# 3 The Writing Side

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Writing is a complex, multifaceted process that has been the subject of an increasing amount of research over the past several decades. One of the major thrusts for this increase in research has been to conceptualize written expression as a cognitive process. Researchers began to study written expression through the lens of cognitive psychology in the 1960s, and this led to a significant increase in the subsequent scientific literature on the topic (Hooper, Knuth, Yerby, Anderson, & Moore, 2009). It is critical that the scientific foundations of writing research continue to develop, as difficulty with written expression is a highly prevalent issue (Lerner, 2000; National Center for Education Statistics [NCES], 2012). For instance, the NCES's National Assessment of Educational Progress (NAEP) data from 2002, 2006, and 2011 indicated that about two thirds of students demonstrated limited mastery of prerequisite information and skills that are essential for proficient writing at their given grade. Specifically, only 27% of U.S. students in 8th and 12th grades scored at or above proficient on the 2011 NAEP assessment (NCES, 2007, 2012). In contrast to its literacy partner, reading, where significant scientific advances have been asserted for underlying components, assessment of these components, and instruction for both typical and atypical readers (National Reading Panel [NRP], 2000), the literature for writing has lagged behind. This is not an accident or oversight but rather reflects the challenge of studying the inherent complexities of written expression. Even more challenging is how these components interrelate with the processes of reading and how these interrelationships may affect instruction.

This chapter is a companion to Chapter 2 in this text, "The Reading Side." As such, a brief overview of the contemporary findings pertaining to written expression will be presented. This will include a brief discussion of definitional issues, two key conceptual models for written expression, underlying cognitive functions, and related intervention approaches. In addition, a major section devoted to the writing–reading connection is provided, with

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preliminary findings from the North Carolina Writing Skills Development Project being presented to address this interrelationship.

## WRITTEN EXPRESSION

### Definition

Writing comprises three basic tasks: handwriting, spelling, and translation. Although each of these components of writing is critical to successful written expression, for this chapter we will focus on the component of translation. Translation—or written expression—can be defined as the production of connected text (e.g., sentences, paragraphs) in order to communicate an idea or thought, descriptive or procedural information, or more general knowledge. This process requires a marriage of many skills including the ability to comprehend structure (i.e., paragraph, sentence), content (i.e., the author's thoughts), and purpose (i.e., the audience, the author's intentions). Other cognitive functions (i.e., processes that rely on underlying brain function) are considered important to translation as well (e.g., language, executive functions; Hooper et al., 2013) and can serve to facilitate or hinder the translational process. Hayes (2012) noted, "What we most commonly think of as writing is the activity of producing text to be read by other people, for example, writing articles or school essays. I will call this formal writing" (p. 18). We agree with Hayes and will highlight this component of writing in the examination of written expression and the writing–reading connection.

### Cognitive Models

The cognitive models of writing feature the writer taking an active role in the writing process, focusing on language use, solitary cognitive processes (e.g., language, memory, attention, executive functions), and the writer's own self-efficacy. Cognitive models propose that writing is recursive, where backtracks and loops are not only frequent but necessary. In addition, although the social constructivist theory places writing inside a larger context of the writer's social identity and the social context within which he or she is writing, cognitive models hone in on the individual experience between the writer and his or her creative process (Hidi & Boscolo, 2006).

***Hayes and Flower Model*** Hayes and Flower (1980) proposed a cognitive model of writing more than 30 years ago that stimulated a significant amount of research in written expression. The model has recently been updated (Hayes, 1996, 2000, 2012) and continues to be one of the most influential models in writing research. This model includes three main components: planning, translating, and revising. It is based on research with adult participants and illustrates writing as a complicated problem-solving procedure that operates within the writer's 1) task environment and 2) long-term memory.

The task environment comprises the social environment (i.e., collaborators and the audience) and the physical environment (i.e., the writing tool and the text-written-so-far; Hayes, 2012). The individual interacts with the task environment using cognitive processes and motivation. The cognitive processes include the planner, which represents the thought processes in preparation for writing (e.g., goal setting); the translator, the process by which the lexical and syntactic choices are made; the memory resources, which include utilizing the author's buffers that hold output; the evaluator, which assesses goal progress; the transcriber, which physically creates new written or spoken text; and the text-written-so-far, which is the previously written text. These processes and the task environment come together to form a finished written product. This model is conceptualized within a

problem-solving approach due to the need for the individual to navigate through the steps and processes by strategizing and solving problems to achieve the writing goal.

***Not-So-Simple View of Writing*** Twenty-six years later, after Hayes and Flower first presented their model, Berninger and Winn (2006) proposed a different model that applies specifically to children's writing. The basic components of the Not-So-Simple View of Writing include transcription, executive functions, and text generation. Simultaneously, working memory activates both short-term and long-term memory, bringing planning, composing, reviewing, and revising knowledge from long-term memory and activating the short-term memory during reviewing and revising. These functions work in synchronicity and recursively to support the translation process. Using their model, the researchers make the case that externalizing cognition (i.e., students relying on more capable others to aid their executive function) can overcome some limitations in internal working memory. They have also supported their model with evidence concerning word storage and processing units (i.e., orthographic, phonological, and morphological), a phonological loop, and executive supports for controlling attention, including both focused and shifting attention. Other functions that contribute to this process include metalinguistic and metacognitive awareness, cognitive presence, and cognitive engagement (Berninger & Hayes, 2012).

