in the correct order.

Multiple spelling options within an alphabetic language mean there are multiple options but limited cues to inform which of these numerous spelling options to choose from. For example, in spelling the word 'skate' the speller could choose the 'sk' or 'sc' option. In another example, in the word 'quick' does the speller choose *cw*, *qw*, *kw*, or *ckw*, for the initial sound, given that each option is a phonetically plausible option for the initial /k/ sound in 'quick' Even *chwick*, (just think *choir*) *is plausible!*

Regarding the context, in almost every European alphabetic system (Ise and Schulte-Korne, 2010) there is inconsistency in phoneme-grapheme correspondences that are important for spelling. English orthography provides more opportunities to misspell than misread a word (Fletcher-Flinn, Shankweiler and Frost, 2004). For example, *scool*, *skool*, and *sckool*, are all phonetically plausible misspellings for the target word *school*.

Learning ability relates to the fact that the process of learning spellings may be more challenging for some than others. Some learners may become aware of the patterns and rules of spelling with minimal attention, conscious awareness, or effort. These learners may be more able to take advantage of incidental learning (i.e. implicit learning; Reber, 1967), through a process called statistical learning (See Saffran et al., 1997, for details). Learning ability suggests that struggling spellers likely find it challenging to learn in this way.

Two major theories of spelling include the stage/phase models (Bear and Templeton, 1998; Ehri, 1995; Frith, 1985; Gentry 1982), and cognitive neuropsychological theories of development. In the former, the view is that children's spelling moves through distinct stages of spelling, including pre-writing, sound, morphological, and complete stages. The stage/phase models provide a useful developmental framework for spelling. Cognitive neuropsychological theories of spelling development such as the Dual Route Model (Coltheart, Rastel, Perry, Langdon, & Zieger, 2001) suggest a division of labour within routes for spelling single words. The Dual Route Model provides a useful framework for the processes involved in spelling. Spelling processing within a cognitive neuropsychological model is achieved through retrieving stored spellings (lexical route) or converting sounds to letters (sub-lexical route). The lexical route is considered a memory-based route for spelling (Houghton and Zorzi, 2003) and the sub-lexical route as a phonics-based route. Semantic information may or may not be accessed in spelling, leading to a distinction between a lexical-semantic and a lexical route. For the target words *which* and *night* for example, the speller who is aware of the alternative options, would need to refer to semantic information to make an informed decision between the homophones: *which/witch* and *knight/night*.

Other theories of spelling development include a constructivist view (Ferreriro and Teberosky, 1982) where spelling moves through stages (presyllabic, syllable, and alphabetic). The child is believed to construct their spelling from what they already know, for example, spelling people as *ppl* where their knowledge the grapheme used to stand for a syllable in the target word. The overlapping wave theory (Kwang and Varnhagen, 2005; and Varnhagen, McCallum, and Burstow, 1997) is a process-orientated approach. Spellers are strategic in their spelling, drawing on whatever strategies they have to aid their spelling, including phonological, morphological and orthographic knowledge.

These theories outlined above have merit. Children do go through stages of progressing to more sophisticated levels of spelling and make use of sound to letter conversion along with whole word retrieval processes to aid spelling. On the other hand, these models are limited in that they miss the multiple linguistic contributions to the spelling process and development as illustrated in Figure 1. More recent models of spelling development (e.g. Berninger et al., 2010; Masterston and Apel, 2010b; Daffern, 2017a; and Treiman and Kessler, 2014) take an integrated, multi-linguistic account of spelling. Here, elements such as orthography which includes alphabetic knowledge and orthotactics, phonology, morphology, and semantics are seminal to the spelling process, development, and intervention. These newer theories of spelling development emphasise the need to make explicit the linguistic elements involved, not only in the development but also in the instruction of and intervention practices for spelling.

The Links between Language, Speech and Spelling

Newer theories of spelling development suggest the speller must simultaneously draw on language and literacy domains, including phonological and morphological awareness as well as orthographic knowledge, to achieve success in spelling. The Links between Language and

Spelling Framework (Figure 1) highlight these key areas. These have been shown, by Berninger and her colleagues (2006) within the Triple Word-form theory, to be important for spelling success. The notion of Triple Word-form theory (Berninger et al., 2006), is hypothesised to contribute and determine spelling success. Here, the quality of word representations at orthographic, morphological and phonological levels, is seen as fundamental to the understanding and processing of the internal structure of words for spelling. Within this theory the linguistic features of words are considered and made explicit in a way that informs the spelling process. The Triple Word-form theory suggest that learning to spell draws on storing and analysing, in memory, the linguistic forms (phonological, orthographic, and morphological) and the parts inherent within them (phonemes; letters, letter patterns, and groups; prefixes and inflectional and derivational suffixes) (Garica et al., 2010). The aim is for high quality linguistic knowledge for analysis and storage that ultimately informs spelling intervention, learning and development. What follows is a description of the roles of the multiple linguistic levels of knowledge and processes, as indicated in the Links between Language and Spelling Framework.

