

The Science of Spelling

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Since the early 1990s the science of spelling has converged on a multi-component parallel-development account of spelling, in which phonological, orthographic and morphological knowledge each contribute independently and develop in tandem from the earliest years of schooling. Stage models, such as Gentry's stage model of spelling development which was first published in 1985, are not supported by the body of research evidence that has accumulated since the early 1990s.

Goswami and Bryant (1990, p146) were amongst the first to recognise that there may be problems in oversimplifying spelling development into sequential stages stating that they '*do not think that children take a series of discrete and identifiable steps when they learn to read and spell*'. In 1994 Treiman, drawing on her research analysing children's spelling errors, proposed that progression is continuous, reflecting gradual improvements in children's phonological and orthographic knowledge rather than a series of qualitatively distinct stages. McMurray (2006, 2020), Treiman & Kessler (2014), Treiman (2016, 2017, 2019) have provided robust evidence which directly contradicts Gentry's claim that the early "phonetic" period is essentially sound-based. They found that children have learned implicitly and are doing distributional, position-sensitive orthographic learning from the start. Therefore children's spelling development will continue to be negatively impacted by claims that the predominant source of knowledge for spelling is phonemic, that is phoneme-to-grapheme correspondence. The difficulties experienced by children who spell by identifying the phonemes in words without the orthographic knowledge necessary to choose the correct spelling for phonemes with multiple mappings, are discussed in McMurray et al (2026).

Berninger et al.,(2010) found that phonological, orthographic and morphological awareness grow substantially and work together during the first three years of school (the US age 6-9) and contribute jointly to learning to read and spell in English. This adds weight to McMurray's (2020) timeframe and optimum period (5-8 years) for development and integration of all three.

Phonology, orthography and morphology (POM) are the linguistic systems that underpin written language development, in particular spelling, and children must internalise them (POM) in an integrated way. This means children must become consciously aware of all three linguistic systems (POM) and how they work together in order to read fluently and spell accurately. Etymology is knowledge about the historical origins of words; it is a useful pedagogical scaffold for teaching morphology and orthography in the upper primary years, but it is not itself a linguistic system the child must acquire.

McMurray (2020) p448 warned that '*The stages that appear apparent in children's writing and which have given rise to stage theories, have been manufactured artificially because of this early neglect in spelling policy. Consequently, the resulting pedagogies which aim to follow this staged approach to spelling development, reinforce the disadvantage experienced by the "good readers/poor spellers" group and the "poor readers/ poor spellers" group.*'

McMurray (2020) provided evidence that teaching children to spell by sound, focusing on phoneme-to-grapheme correspondence only, leads to long term spelling difficulties for children who have orthographic processing difficulties. Orthographic processing difficulties are not limited to children with dyslexia and represent a larger group of primary school age children. Teachers often recognise this, as noted by the presenters from St Teresa's Primary school at the DE conference on 11th May 2026. They stated that 'Even our very good readers who could express themselves well were struggling with spelling'.

The underlying problem for poor spellers is that they cannot detect patterns in print, that is, they have poor orthographic processing and can only identify individual phonemes in words because that is all they have been taught. Given the multiple mappings from spelling to sound and sound to spelling this results in incorrect spelling and dysfluent reading. Examples of incorrect phonologically plausible spellings are **youst** for 'used', **sed** for 'said', **becos** for 'because', **tol** for 'tall', **cilt** for 'killed'. Orthographic awareness and processing needs to be developed by 8 years of age and should be the primary focus when teaching children to spell (McMurray, 2006, 2020). Orthographic processing enables the development of sounds linked to orthographic units at onset, rime, syllable and word level. Developing sensitivity to these orthographic patterns and the blended sound units they represent should be the primary focus. This means that when children see a frequently occurring orthographic pattern such as 'est' they recognise it as a unit of sound and do not need to identify each phoneme. When children can do this they have progressed to orthographic mapping. If they still have to identify each phoneme one by one, they have only acquired alphabetic mapping skills. (McMurray et al, 2026: page 6; McMurray and Fleming, 1998: Stage 2).