## Cognitive Underpinnings

Based on the previously mentioned theoretical models, as well as others (e.g., Kellogg, 1996), there are several clear cognitive functions that have been identified as being important to children's written expression. Fine-motor, attention, language, visual processing, memory, and executive functions all hold potential significance for written expression. Given the language-based aspects of written expression, targeted linguistic functions have been deemed critical to successful written expression. For example, phonemic awareness is essential to both writing and reading acquisition (Juel, Griffith, & Gough, 1986), and Berninger, Abbott, Nagy, and Carlisle (2010) found that linguistic functions such as phonological, orthographic, and morphological processing also are critical to written expression, particularly in young elementary school children. The nuances and interrelationships between these core linguistic functions are complex, each having their own developmental trajectories, but suffice it to say that if these functions are disrupted, children will struggle in their written expression. Hooper and colleagues (2011) demonstrated the overwhelming importance of language functions (e.g., phonological processing) for both first and second graders' written language, and in a related study documented preschool language and phonological processing abilities as significant predictors of later growth in written language in grades 3, 4, and 5 (Hooper, Roberts, Nelson, Zeisel, & Kasambira Fannin, 2010). These language-related functions appear to be critical to early written expression, and it is suspected that these functions will serve as mediators of writing development.

Another cognitive domain that has been deemed important for children's written expression is executive function. Executive functions comprise multiple cognitive abilities, including working memory, planning, problem solving, inhibitory control, and set shifting, and have been shown to be important in the process of written expression. Hooper, Swartz, Wakely, de Kruif, and Montgomery (2002) and other research groups (e.g., Vanderberg & Swanson, 2007) found that poor writers in elementary school were less proficient in some executive functions than good writers. Specifically, poor writers had greater difficulties in the initiation and set-shifting functions but not in sustaining and inhibitory control abilities. Altemeier, Jones, Abbott, and Berninger (2006) found executive functions to be important

to notetaking and report-writing and implicated these functions in the reading–writing connection. Further, although a writer may have good spelling and handwriting skills, executive functions (e.g., planning) may hinder the child's ability to translate thoughts to paper. For example, a student proficient in spelling and handwriting may experience significant difficulties organizing ideas; consequently, this student's ideas will not be translated effectively in the essay without significant outside effort by teachers and others.

Finally, working memory functions have been deemed critical to the writing process. These functions underlie the active maintenance and simultaneous management of multiple ideas, the retrieval of grammatical rules from long-term memory, and the recursive self-monitoring that is required during the act of writing (Kellogg, 1996; Vanderberg & Swanson, 2007). More generally, working memory has been found to make both general and domain-specific (e.g., verbal vs. visual-spatial) contributions to the writing process (Vanderberg & Swanson, 2007). Further, a variety of studies have indicated that poor writers typically have reduced working memory capacity or inefficient working memory that could undermine the entire translational process. How developmental change in this system contributes to deficits or facility in the translation process remains to be determined.

With respect to the cognitive underpinnings of written expression, it is important to note that the manner in which these abilities affect written production as well as the development of written expression is only beginning to be understood. In this regard, Berninger and Amtmann (2003) have placed within a neurodevelopmental framework several key cognitive functions that unfold in a hierarchical fashion, thus mediating the development of written language. Specifically, they noted that the written expression of early elementary school students will be constrained by factors related to fine-motor output (e.g., letter formation) and then linguistic capabilities—including memory for letters and words (Berninger et al., 2002; Berninger & Winn, 2006)—with executive functions emerging later in development. In addition, recent work has shown that task requirements in school curricula change in later grades, as children are expected to integrate reading and writing during translation, making the translation process for writing more complex as age increases (Altemeier, Abbott, & Berninger, 2008; Altemeier et al., 2006).

## Writing Interventions

At present, evidence does not support a single, comprehensive method for teaching writing across the elementary and secondary school years, although 72% of primary grade teachers use the process approach to teach writing to their students (Cutler & Graham, 2008). Teachers who use the process approach focus on a cycle of brainstorming, editing, and translating (Graham & Harris, 2009). Teachers not only are using related methods to teach writing, but they also have their students write the same types of compositions. In most elementary classrooms, students are primarily engaging in narrative writing as opposed to expository writing (Cutler & Graham, 2008). Indeed, Chapter 2 highlights that little time is spent in the direct instruction of written expression in a broader literacy curriculum, and it remains unclear how this might change with the adoption of the Common Core State Standards.