Orthographic awareness

Orthography (Apel, 2011) is considered to include alphabetic knowledge and orthotactics (Materston & Apel 2000). Alphabetic knowledge, or *the alphabetic principle* (O'Connor and Bell, 2004), is the knowledge that consonant and vowel sounds in words (phonemes) link with a letter or group of letters (graphemes). In addition, the alphabetic principle comprises the knowledge that there are often alternative options (e.g. the sound dʒ can be represented by the letters *j*, *g*, or *dge*; the sound /i:/ can be represented by *ee*, *ey*, *y*, *e*, *ea*, *ei*, *ie*, etc.). Orthotactics relates to the positional constraints of graphemes in words and reflects understanding of acceptable and unacceptable letter sequences.

Alphabetic knowledge - Consonants and Spelling

Alphabetic knowledge, both letter name and letter sound, has been shown to be a foundation skill important for spelling development (Foulin, 2005; Levin *et al.* 2006; Piasta and Wagner, 2010; Treiman and Kessler, 2003). Alphabetic knowledge relates to the ability to convert a phoneme to the correct grapheme. The Alphabetic Principle (O'Connor & Bell, 2004) is the knowledge that phonemes link to graphemes and that one can convert one to the other.

Novice spellers often use the name of the grapheme to represent a word or syllable (Read, 1975, 1986), for example, *are* spelt as *r* and *people* spelt as *ppl*. Letter knowledge for spelling entails letter name and letter sound structure. Letters vary in the degree to which their letter sound properties are represented in their names and the degree to which they are 'iconic'; how much, their letter names represent the sound they make.

Treiman and Kessler (2003), suggest that English letter names are iconic in that 23 out of 26 letters of the English alphabet, when spoken aloud, have the letter sounds inherent within them. However, many have additional phonemes inherent in their letter names. The [ɛ] sound (as in *end*) is inherent in the letter name of the consonant graphemes *f*, *l*, *m*, *n*, *s*, and *x*; the vowel [i:] (as in *bead*) is inherent in the production of the consonant letter name for the letters *b*, *d*, *g*, *p*, *t*, and *v*, in this case following the consonant; the vowel [eɪ] (as in *day*) can be heard in the letter names *j* and *k*, again following the consonant; and the vowel [ɑ:] (as in *star*) can be heard in the letter name *r* where the vowel precedes the letter name production [ar]. These features explain why the beginner speller might spell the words *car* and *are* as *cr* and *r* respectively. Another important factor to consider is non-iconic letters. An example of a non-iconic letter in the English alphabet is the letter *w* where its letter name is /dʌbəlju/. This letter name does not contain its associated sounds. The letter *y* is particularly challenging as

its letter name contains the sound heard in the letter sound for the letter w. This explains why the word *when* may be spelt as *yen*.

For the beginner speller properties of letter names are challenging as it may not be clear which part of the letter name constitutes the letter's sound; the vowel sound that comes before or after the consonant, both or neither. Treiman and Broderick (1998) found that beginner spellers (UK education system ages 4-6) were more likely to know the sounds of letters if the letter sound was present at the beginning of its associated letter name, as in the letters, /p, t, d, b, a/, than if the letter sound is at the end of its letter name, as in the letters /l, m/. The suggestion is that consonants are easier to discriminate when the vowel sound appears after the consonant, when you say its letter name, than when the vowel appears before the consonant; perhaps because the consonant is more salient coming before a vowel than after.

Another important aspect of letter name structure is its inconsistency with some letter names inconsistently related to their letter sounds. For example, the letter *c* can represent the sound [k] as in *cat*, *choir*, or *school*; the sound [s] as in *ice*; and the sound [ʃ] as in *ocean*. In another example the letter *y* can represent [y], [ai] or [i:] as heard in the words *yes*, *by* and *baby*. In summary, letter names, and the vowel and consonant sounds inherent in them can result in spelling errors such as *by* or *bye* spelt as *bi* or *nice* spelt as *nis*.

Alphabetic Knowledge - Vowels and spelling

Another important aspect of letter name structure is the inconsistency with which some letter names relate to letter sounds. For example, a speller who misspells *bot* for *boat* has clearly used the alphabetic principle; they have spelt *boat* using plausible phoneme-grapheme rule application [b], [o], [t]. Here the sound in the letter name of *o* has the diphthong [əu] quality sound and has consequently been used to represent the diphthong [əu] pattern. So, relying on

letter names or letter sound for signalling vowels can result in phonetically accurate but orthographically incorrect spellings.

A vowel diphthong is described by Ladefoged (2005) as a sound that changes in vowel quality during its production. Although there are two distinct vowels inherent within a vowel diphthong (Table 1) there is no syllable break in their oral production. This means that vowel diphthongs have changing phonetic properties and a novice or struggling speller could potentially focus on only one aspect of this and try to represent this in their spelling.

