



The Benefits and Links Between Handwriting Instruction and Literacy & Learning

Research Overview: GHS Professional Learning Series | Research Brief 1 of 3

Introduction

Handwriting is a core occupational skill for children, important for participation across the school environment. Handwriting (forming legible letters and combining them into words) and word-level spelling (encoding) together constitute what writing research calls transcription (Sedita, 2023). Written expression, or composition, is the higher-order process of generating ideas, planning, and constructing sentences and text (Shanahan et al., 2024). Written expression serves as a primary means for children to engage with learning tasks.

Difficulties with handwriting can affect written expression, which in turn can impact a child's access to the curriculum and limit involvement in daily school-based activities. Supporting the development of handwriting is fundamental to occupational therapy and closely aligned with promoting occupational success in education and schooling (Ray et al., 2022; Shanahan et al., 2024; Graham et al., 2018). The evidence base on handwriting spans pedagogical and occupational therapy perspectives, demonstrating the convergence of cognitive-linguistic and sensory-motor skills vital to a child's active participation throughout the school day.

The Integrated Hourglass: A Framework for Enabling School-Based Occupational Participation forms the clinical foundation of the Groundwork Handwriting System (GHS). This framework conceptualises handwriting at the convergence of two streams: the **top-down** Cognitive Integration and Language & Literacy layers, and the **bottom-up** Sensory-Motor Integration and Perceptual-Motor layers. The research reviewed in this three-document series assesses both streams, with particular emphasis on the child at their intersection.

The Importance of Handwriting Automaticity

Cognitive Load Theory (Sweller, 1988; Sweller et al., 2019) reinforces a consistent finding in handwriting research: when letter formation becomes automatic, cognitive resources devoted to the mechanics of transcription (handwriting and word-level spelling) become available for idea generation, planning, and sentence/text construction. Conversely, when handwriting is not yet automatic, those resources are consumed by the mechanics of letter formation rather than being available for composing. This shows the link between transcription skills and written expression: as a child's handwriting fluency improves, expressive writing is enhanced.

- Handwriting automaticity is linked to the quality of children's writing and, over the longer term, to their reading (Malpique, Pino-Pasternak, & Roberto, 2020). This association with writing quality persists even after accounting for factors such as attitude toward writing, home language, and year level (Skar, Lei, Graham, Aasen, Johansen, & Kvistad, 2022). Assessing automaticity early can therefore help identify students who would benefit from additional practice.
- The early and efficient acquisition of writing skills, including automaticity, provides a foundation for later academic progression (Barnett, Connelly, & Miller, 2020).
- In a randomised controlled trial, first-grade students who received supplemental instruction in handwriting and spelling made significantly greater gains in handwriting fluency, legibility, and spelling accuracy than their peers (Graham et al., 2018). These gains transferred to sentence construction and word choice in writing, supporting the cognitive load argument that transcriptional automaticity frees capacity for composition (Graham et al., 2018).
- Among children presenting with handwriting difficulties, cognitive strategy training grounded in Chapparo's Perceive, Recall, Plan, and Perform (PRPP) system, targeting planning, letter recall, attentional regulation, and sensory perception, had the greatest effect on letter-formation accuracy (Mathwin et al., 2023).
- In the Mathwin et al. (2023) study, all ten participating children mastered all 26 lowercase letters after approximately nine hours of targeted cognitive strategy support, underscoring the value of structured, explicit intervention.

Integrated Hourglass link:

The cognitive load argument maps directly to the Cognitive Integration layer of the top-down stream, specifically Attention, Processing Speed, and Memory Strategies. Handwriting automaticity is also where this top-down layer meets the bottom-up Perceptual-Motor stream: when transcription is not yet automatic, cognitive resources are consumed by letter formation rather than by the communicative act of writing. Developing and assessing automaticity early is therefore crucial, as it increases the child's ability to access classroom learning and to engage fully in the occupation of learning.

Handwriting Shapes Neurological Networks

A growing body of neuroscientific and cognitive research indicates that handwriting creates a strong link between movement and perception: the physical act of forming a letter activates brain regions associated with reading, an effect not observed when letters are simply viewed (Ray et al., 2022). This connection is especially important in the early stages of literacy acquisition, when children are building the letter-sound associations that support phonics and word-level reading and writing.

- Evidence from a systematic review indicates that handwriting automaticity, in particular letter-writing fluency, is associated with better writing composition and improved letter-name and letter-sound knowledge (Ray et al., 2022).
- There is moderate evidence that handwriting instruction improves spelling and word reading skills, with some evidence also indicating benefits for phonological awareness. This supports the view that handwriting instruction complements phonics instruction within a comprehensive literacy approach (Ray et al., 2022).
- Children with learning disabilities benefit most from interventions that emphasise handwriting, spelling, self-management, and independence, such as structured self-checking, rather than from isolated skills or handwriting practice alone. However, this evidence is still emerging, based on small samples and non-standardised measures (Bray et al., 2021).

Integrated Hourglass link:

The Language & Literacy layer of the top-down stream, specifically Phonemic Awareness and Phonics, is closely linked to the bottom-up Perceptual-Motor layer. When children form letters by hand, they strengthen neural pathways essential for developing word-level reading and writing. In this way, the physical act of writing actively supports early literacy skills.

