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## Spelling in oral deaf and hearing dyslexic children: A comparison of phonologically plausible errors



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### ABSTRACT

A written single word spelling to dictation test and a single word reading test were given to 68 severe-profoundly oral deaf 10–11-year-old children and 20 hearing children with a diagnosis of dyslexia. The literacy scores of the deaf children and the hearing children with dyslexia were lower than expected for children of their age and did not differ from each other. Three quarters of the spelling errors of hearing children with dyslexia compared with just over half the errors of the oral deaf group were phonologically plausible. Expressive vocabulary and speech intelligibility predicted the percentage of phonologically plausible errors in the deaf group only. Implications of findings for the phonological decoding self-teaching model and for supporting literacy development are discussed.

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## 1. Introduction

It is well documented that children who are born deaf or who are deafened before they learn to talk experience difficulty in acquiring literacy skills (Traxler, 2000; Wauters, van Bon, & Tellings, 2006) and that the gap in performance between deaf and hearing children widens with age (Harris & Terlektsi, 2011; Kyle & Harris, 2010, 2011). Although literacy includes reading and writing, the vast majority of studies have focussed exclusively on deaf children's reading ability. Fewer have been concerned with the area of deaf children's spelling, despite research indicating that, at least for hearing children, there is a relationship between spelling and learning to read (Frith, 1985).

Colombo, Arfe, and Bronte (2012) note in their study of phonological mechanisms in written spelling in profoundly deaf children that 'the ability to form a well-defined and robust representation of the phonological structure of words, and the consequent knowledge of their sound components is a prerequisite for the acquisition of literacy' (p.2022). Deaf children's reduced auditory access to the spoken word has consequences for the development of robust phonological representations resulting in comparatively poor phonological skills and literacy (e.g. Leybaert & Alegria, 1993; Ormel, Hermans, Knoors, Hendriks, & Verhoeven, 2010). However, information derived through speech reading (lipreading or visual speech processing) is known to play an important role in supporting deaf children's acquisition of phonological skills and reading

Abbreviation: PPE, percentage of phonetic errors.

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and spelling development (Harris & Moreno, 2006; Kyle & Harris, 2006, 2010; Kyle, MacSweeney, Mohammed, & Campbell, 2009). Deaf children (Wakefield, 2006) and hearing children with severe phonological deficits (McNeil & Johnston, 2008) rely more than their typically developing hearing peers on visual orthographic skills, either as a compensatory strategy and/or to capitalise on their relative strengths. Other researchers have highlighted the importance of other key skills to literacy outcomes in deaf children, including vocabulary and language skills (e.g. Geers & Moog, 1989; Kyle & Harris, 2010; Mayberry, del Giudice, & Lieberman, 2011).

It has been suggested that the stages of learning to read and learning to spell may have a reciprocal relationship and that progression in the early stages of reading can help the child progress in the early stage of spelling. As spelling ability develops, this, in turn, positively affects progress in reading (Frith, 1985; Westwood, 2005). This is evident in the strong positive associations usually observed between reading and spelling ability in typically developing children (e.g. Bishop, 2001; Caravolas, Hulme, & Snowling, 2001), but higher quality lexical representations are more important for accurate spelling than reading (Perfetti, 1997). To gain understanding of the kinds of strategies involved in decoding and recoding the written word, researchers have analysed children's reading and spelling errors. Such studies are informative as they provide a window into the strategies children use and the extent to which the phonological route is adopted (Greenberg, Ehri, & Perin, 2002; McGeown, Medford, & Moxon, 2013). The analysis of spelling errors is a more reliable method for deaf children with poor intelligibility as it is not dependent on the quality of speech production.