Vowel diphthong	Example word	First vowel sound	Second vowel sound
ɛɪ	Face	ɛ as in bed	ɪ as in pit
əʊ	Coat	ə as in upon	ʊ as in good
aɪ	Kite	a as in sky	ɪ as in pit
aʊ	Cow	a as in sky	ʊ as in good
ɔɪ	Boy	ɔ as in short	ɪ as in pit

Table 1 – Vowel elements in vowel diphthongs and example spelling realisations

It is feasible to hypothesise that a beginner or struggling speller may focus on the first or second vowel quality of vowels diphthongs in their spelling. In the case of spelling *paper* as /pep/, where the speller has made use of the letter /e/ for the diphthong [ɛɪ], the speller has used the initial vowel sound [ɛ] to represent the vowel diphthong in the first syllable of *paper*. Short vowels are also important for spelling. In most cases this is seen when spellers use the letter's name as a clue to spell vowels; because the letter name has phonetic properties close to the target sound, and this can result in incorrect spelling. For example, in the word *bacon*

the vowel diphthong, in the first syllable, has the same name as the vowel letter name for the /a/ grapheme. This can result in misspelling, for example, *break* spelt as *brak*

Orthotactic awareness

Orthotactic knowledge is used to refer to the positional constraints of graphemes that represent sounds in words (Goulandris, 1994). It reflects understanding of acceptable and unacceptable letter sequences and consequently plays a key role in spelling. This also includes, for example, knowledge of spaces between words. More specifically, this relates to the rules around placement of grapheme or graphemes within words and this is important for correct realisation of spellings. Examples include the fact that the letter sequence *ck* can never occur at the start of an English word and the letter *v* can never occur at the end of an English word. In another example, the long [e:] vowel pattern means that the [e] at the end of a one syllable word such as *hate* leads to the 'a' being realised as [ei]; the [a] in *hat* becomes an [ɛɪ] in [hæt]. Further, certain letter sequences frequently appear together, for example, *ing*, *tion*, *able*, and knowledge of these are key for spelling.

Speech, Phonological awareness and Spelling

Spelling difficulties are seen in children with phonological disorder (Schuele, 2004) and children with speech sound disorder (McNeil et al., 2017). The current thinking is that speech difficulties are linked to higher risks of literacy problems in the context of: poor language and/or phonological awareness skills deficits (Pennington and Bishop, 2009); when the speech difficulties are severe. The links between speech, phonological awareness, and spelling are therefore key in spelling development.

Speech and Spelling

SLPs and teaching staff, working on literacy, need to engage with the relationship between speech and spelling when working with children and when talking with parents about their

child's progress or otherwise. It is likely that like me SLPs have experienced and had to reassure parents about the links between child speech and the influence, or otherwise, on spelling. Parents, and likely education staff, may question the behaviour of the child who is "sounding out", that is. pronouncing each letter separately, in order to aid spelling. For the purposes of devising an intervention plan it is important to note how the child articulates the sounds they are sounding out, what they eventually write, and whether these elements are likely linked. Furthermore, linked to this, is the child's sensitivity to the phonetic features of words (Bourassa and Treiman, 2003) and spelling.

Children are sensitive to a sound's phonetic features (Bourassa and Treiman 2003). This sensitivity is attributed to the influence of phonologically conditioned allomorphs, i.e. morphemes which vary according to context. A classic example is past tense "ed", which can be realised as [t], [d], or [Id]. These allomorphs are problematic for spelling because, as shown in Table 2, their form is influenced by neighbouring sounds, morphophonology, and may be realised as phonetically correct but orthographically incorrect.

Phonological conditioned allomorph	Context	Example
Plural segment is /s/	after voiceless sound	cup- cups
Plural segment is /z/	after voiced sound	birdz - birds
Plural segment is /iz/	after s, z, sh, sound	rosiz - roses
Past tense segment is /t/	after voiceless sound	pickt - picked
Past tense segment is /d/	after voiced sound	bangd - banded
Past tense segment is /id/	after alveolar plosive	plantid - planted

Table 2- Signalling regular plural nouns and past tense forms

Consequently, morphophonology influences the novice speller's representation of these allomorphs in spelling. This entails that the novice or struggling speller will try to represent the phonetic features of the words they hear rather than adhere to the morphological rules and spelling conventions. This sensitivity to the phonetic features of sounds can result in what is

described as, at worse, illogical at best phonetic spelling. However, on examination, the speller is making logical choices through their phonetic analysis and using this to inform their orthographic choices. For example, common spelling errors that result from phonetic sensitivity include the spelling of regular plurals and regular past tense forms as given in Table 2 above.

In other examples, spelling *dry* as *jri* or *hand* as *had* can be explained by children's phonetic sensitivity. The child may classify some segments of a spoken word differently than assumed by the conventional writing system. For instance, spelling *dry* as *jri* although erroneous is phonetically plausible. Essentially, when a child comes across a word such as *dry* for spelling, they tend to write the digraph /dr/ as /j/. Treiman (1993) suggests that children write /d/ before /r/ as a /j/. In this example, when /d/ occurs before /r/ the contact between the blade of the tongue and the alveolar ridge is made further back in the mouth (post alveolar region) than when /d/ occurs before a vowel. Furthermore, the closure is released more slowly than when /d/ precedes a vowel due to the phased transition into the alveolar approximant. This gives /d/ before /r/ a degree of friction that is like the friction that occurs in [ɖ] which is normally spelt as /j/. Phonetic sensitivity is therefore critically important in spelling in alphabetic script. In the case of spelling *hand* as *had* English speaking children may consider nasality to be a property of the vowel rather than a separate unit. Consequently, in spelling *hand* as *had* the speller has signalled the vowel within their spelling but has assumed that the nasal consonant is part of the vowel and therefore assimilates it with the end /d/ consonant rather than representing it as a separate unit. In sum, there are many linguistic processes that influence spelling including morphophonology, articulatory gestures of place, manner, and voice, anticipation of other phonemes, and the exaggerated pronunciations of letters, often heard by the novice speller (who is drawing on auditory and kinaesthetic feedback) in their