Writing Instruction Supports Reading Outcomes

The reading-writing relationship is often discussed in terms of shared phonological and orthographic processes. A growing body of evidence shows that teaching writing, and specifically transcription skills, produces measurable gains in reading outcomes for students with literacy difficulties (Shanahan et al., 2024). This two-way relationship is theorised through the Interactive Dynamic Literacy Model (Kim, 2020, as cited in Shanahan et al., 2024), which positions reading and writing as mutually reinforcing and co-developing skills.

- A meta-analysis of 19 studies found that writing instruction produced a small but statistically significant positive effect on English reading outcomes (Shanahan et al., 2024).
- Instruction focused on transcription, including handwriting and spelling, produced larger reading gains than instruction focused on other writing processes (Shanahan et al., 2024).
- The evidence base supports integrating handwriting and spelling instruction into early literacy approaches and intervention (Shanahan et al., 2024). This is relevant to both universal classroom teaching (Tier 1) and focused support (Tiers 2 and 3) provided by learning support teachers and occupational therapists.

Integrated Hourglass link:

The two-way reading-writing relationship is reflected in the Integrated Hourglass's dual-stream structure. In the top-down stream, the Language & Literacy layer contains both the Decoding and Encoding components, which the research reviewed here confirms are intertwined rather than separate developmental trajectories. Handwriting instruction sits at the point where this top-down layer meets the bottom-up Perceptual-Motor layer, where the two streams converge on the child.

The Importance of Early Instruction and Support

The developmental period for foundational handwriting skills is well documented in the literature, with kindergarten and early Year 1 identified as a key window for building the automaticity that supports later literacy success (Ray et al., 2022). Importantly, the research also shows that a substantial proportion of children require direct, explicit instruction.

- A systematic review of 17 studies involving 3,343 children found that kindergarten handwriting skills, including letter-writing fluency and perceptual-motor skills, predicted later literacy outcomes such as letter knowledge, word reading, and spelling, with phonemic awareness in a weaker evidence strand. The authors describe these conclusions as preliminary (Ray et al., 2022).
- First-grade students who were not acquiring transcription skills at the expected rate showed meaningful gains when provided with targeted supplemental instruction in handwriting and spelling. This transferred to sentence-construction fluency and composition vocabulary, but not to composition length or overall writing quality (Graham et al., 2018).
- For approximately 30% of kindergarten students, difficulties establishing letter-sound correspondences have proved resistant even to targeted reading instruction (Paige et al., 2018, as cited in Ray et al., 2021). Early identification and targeted handwriting instruction may alleviate these difficulties.
- Australian cross-sectional data reinforce how early these patterns set in: Year 1 children correctly wrote a mean of 8.17 of the 26 lowercase letters from memory (Year 2: 12.76), and letter formation, placement and legibility-rule errors affected the largest numbers of children in both year groups, with these three subskills showing no significant improvement between Year 1 and Year 2 even as overall accuracy rose (Mathwin et al., 2024).

Integrated Hourglass link:

*The early intervention evidence maps to the Integrated Hourglass structure beneath the GHS. The Integrated Hourglass positions the notion that '**Regulation Enables Learning and Learning Refines Regulation**' at the centre of the framework. Thus, early handwriting intervention is more than just building motor skills, as it supports the regulatory and cognitive conditions in which all*

literacy learning occurs. Early screening and systematic response are therefore clinical and educational priorities.

Implications for Practice

The following practice implications emerge from the evidence reviewed. They are relevant to classroom teachers, learning support teachers, and occupational therapists.

- Explicit handwriting instruction, with a structured formation sequence, consistent verbal prompts, and daily practice, is essential (Ray et al., 2022).
- The goal of handwriting instruction in the early years is automaticity, not just legibility. Systematic, frequent practice builds the motor memory that frees cognitive resources for composition (Graham et al., 2018; Ray et al., 2022).
- For students with learning disabilities or co-occurring profiles, cognitive strategy approaches (including explicit self-monitoring tools) are more effective than generalised motor practice alone. Handwriting tasks should be embedded within meaningful literacy tasks, such as phonics activities, where possible (Bray et al., 2021; Mathwin et al., 2023).
- Early screening for handwriting difficulty allows timely, directed support before difficulties compound into substantial literacy challenges (Graham et al., 2018). Kindergarten and early Year 1 are key windows for identification and intervention (Ray et al., 2022).

Summary of Key Takeaways

Key Finding	Clinical and Educational Implication
Handwriting automaticity reduces cognitive load	Systematic, daily practice to fluency should come before demands for extended written composition
Physical letter formation builds neural reading architecture	Handwriting instruction actively supports phonics and word reading
Transcription instruction improves reading outcomes	Integrate handwriting and spelling as explicit components of literacy programs, particularly for students with difficulties
Kindergarten is a key developmental window	Early screening and structured response prevents compounding of literacy difficulties into later years
Cognitive strategy approaches are most effective for students with difficulties	Self-monitoring tools and meaningful task integration are more effective than isolated motor drills for students with learning disabilities

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