It is also important to remember that the integration of the 3 linguistic systems is essential and the teaching of orthographic patterns should extend to the morphemic knowledge associated with each word in the pattern together with the language development and usage. For example, at 6–7 years of age onset and rime spelling patterns should be taught with the associated word meanings (morphemic knowledge) for each of the spellings in the pattern. Taking the onset and rime pattern, cap, lap, gap, map, nap, rap, clap, trap, strap, wrap as an example, the spelling "lap" represents 4 free morphemes: 1. **A noun** – part of your body "the cat sat on my lap"; 2. **a noun** – a circuit in a race "I ran a lap of the track" 3. **a verb** – water breaking gently against the shore "the water lapped against the shore," 4. **A verb** – animals drinking by collecting liquid on their tongue "the cat lapped up the milk." The orthographic rule for making the past tense and continuous of regular verbs can be taught, i.e., the doubling rule for adding 'ed' and 'ing'. The integration of orthographic rules is very important for young children to avoid the cognitive overload that learning rules in isolation can cause, resulting in difficulties with retrieval from memory. The teaching described above for the word 'lap' is an example of how all three linguistic systems should be integrated. This language development is foundational to success. (McMurray et al, 2026: page 6; McMurray and Fleming, 1998: Stage 2).

'Orthographic processing is how you identify and form orthographic units, commit them to memory and retrieve them. It is the cognitive process that enables the detection of letter patterns representing a whole word, patterns within words (onset and rime), syllables, and rules and regularities in print, by attending to each letter whilst also noting letter sequences in parallel as units, thus enabling these orthographic units to be stored in memory.' (McMurray et al, 2026, page 3).

Orthographic knowledge can be acquired implicitly from reading experience by children who do not have orthographic processing difficulties. However, children with poor orthographic processing require systematic, structured and explicit teaching of orthographic patterns at onset and rime, syllable and whole word level together with orthographic rules.

Treiman et al. (2019) found that phonological plausibility (spelling by sound resulting in the selection of letters that do represent the phonemes in the word, but the wrong letters are selected from the range of letters that can spell that sound) is not a good indicator of later success in spelling. They found that the best predictor of later

spelling was orthographic correctness which significantly outperformed phonological plausibility. This was based on a UK sample of children in the reception year (mean age 5 years 1 month at baseline) and their later spelling performance (mean age 7 years 3 months). Treiman et al. (2019) concluded that, 'These findings fit with other evidence that even young children can attend to and remember visual orthographic features of words.' McMurray et al (2026, page 4) (Reception in England is Year 1 in NI, and Year 2 in England is Year 3 in NI.)

The DE (2025) Literacy Framework recommendation on page 85 advises that:

In the Foundation Stage, spelling should be taught primarily through phonics. Children should be taught to spell words by saying the target word clearly before segmenting it into the correct phonemes.

Treiman's research has shown that even preschool children can show graphotactic awareness. Children in the foundation stage should be encouraged to spell using letter names supported by sounds and not the other way round. Phonologically plausible spellings (**sed, becos**) should be seen for what they are, an indication of potential orthographic processing difficulties. Children with orthographic processing difficulties who are taught to spell words using phoneme-to-grapheme correspondences, without regard for what the word looks like, choose the wrong letters from the range of alternative spellings for phonemes. This results in phonologically plausible but incorrect spellings. The development of knowledge of orthographic units (onset & rime patterns, syllables) is essential for spelling accuracy and reading fluency.

Phonics at phoneme-to-grapheme level should not be the predominant approach when learning to spell, it is an important supporting strategy, but because one phoneme can be spelled with many different graphemes it results in phonologically plausible but incorrect spellings for children with orthographic processing difficulties. If children do not know the names of the letters of the alphabet (see the leaflet on letter names) and if phoneme-to-grapheme correspondence continues to be the predominant approach to teaching spelling, 25% or more of 8 year old children, on entry to KS2, may already have entrenched spelling difficulties because orthographic knowledge was not developed sufficiently in KS1. Please see the 4 spelling categories and samples of writing in McMurray, Morrow and Bower (2026: pages 10-13) to assess the extent to which children, on entry to Year 5 (KS2) in your school, have entrenched spelling difficulties that will be difficult to remediate. Children in Year 5 in N. Ireland are 8-9 years of age.

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