spelling recitations. All these factors are likely to influence the novice or struggling speller rather than motor processing.

Phonological awareness refers to the ability to explicitly identify, reflect on, and manipulate the sound structures of a language (Masterson and Apel 2010). To master spelling in an alphabetic script the learner must have an explicit understanding that words consist of syllables. In addition, the learner needs to appreciate the internal structure of these syllables including onsets and rimes (intra-syllabic level) and phonemes (phonemic level). These phonemes are represented by a grapheme. According to the phonological deficit hypothesis (Goswami & Bryant, 1990) a deficit in phonological awareness is enough to cause difficulties when spelling new or unfamiliar words.

Phonemes are the smallest segment of a spoken language's phonological structure that cues meaningful differences between words. It allows the speller to identify the number of sounds in words which supports decisions around grapheme selection in spelling words. Learning to spell in English depends on accurate mapping between phonemes and graphemes (Zourou, Ecalle, Magnon, Sanchez, 2010). However, the English alphabetic system often has several graphemes that can be used to represent the same phoneme as shown in Table 3, a characteristic I describe, in my practice, as higher-level alphabetic knowledge. In this view progress in spelling is seen as the speller moves from basic phoneme to grapheme knowledge to a higher level of knowledge where they realise that a phoneme can have multiple options of grapheme representation.

Phoneme	Common spelling options	Examples
[t]	t, tt	Put, butt
[f]	F, ff, ph, gh	Fox, coffee, phone, cough
[dʒ]	J, g	Jug, gem

[k]	k, ck, c, ch, que, q,	Kite, lock, cat, school, chemist, antique, quiet
[ʃ]	ch, sh	Chef, shelf
[i:]	ie, ea, ee,	Chief, beat, bee

Table 3- Examples of Alternative Spelling Options

At the intra-syllabic level, phonemes are combined to form larger units. These units relate to the onset, the initial consonant/s (e.g. c in cat and spl in splash), the rime (at in cat and ash in splash); the vowel nucleus (a in cat and splash), and the coda, the consonants after the vowel nucleus (t in cat and sh in splash. These elements are key for spelling. Rimes have neighbours that may vary in orthographic and/or phonological form (Table 4). Therefore, at the intra-syllabic level, explicit (orthographic and phonological) rime awareness is key to successful spelling. Syllabic awareness allows the speller to break words into syllables and then assign graphemes or groups of graphemes to each syllable. These elements can be informed by linguistic knowledge at the phonemic, semantic, and/or morphological levels.

Homophone variant	Description/phonological form	Orthographic rime forms
Heterographic homophone	Spelt differently and sound the same	Herd- heard Beef, chief, leaf,
Homographic heterophone	Spelt the same and sound different	Hint – pint Have – gave
Homographic homophone	Spelt the same and sound the same	Save – gave Hint- mint

Table 4- Homophone Variants and Spelling

Morphemes, Semantics and Spelling

For spelling to progress the speller needs to move from spelling based on sound-based patterns (phonology), to spelling based knowledge of morphology and meaning (semantics). Awareness of morphemes in words is known as morphological awareness. The understanding and ability to reflect on and manipulate the meaningful parts of a language (such as roots, prefixes and suffixes) contributes to spelling (Apel and Lawrence, 2011). This

knowledge helps the learner to understand and appreciate morpheme forms and their semantic contribution to spelling.

Morphological Awareness

Morphological awareness, the ability to consciously analyse, reflect on, and manipulate the structure of words in terms of their units of meaning, i.e. morphemes (Carlisle, 1995). The hypothesis that certain spelling difficulties arise from limited morphological awareness is referred to as the morphological deficit hypothesis (Bourassa and Treiman, 2001). This hypothesis attributes difficulty in spelling to the learner not having an awareness of how words are broken down into morphemes and consequently the awareness or ability to apply morphological structures to English words. Inability to signal morphology in spelling puts learners at risk of not progressing beyond sound based to meaning based spelling.

Within the domain of morphology, a distinction is made between inflectional and derivational morphology. Explicit awareness of inflectional and derivational morphology is key to spelling as it supports the learner's progression from an alphabetic and phonological task to one that includes morphology. In this way it allows the speller to appreciate how morphemes can be reflected orthographically in the light of, what can be conflicting, phonological information.

