The Interaction of Reading, Spelling and Handwriting Difficulties with Writing Development

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Editorial

The early and efficient acquisition of writing skills provides the foundational base for later academic progression. In fact, expectations around writing increase in demand with children's academic progression through education and formal writing assessments are often used as a judgement on that academic progression. Therefore, those children who struggle to develop proficient writing skills are at a higher risk of educational failure in the literate arts and across most curriculum content areas.

For developing writers, the early and efficient acquisition of writing skills can be a complex process. Contemporary theories and models of writing (Berninger, Vaughan, Abbott, Begay, Byrd, & Curtin, 2002; Hayes & Flowers, 1980; Kellogg, 1996; Kim & Schatschneider, 2017; Olive, 2014) recognise the complex interaction of skills including 'higher order' linguistic and executive function skills and 'lower order' transcription skills of spelling and handwriting required to produce writing. Recent advances in hardware and software technology have allowed for online capture and detailed examination of real time writing (handwriting or keyboarding) enabling a significantly richer examination of the writing process (Alamargot, Chesnet, Dansac & Ros, 2006; de Smet, Leijten & van Waes, 2018; Hacker, Keener & Kircher, 2017; Lambert, Alamargot, Laroque & Capporossi, 2011). This process-oriented data can now be considered alongside the written product and more global assessments of speed of production and text quality. These theoretical and methodological advances in writing research have sparked investigations of each of the components and their inter-relationships. Cross-linguistic examinations of writing (Caravolas, 2006; Wengelin & Arfé, 2018) allow for comparisons among languages with varying orthographies and within languages investigations examine the potential impact of different scripts (manuscript and cursive) and writing-related tasks (e.g. dictation, copying and note-taking).

Recent research on writing has helped to elucidate the mechanisms of writing in skilled writers, with some recent work beginning to chart developmental processes through childhood (Wagner, Puranik, Foorman, Foster, Wilson, Tschinkel et al., 2011). Current models generally emphasize patterns of typical development to mature levels of skill. Less well understood are the significant writing difficulties seen in various groups of individuals with learning disabilities - including those with reading and spelling disability, handwriting delay and motor difficulties (e.g. Dyslexia and Developmental Coordination Disorder, DCD) (Afonso, Connelly & Barnett, 2019; Arfé, Dockrell & Berninger, 2014; Berninger, Nielsen, Abbott, Wijsman & Raskind, 2008; Dockrell, Lindsay & Connelly, 2009; Graham, Harris, MacArthur & Schwartz, 1991; O'Hare & Khalid, 2002; Miller, McCardle & Connelly, 2018, Montgomery, 2007).

This special issue will address this gap and provide a better understanding of the interaction of the components of writing (e.g., reading, spelling and handwriting) on writing development in individuals with neurodevelopmental disorders. This collection of six papers investigates writing performance in individuals with dyslexia, other learning disabilities and motor difficulties across childhood and into early adulthood. The collected papers use a diverse set of methods and writing tasks, across four orthographies (English, French, Spanish and Italian), and findings highlight the theoretical and practical insights that can both improve our understanding of writing development and provide us with insights that can be developed to assist both children and adults with their writing skills, particularly for individuals with or at-risk for learning disabilities, including dyslexia.

In the first paper Arfé, Corato, Pizzoccaro and Merella examine the interaction of spelling and handwriting problems in Italian, a language with a shallow orthography. They examine performance of 8-10 year-olds with dyslexia and handwriting difficulties on a range of writing tasks including the alphabet task and sentence copying; they make comparisons

with both a chronological age-matched and handwriting skill-matched control group. The results suggest that poor handwriting is more related to poor spelling than to the motor difficulties. However, as Arfé et al point out it has often been assumed that handwriting difficulties in a shallow orthography, such as Italian, would not be explained by a spelling difficulty. The implication is that both motor and spelling instruction are likely necessary to improve handwriting skills in children with dyslexia and shifts the emphasis away from a primarily motor-based explanation of handwriting difficulties for learners in both shallow and deeper orthographies. Furthermore, Arfé et al highlight that the over use of sublexical spelling strategies may provide a focus for further investigation in both Italian and other orthographies for the future.

In the second paper Afonso, Suárez-Coalla and Cuetos focus on 8-12 year old Spanish-speaking children with dyslexia. Using both a chronological age-matched and a reading age-matched control group, they used copying and spelling-to-dictation tasks to examine the spelling difficulties faced by the children with dyslexia. As with Arfé et al above, it was found that the writing latencies of Spanish-speaking children with dyslexia were slower than their peers and strongly related to their reading difficulties, highlighting a difficulty in the lexical level of processing. Spelling accuracy was worse than expected for their reading ability emphasising the extra difficulty writing imposes on children, even in languages where the mapping from phonology to orthography is more straightforward. The children with dyslexia were much slower than both chronological age-matched and the reading age-matched control group at beginning to copy words. Providing the spelling of a word to a child with dyslexia to copy out is not an advantage to them and is an important instructional point.

Handwriting and letter production in a group of struggling writers continues to be the subject of the third paper in this series. Prunty and Barnett provide a detailed examination of

letter production in 8-15 year-old English-speaking children with Developmental Coordination Disorder (DCD). They compared performance on letters produced in the alphabet task to the same set of letters produced in sentence copying with an age-matched control group. The DCD group showed a higher percentage of errors in producing letter forms than their same-age peers. They also showed less consistency between the two different writing tasks, pointing to the additional cognitive load of a sentence copying task and the difficulty of automatizing handwriting skill when there is inconsistent performance. This reflects difficulties in consolidating the motor program with the orthographic information required to be conveyed quickly and accurately and suggests these students may benefit from more explicit teaching and practice of letter forms. Interestingly, the children had particular problems with the 'r family' of letters, with 5 of the 7 letters (r, n, m, h, and b, but not k or p) affected. This has both practical implications for the classroom but also suggests instructional targets for integrating motor programming with orthography.