Although developmental stage models of spelling may differ in their terminology and number of stages, in general they suggest that typically developing children progress through a series of increasingly sophisticated stages as they advance through school (Ehri, 1992; Frith, 1985; Mayer, 2007). Certain errors can be symptomatic of a certain stage/stages and could point to spelling delay or disorder. In the early stages errors are undifferentiated, but between the ages 7 and 11 years, typically developing children show a high reliance on phonetic spelling (Frith, 1985). Bishop and Clarkson (2003) found a steady increase in the proportion of phonologically plausible errors made by typically developing children aged 7–13 years, comprising about half of the spelling errors in the youngest age group and three-quarters of the misspellings of 12 year olds. Similarly, McGeown et al. (2013) found that two-thirds of their sample of 7-year-old typically developing children used phonological strategies for reading and spelling according to their error analysis of irregular words. Strategies children used were mixed, but most showed some preference and exclusive use of either a phonological or orthographic (visual) strategy for spelling was relatively rare. Only a small percentage (4%) made sole use of a phonological strategy for spelling, compared with nearly a quarter of the sample (22.3%) for reading. Both phonological and orthographic spelling strategies were predicted by an independent measure of decoding. These findings, together with children's variable strategy use, are in line with Share's (1999) self-teaching hypothesis that underscores the critical role of item-by-item phonological decoding skills for the acquisition of word specific orthographic representations in reading. More recently the self-teaching role of spelling has been highlighted, which like decoding 'requires close attention to letter order and identity as well as to word-specific spelling-sound mappings' (p.22, Shahar-Yames & Share, 2008).

Literacy, both spelling and reading, depends not only on a child's age and developmental stage, but on other factors such as exposure to print, teaching methods, and the nature of a child's native language, in particular the degree of correspondence that exists between phonemes (speech sounds) and graphemes (letters, or sequences of letters). Opaque orthographies such as English or French have a high proportion of irregular words, compared to transparent, regular orthographies such as Italian, which present additional challenges to the young learner. Spelling in all alphabetic languages relies heavily on intact phonological abilities, but opaque orthographies demand much more specific knowledge of the written language involved that is acquired across time (Share, 2004).

Dyslexic children, like deaf children, have deficits in processing phonological information that compromise their decoding skills affecting their reading and spelling abilities (Hulme & Snowling, 2013), but studies investigating reading ability in dyslexic children far outnumber those looking at spelling, even though the majority of individuals with dyslexia are found to have spelling difficulties too (Wimmer & Mayringer, 2002). Across the early school years the proportion of phonologically plausible errors that dyslexic children make increases, although the overall spelling error rate still remains higher than expected for children of the same age, and the proportion of phonologically plausible errors is lower than expected, particularly in opaque orthographies. For example, Wimmer (1996) found that a small sample of 1st grade German speaking children with dyslexia could not spell a single nonword and most of their misspellings were phonologically implausible. Three years later in the 4th grade, although still dysgraphic, the majority of their errors in this relatively shallow orthography were phonologically plausible. Likewise, Angelelli, Notarnicola, Judica, Zoccolotti, and Luzatti (2010) in a follow-up study of 33 Italian dyslexic children in 3rd grade found they produced a high rate of all types of errors, but by 5th grade most of their errors were phonologically plausible. A recent study investigated 26 French-Canadian dyslexic children aged 9–12 years (mean age 11.2) in comparison with 26 chronological age (CA) matched controls and 29 reading age (RA) (mean age 7.9) matched controls. Using a free production spelling task, they found the dyslexic group's performance was more commensurate with the younger RA group than the CA group, with a mean percentage accuracy score at word level of 43.5% (dyslexic group), 61.13% (RA group) and 82.45% (CA group) (Plisson, Diagle, & Montésino-Gelet, 2013). Adopting a binary system to classify phonological errors as either plausible or not plausible, about three quarters of the errors of the 11-year-old dyslexic group and the younger RA controls were phonologically plausible (74.57% and 75.68%, respectively) compared with nearly nine-tenths of the CA group (88.12%).

The question of whether deaf children employ phonological strategies when attempting to spell target words has been addressed by research studies with somewhat conflicting results. A number of UK and US studies based upon spelling error

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