For example, with regard to inflectional morphology the spelling of the past tense morpheme units in the words *played*, *jumped*, and *waited* have the phonological form [d], [t] [ɪd] respectively with each form, the allomorphs, being a variant of the past tense morpheme. A speller signalling these allomorphs, within their spelling, is reflecting the sound properties of the target. However, perhaps they are unaware that the orthographic representation is *ed* and remains so in spite of the phonological form suggesting otherwise. In addition, at the

phonetic level speech is represented by strings of phones. Each phone represents a combination of articulatory gestures, including place, manner, and voicing (Ladefoged, 2005). It is likely that together these factors help explain why the speller makes phonological and orthographic errors when signalling morphemes in spelling. Developing explicit awareness of morphemic units and their function in conveying meaning in the written form informs a learner's morphosyntactic awareness and knowledge of the internal structure of words. Consequently, knowing that *played*, *walked*, and *wanted* each have two morphemes (the verb base morpheme and the inflectional morpheme *ed*), which are represented in a consistent way regardless of phonological presentation, will enable a child to accurately spell these words

Derivational morphology is important for the generation of new words from a base morpheme, resulting in a new word. This word will differ in meaning and may differ in word class. For the speller this knowledge is useful for creating new words for spelling. For example, adding the derivational suffix *-ful* to the base *play* creates the word *playful* thereby altering the meaning of the word and changing the word class from a verb to an adjective.

The relevance and importance of morphology to spelling is evident from recent instructional studies (Apel and Diehm 2013; McCutchen et al., 2013; Wolter and Dilworth, 2013; Wolter & Squires, 2014), meta-analyses (Bowers, Kirk, and Deacon, 2010; Goodwin and Aln 2010, 2013), and reviews (Carlisle and Goodwin 2013) which have found significant effects of morphological instruction for improving spelling.

Semantic Awareness

Semantics becomes important when one considers homophones; that is words which sound the same but have different meanings. Semantic knowledge is necessary for the child to use

correct spelling to signal the correct meaning. Relying on just what is heard without taking account of contextual knowledge will result in incorrect spelling. For example, without semantic knowledge the individual may not be able to choose the correct word from a range of options. For example, in the sentence, *I went to/ two/ too/ the shops to/too/ two/ buy/bye/ by/two/too/to/ pairs/pears of shoes and my friend came too/two/to*, the speller may or may not know the alternative forms for homophones but needs to, to ensure meaningful spellings. The speller may have limited knowledge of alternative option and so may go with what they know, which may or may not be the correct option. Thus, semantic knowledge can inform or hinder spelling at sentence level and when considered in combination with orthography it can present a confusing picture. The speller may or may not know that there are several meanings for the word /tu/ but not know the alternative spellings (to, too, two) or they may know the alternative spellings but not the associated meanings.

A metalinguistic metacognitive approach to spelling intervention

The metalinguistic approach within a metacognitive framework ‘meta-practice’ is proposed as an approach to assessment and intervention that clinicians and teachers can utilize in the assessment and intervention of spelling.

Metalinguistic element

The Links between Language and Spelling Framework suggest a linguistic approach to assessment and intervention. The meta-linguistic aspect of metapractice promotes explicit instruction in orthographical, phonological, morphological, and semantic processes involved in spelling. This metalinguistic approach entails supporting the child in building explicit awareness, through visual and verbal techniques, of how to manipulate the structural features of language important for spelling.

The linguistic aspect has implications for assessment and intervention of spelling difficulties and disorders. The suggestion is that the linguistic analysis (i.e. phonological, orthographic, morphological, and semantic), of spelling errors that underpin the incorrect spelling, informs the interventionist as to where attention needs to focus for spelling remediation. Traditional approaches to spelling assessment are considered in absolute terms; the speller is either correct or not. This approach is limited in its capacity and sensitivity in recognising emerging and acquired utilisation of linguistic skills important for spelling. Incorrect spellings can reflect progress and change at a linguistic level, and this can be used to inform intervention. For example, the spelling of the target word *station* where the speller moved from *statshun* to *stasion*, although incorrect suggests awareness of alternative spelling patterns. The aim is for spelling assessment to ensure that spellers' linguistic skills, current and emerging, are considered so appropriate intervention can be suggested. In this way, SLPs or classroom educators can support the novice or struggling speller, from a position of informed knowledge, to progress in their spelling.

Metacognitive element

The meta-cognitive aspect (Appendix A) of the meta-practice approach is informed by Flavell's (1979) work and has two primary aims. Firstly, to encourage the learner to take responsibility for their learning and in a very explicit way through promoting and supporting their active engagement in the process of spelling. Furthermore, the process can be promoted through making explicit, (in both verbal and written means) to the child, the task aims and objectives and the rationale for this, what they are doing and why, what they currently know and need to know, what strategies or techniques they need to use, and how the strategy will support learning. This process can be supported through the *What Have I Learnt Cards* - *WHILC* (Appendix B). Here, children are encouraged to reflect on their learning in verbal

and written forms. The WHILC aims to promote and support the reflective process inherent within a meta-cognitive instructional framework. In addition, Top Tips Cards (Appendix C) provide the learner with tips to support learning. The metacognitive element encourages teaching practices that promote thinking about thinking in spelling. Further, it aims to build awareness of the content and the purpose of the strategies, knowledge, and skills being learnt. The second aim is to support generalisation from the original learning context to other settings such as home and school. This can be promoted through, for example, making explicit how the learning within the original context (e.g. school) relates to and is useful within and other contexts such as home. The metacognitive aspect of metapractice is considered at three levels; person, task, and strategy.