In the fourth paper in the series, which will be in the second part of this special series in the next issue of the *Journal of Learning Disabilities*, Alamargot, Morin and Simard-Dupuis investigated handwriting in French-speaking children with dyslexia at age eleven years, comparing their performance on two very simple tasks of writing out the letters of the alphabet and their written name to a chronological age-matched, and a spelling-matched control group, who were roughly two or more years younger. Their idea was to minimise the amount of orthographic processing required for the children with dyslexia. Although the more familiar task of name writing yielded few between group differences, by contrast, the results demonstrated that, by the end of primary schooling, the children with dyslexia were much slower at writing the letters of the alphabet and produced less legible letters than their same age peers. There was also a strong relation between their motor skills and their higher frequency of short pauses during the letter production task for their same age peers.

Alamargot and colleagues suggest that writing performance on these simple tasks represent a delay for students with dyslexia. Implications of this work are that children with dyslexia may benefit from training to support accuracy and fluency of handwriting throughout schooling as well as interventions to support their spelling. The work also highlights their continued potential difficulty simultaneously managing and coordinating handwriting processes (such as integrating motor planning and orthographic knowledge of letters) with the more complex cognitive processes that are required for spelling and ultimately for composition.

Turning to focus on older students, in the fifth paper, Oefinger and Peverly studied more complex writing tasks, examining the note-taking performance in English-speaking high school students with and without a diagnosis of a learning disability (LD). The demand of writing under time pressure to take notes represents a rarely studied form of writing. Yet it is a very important skill to develop and is related directly to test performance. Previous research has shown that handwriting is a key predictor of note taking effectiveness (Peverly, Garner & Vekaria, 2014). Oefinger and Peverly report that the group with LD performed more poorly on a range of measures (handwriting speed, listening comprehension, background knowledge, sustained attention, quality of notes and test performance). Listening comprehension and background knowledge were found to be the main factors associated with difference in note-taking and test performance. Handwriting speed may have been a suppressor variable, demonstrating the confluence of diverse factors on written outputs in young adults. Given the importance of comprehension and background knowledge, future research may examine whether listening comprehension interventions in combination with note-taking instruction may differentially support students with LD. Teachers may also use a range of interventions to help students with LD develop compensatory strategies, including

recording lectures, pausing during presentations and providing cues in lectures to help students record and review content.

In the last paper, reflecting the oldest participants within this collection of papers, Sumner and Connelly report on writing and revision strategies in English-speaking undergraduate college students with and without dyslexia. The group of students with dyslexia made more spelling errors and had poorer-rated texts than age-matched controls when writing to an expository essay prompt, although the amount of text they produced was similar. The quality of the written essays of adults with dyslexia was highly related to their word spelling ability. They also showed more spelling related revisions in their writing during and after transcription but other aspects of revision were the same across groups. Spelling, often seen as a "lower order" skill, hinders and can restrict the application of "higher order" skills by demanding extra cognitive resources during writing even in adults with dyslexia who have succeeded in getting to college. It seems that for college students with dyslexia the prevalence and salience of spelling errors demands immediate revision when writing more than other types of revisions. However, even then about 80% of spelling errors still go uncorrected by them. Thus, the negative impact of spelling on the wider aspects of compositional quality is subsequently not addressed due to their over emphasis on spelling error revisions. The findings suggest that continued support with spelling and writing is needed at university for students with dyslexia but that this should include explicit strategies for revision around the wider rule-based conventions of writing organisation/coherence, punctuation, grammar, and sentence structure.

Taken together, these studies aid our understanding of the development of handwriting, writing and note-taking of individuals with LD, with DCD, and with dyslexia. The body of work has several important implications for informing developmentally-sensitive theoretical models of the writing process as well as practical implications for educational

professionals working to support the development of writing skills in these groups. First, it is clear that individuals with writing difficulties across the lifespan will continue to require interventions in parts of the writing curriculum that are traditionally taught early in schooling, such as handwriting and spelling. It is important that practitioners are aware that "mechanical skills" such as handwriting and spelling can disrupt writing quality at all levels and individuals with learning difficulties will require long term support with their spelling and handwriting. Further, this body of works highlights the continued, broader need for developmentally-sensitive research focused on writing development that is inclusive of diverse populations of developing writers and the need to understand writing demands of different orthographic scripts and how this interacts with specific learning disorders and other conditions impacting writing.

Future research will benefit from employment of longitudinal designs to track developmental outcomes for aspects of writing in students with learning disabilities over longer periods of time. This will allow researchers to understand the development, and over reliance, on redundant and unhelpful writing techniques (slow and inconsistent letter formation, over use of sub-lexical spelling strategies, immediate revision of spelling errors etc). Sophisticated data analysis techniques using larger samples that include nesting within schools and classrooms will be needed to help understand the contribution of various factors to writing development over time. Unravelling the complex relationships between orthography, letter formation and motor processes is an exciting area of further investigation highlighted by the papers in this special series. While different languages and depth of orthographies will have an impact on writing development, the papers in this special series have demonstrated more similarities across alphabetic orthographies than differences. A wider research endeavour to also include non-alphabetic orthographies would serve the field well in this regard. Finally, in future research the effects of specific interventions to address

writing problems need particularly careful evaluation so that practitioners can be appropriately advised on how best to support students with writing difficulties.

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