Metacognitive person level knowledge refers to the learner's knowledge regarding the learning process. The relevance here is that personal self-efficacy can impact on the level of active engagement by the learner. Metacognitive task knowledge is the learner's knowledge of the nature of the task in hand and the possible challenges; you as a learner may have some specific task knowledge but need to develop further skills. In this way the learner and interventionist (SLP or teacher) have a shared knowledge of the demands of the task.

Metacognitive strategy knowledge refers to knowledge and awareness of the types of strategies that could be used to reach a goal. In addition, it refers to knowledge of when and under what circumstances strategies can be used. For example, knowing sub-vocal rehearsal is a useful strategy to aid spelling of a single word but not for spelling a list of words.

Metapractice intervention - Feedback

Success in literacy is attributed to corrective feedback (Wanzek et al., 2006), and reflection (Berninger, Abbott, Whittaker et al., 2008). Therefore, their inclusion in intervention is key.

The learner is provided with immediate and informative feedback and praise, both verbal and

written, on what they have done or are doing within a task or after a task. The feedback needs to inform their practice. For example, comparison between their written representation of the word and correct orthographic target representation. Praise needs to reinforce the process the child is or needs to be exhibiting. This can be supported through explicit (verbal and written) feedback. Below I will set out guidelines, using an example case to illustrate, of how metapractice can be utilised to inform assessment and intervention

A Child Case Example

School-based SLPs or teaching staff could encounter a child such as Tom, a school-aged child aged 9 years. Tom's speech and language skills are within the expected average range for his age and as compared to his peers. Further, there were no reported sensory or motor difficulties. Tom presents with the spelling profile as illustrated in Table 5. Using the Links between Language and Spelling Framework one can draw on this to guide decisions around the linguistic knowledge and processes one needs to consider in regards assessment and intervention. Evidently, Tom's spellings are phonetically accurate but orthographically incorrect. Despite in-school phonics (synthetic and analytical approaches) Tom's spelling remains a real challenge for him. From the linguistic analysis (Table 5) and drawing on spelling assessment data (Appendix D) Tom's spelling indicates a primarily phonetic spelling profile with some alphabetic inaccuracies. The indication is that there is a need for higher level alphabetic knowledge development (orthographic knowledge – Alphabetic level) and phonological awareness at the intra-syllabic level (phonological level). Tom also demonstrates some difficulties in signalling correct past tense forms (morphological level) in the words he has attempted to spell. Tom also shows confusion over homophones (semantic level).

Target word	Tom's spelling	Linguistic domain of difficulty	Interpretation	Intervention suggestion
voice	Vose	Orthography	Knowing alternative spelling options for [s]. Is aware of /s/ saying s but he now needs to learn the alternatives.	Higher level alphabetic knowledge - teaching the alternative spelling patterns for consonants starting with /s/ spelling options.
knew heard dear	new herd deer	Orthography Alphabetic Semantics	Is aware of alternative pattern for [n] Homophone error knew-new	Semantic awareness – focus on teaching concept of homophones and variants (Table 1)
stories classes	storys clasis	Morphology	Is aware of how to signal plural in spelling. is aware of use of s but not of alternative options	Morphological awareness – focus on teaching inflectional morphology. In this case, plural forms and how to signal them in spelling- s, or es endings (change y to i then add es).
frightened stopped wrapped invented	friend stopt rapt invented	Phonological awareness Morphology	Is aware of at least one appropriate spelling pattern for target (ite) needs to be aware of options for the pattern (ight) Limited knowledge for /i/ and /r/ spelling pattern. Is aware of the ed pattern and can apply it.	Phonological awareness at intra-syllabic level. Focus on common rime patterns differences and similarities e.g. 'ite' for 'ight' as well as other common rime patterns Morphological awareness – focus on teaching inflectional morphology, in this case past tense forms and how their sounds imply a spelling, but you use ed ending. Vowel awareness for /i/ pattern. Teach alternative spelling options for vowel patterns.
hedge	Heche	Orthography	Sound and graphemic errors [ch] for [dʒ]	Orthography awareness - focus on alternative spelling patterns for j
information explosion	infmashon exploushon	Orthography	Phonetic spelling of key spelling pattern. Not aware of fact that <i>tion</i> is the most common pattern.	Phonological and Orthography awareness – focus on alphabetic knowledge alongside phonological awareness focusing on common rime families - <i>tion</i> , <i>sion</i> , <i>cian</i> . Be useful to highlight <i>tion</i> is most common pattern and <i>cian</i> used when word refers to a job or career.
Used	Uoosd	Orthography Morphology	Split vowel digraph error uoo for u-e Inflectional morphology error for past tense forms	Orthography awareness –focus on teaching long vowel patterns Morphological awareness – focus on inflectional morphology – past tense forms.

Table 5 – Linguistic Analysis and Intervention suggestions for Tom

Metalinguistic Intervention

Given Tom's spelling profile, instruction needs to develop his knowledge and awareness of the internal structure of words drawing on linguistic elements of phonology, orthography, morphology, and semantics. Table 5 provides suggestions for linguistic levels of intervention for Tom. For Tom the development of metalinguistic awareness at the levels discussed would support his ability to think explicitly about the linguistic skills relevant to his spelling.

Metappractice for Tom fits the Triple Word-form theory (Berninger et al., 2006). For Tom, learning to spell entails supporting him in analysing several levels of language (phonology, orthography, semantics, and morphology) and their parts (phonemes, graphemes, letter patterns, and morphemic units).

Metacognitive Intervention

The meta-cognitive process (Appendix A-Orientation) of making learning explicit within the metapractice approach has two primary aims for Tom. Firstly, to encourage his ability to take responsibility for his learning through his active engagement in the learning process.

Secondly, to support generalisation from the original learning context to other settings such as home and school. This can be promoted through making explicit to Tom knowledge at person, task and strategy levels.

At the person level (Appendix A- Demonstration), this would entail making explicit to Tom what he currently already knows and now needs to know, (i.e. he can spell using sound to letter correspondences), his learning processes, (i.e. his use of sound to letter conversion is correct and he now needs to learn the alternative grapheme options), and when to put his knowledge into functional use in other contexts outside of the original learning context.

At the task level, Tom's knowledge of the nature of the task in hand is made explicit. For example, *I am going to read some words to you and you are going to see if you can identify, from my list (e.g. cats, ice, house, etc) the letter or letters that make the [s] sound (the task) and then we are going to make a grid of all the ways to write the [s] sound with some example words to remind us.* Then, to inform Tom of the potential challenges, in this case *it is not always easy to know which spelling option to choose. In this task you are learning about the [s] spelling patterns. There are some common ones and some rarer ones. You know some* (show him his spelling of the target word *voice* with the s spelling option) *but you need to learn the other common options.* In this way Tom has a clear idea of the task he is doing and why,

At the strategy level (Appendix A- Practice), Tom needs to be aware of his spelling strategy strengths and needs. His spellings are phonetically accurate and therefore in some cases close

to the target. Furthermore, Tom's knowledge and awareness of the types of strategies or techniques that could be used to reach a goal are made explicit. This is achieved through, for example, drawing on data from Tom's spelling analysis and alerting Tom to what he knows. *Tom you already know that the past tense pattern can be spelt as ed* (then show Tom his spelling of the word invented), *and this is the way you can show the past tense*. Then Tom would be informed of what he needs to know now. *When the word refers to past tense you always use the ed ending even if it sounds like something else*. Finally, Tom needs to know when and under what circumstances he can use these strategies to support his onward learning. For example, you could suggest to Tom *when you are talking about the past tense the end part of the word may sound like t, d, id as in walked, played, wanted but you still use the ed form*. Once Tom has the concept one can move on to putting this knowledge into practice with a range of words.

Metapractice intervention - Feedback

Tom would be provided with immediate, informative, and explicit feedback and praise on what he has or is doing within a task or after a task (Appendix A- Reflection). The feedback would inform his practice and the praise needs to be encouraging as to the process Tom is or needs to be exhibiting. Feedback would make use of both verbal and written modalities. In addition, WHILC could be drawn on to support this. For example, making clear and explicit letter-by-letter comparisons between his written representation of the target word and the correct orthographic target representations. So, instead of a cross alongside the word *new* he would receive 3 ticks (one for each letter correct). He would then be asked to reflect on his learning, for example, *in the word knew, as in I knew he was lying, what do you need to remember for this spelling?* The expected response is *I use the kn spelling pattern*. Finally, one could reiterate the homophone nature of words *knew* and *new*, i.e. the fact that the words *knew* and *new* sound the same but are spelt differently and mean different things.

Conclusion

The Links between Language and Spelling Framework suggest a metacognitively based meta-linguistic approach to assessment and intervention. Knowledge of the linguistic processes involved in spelling errors guides and informs interpretation of assessment data and intervention decisions. Links can be drawn between assessment data and linguistic domains implied and intervention focuses on what and how to apply these linguistic elements to aid spelling. The Links between Language and Spelling Framework makes explicit the key linguistic knowledge and sensory and motor domains for consideration regarding spelling assessment and intervention. The SLP and teacher can draw on the links illustrated to guide their assessment and intervention decisions. A meta-cognitive instructional approach forms the process of practice and instructional organizing framework to support and actively engage the learner in the metalinguistic learning process for spelling. This metapractice approach takes an informed (linguistic) and explicit (metacognitive) approach to spelling assessment, analysis, and intervention. The aim is to induce a system wide change in spelling. The speech and language therapist is ideally placed to assess key speech and language domains that impact spelling and inform key others (e.g. parents, teaching staff) as to these links and how they can inform spelling assessments, intervention, and development.

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Appendices

MAKING LEARNING EXPLICIT		
	Strategic Level	Behavioural Level
1	Orientation Information about the nature and demands of the task. Top Tips Cards presented	To clearly identify and delineate tasks and learning objectives from the outset. <ul style="list-style-type: none"> • Learning is made transparent through use of verbal scripts that reflect the individual needs of the learner. • Expectations on the learner are made clear. • Learning is related to learners' interest and current learning needs. • The facilitator explains why the task is being carried out from the child's development and learning point of view thereby putting the learning into context what's in it for me aspect.
2	Demonstration What knowledge and strategies are likely to be effective in achieving the learning aims	Modelling of expected behaviours <ul style="list-style-type: none"> • The facilitator makes explicit the knowledge and strategies that are pertinent to the task. • The facilitator highlights what knowledge, skills, and processes the <u>child currently</u> used and now needs to use. • The facilitator verbalises and/or models to the learner the behaviours that they wish to see the learner exhibit. • The learner may be encouraged to use teach back, that is, to tell the facilitator, in their own words, what it is that they are expected to do. • TTC now complement and supplement learning through emphasising the underpinning knowledge and skills required in the task.
3	Practice Operationalisation of strategy knowledge	The learner has the opportunity to put the knowledge and behaviour into practise in a functional way. <ul style="list-style-type: none"> • Facilitators model and demonstrate the required learning. • Facilitator's provide informative and descriptive feedback to facilitate learning. • The learner is given multiple opportunities to put into practice skills and strategies pertinent to the task. • Informative and descriptive feedback is provided to facilitate learning.
4	Reflection Personalised feedback and reflection at person level. What have I learnt?' forms completed.	Reflection considers: <ul style="list-style-type: none"> • Whether they achieved the learning aim. • What was learnt in the task? • What was done in the task to achieve the aim? • Why the task/activity was carried out. • What knowledge and skills are needed to aid future learning? • When and where they can use the strategy knowledge in the future.

Appendix A – Metacognitive Framework: Making Learning Explicit

<p>What have we learnt about?</p>	<p>My special spelling trick for today was the:</p>
<p>How to use special tricks to help my spelling</p>	<p>I can use this trick when.....</p>
<p>Why is it important?</p>	<p>So that I can</p>
<p>When can I use it?</p>	<p>When I am spelling at _____</p> <p>or at _____</p>

Appendix B - Example What Have I Learned Card

Use this card to remind you of the different ways of reading and spelling the sound 'SHUN'.

TOP TIPS

Most Common

tion	station medication
sion	mansion television
cian	electrician magician

Usually job roles

Appendix C – Example Top Tips Card: Shun Spelling Patterns

Assessment used and purpose
<p>Spelling ability - Assessing spelling ability at a lexical (real word spelling). Fine grain qualitative analysis entailing detailed investigation of learners' spelling ability. This relates to sub-lexical (pseudo word spelling) level and application of orthographic (application of graphemes and their alternatives), phonological (syllabic, intra-syllabic, and phonemic knowledge application), semantic (homophone knowledge) and morphological (derivational and inflectional knowledge). Pseudo-word spelling test indicated the learner's ability to apply sound to letter rules compared to typically developing spellers. Informal sample of spelling ability. Spelling ability at text level.</p> <ul style="list-style-type: none">• Single Word Spelling Test (Sachs and Masterson, 2000).• Subtest of Queensland University Inventory of Literacy (Dodds, 1996)• Informal story writing.
<p>Phonological Processing</p> <p>Broad spectrum standardised of ability to manipulate sounds in words at syllable, intra-syllabic and phonemic levels.</p> <ul style="list-style-type: none">• Comprehensive Test of Phonological Processing (Rashotte, Torgesen, & Wagner, 1999)
<p>Questionnaires - Compliment, support corroborate and verify findings from assessment data from parent/carer and child perspective. Supplementing qualitative and quantitative data collected. Informal assessment of feelings, views and attitude with regards to the parent and child views of literacy strengths and weaknesses.</p> <ul style="list-style-type: none">• Parent and child questionnaires
<p>Narrative ability - Informal sample of written narrative. Skills assessed, ability to compare and contrast with written and verbal narrative skills. Assess quality of written skills at text level.</p> <ul style="list-style-type: none">• Informal story writing
<p>Alphabetic knowledge - Informal assessment of alphabetic knowledge at sound and letter level. Skills assessed - Process and application of linguistic knowledge for spelling. Phoneme to grapheme knowledge and rule application at letter level from verbal presentation for letter names and letter sounds. Ability to write the correct letter from the verbal presentation of its name and sound.</p> <ul style="list-style-type: none">• Phoneme to grapheme rule application
<p>Language ability - To aid in building a profile of verbal linguistic skill strengths and needs. Taping linguistic skills and ability in terms of morphology, syntax, grammar and semantics.</p> <ul style="list-style-type: none">• Clinical Evaluation of Language Fundamentals 5 (Semel, Wig, & Secord, 2017)

Appendix D – Assessment for Spelling