In addition, almost one third of teachers believe that they are not sufficiently prepared to teach writing in the classroom (Cutler & Graham, 2008). Even if teachers may provide lessons on spelling and grammar daily, they do not spend much class time teaching written expression to their students. It is estimated that students spend only about 105 minutes per week (i.e., 21 minutes per day) writing, with all writing components (e.g., brainstorming, revising, drafting) being included in this time. Despite students not receiving much time in

the classroom to write, writing assignments for homework are not uncommon. This disconnect undoubtedly will hinder homework performance and production, particularly with writing demands increasing with advancing grades, and how this disconnect will affect the implementation of the Common Core State Standards remains to be determined (e.g., How will writing be incorporated to facilitate the standards of English or science?).

The expansion of the scientific understanding of the writing process has developed concurrently with efforts to intervene with students showing writing difficulties. A variety of interventions, such as self-talk, talk through, and various forms of technology, have proven successful in improving the struggles in writing faced by children. These types of intervention have been shown to increase metacognitive capabilities, self-regulation, self-efficacy, and active learning (Englert, 2009; Graham, Harris, & Mason, 2005; Hooper, Wakely, de Kruif, & Swartz, 2006; MacArthur, 2009; Rogers & Graham, 2008). For example, Klein (2000) found that thinking aloud while writing a journal entry for science class had a greater impact than the amount of text that the students wrote. Similarly, Green and Sutton (2003) found that writing skills improved when children considered both the audience and the purpose of their writing. In general, the evidence to date indicates that, for students with writing difficulties, explicit writing instruction appears to be essential (Berninger, 2009; Hooper et al., 2009; Troia & Graham, 2002). In addition to improving transcription skills, explicit instruction has been shown to improve planning capabilities that, in turn, have produced increased length, better organization, and improved quality of students' compositions (Baker, Chard, Ketterlin-Geller, Apichatabutra, & Doabler, 2009; Graham & Harris, 2009). In general, the magnitude of the treatment effects has ranged from small (Berninger et al., 2002; Hooper et al., 2011) to large (Englert, 2009; Graham & Perin, 2007), depending on the outcome variables used, instructional formats employed, ages of the students, and specific interventions that were implemented.

In conjunction with the information given earlier, interventions to improve written expression have often utilized targeted strategies. Early work applying strategy instruction to difficulties in written expression was foundational in strategy-based intervention research (Graham, 2006). Advanced planning strategies have demonstrated improvement in writing quality, composition length, and increased time taken for planning (Troia & Graham, 2002). One of the most researched approaches using strategies to improve written expression is the Self-Regulated Strategy Development (SRSD) method. The SRSD method can be used by classroom teachers to explain various learning strategies to students. When using SRSD, the instructors teach the students strategies for writing and explain how and when to use the strategies (Graham & Harris, 2009). SRSD is not only a method for teaching writing; SRSD instruction promotes the student's ability to monitor and manage his or her own writing and encourages students to develop positive attitudes and beliefs about writing and about themselves as writers. The effectiveness of SRSD also has been shown to be quite positive across different ages and different types of learners. In a series of meta-analyses examining writing instruction, SRSD instruction yielded a larger average effect size (ES = 1.14) than non-SRSD instruction (ES = 0.62; Graham & Perin, 2007). SRSD instruction is applicable not only to typically achieving students but also to students who struggle with writing and to students with learning disabilities (Graham & Harris, 2009). Furthermore, SRSD is effective with students in varying grade levels, from elementary school to high school, and across genres (e.g., expository and narrative writing). The results of several meta-analyses that evaluated the use of SRSD in studies to improve writing have continued to show the utility of SRSD (Graham, 2006; Graham & Harris, 2003; Graham, McKeown, Kiuhara, & Harris, 2012; Graham & Perin, 2007). This work also has led to explicit recommendations

for writing instruction that appear to be specific to the development of the writing process. Berninger (2009) also offered a similar set of recommendations.

## WRITING–READING CONNECTION

In Chapter 2 of this text, Connor and colleagues provided an intriguing set of findings detailing how reading and writing interact in an instructional setting under the broader construct of literacy. They concluded that writing is an important component of reading assessment and intervention—particularly reading comprehension—but that the development of writing skills may require a different type, or perhaps quality, of instruction than reading (e.g., decoding) due to its inherent complexity. This conclusion is in line with findings by Mehta, Foorman, Branum-Martin, and Taylor (2005), who found that writing was an important component of the larger literacy construct but that the quality of instruction was related to the quality of the written expression. Despite these initial findings, though, we are only beginning to understand the nature of the writing–reading connection (Graham & Hebert, 2011).

### Shared Underlying Functions and Shared Instructional Benefits

With Chapter 2 focusing on a number of key instructional issues pertaining to the relationship between writing and reading within a broader literacy curriculum, there also has been a growing body of evidence indicating that writing and reading share a reciprocal and beneficial relationship in literacy development (Shanahan, 2006), with the existing literature pointing to many of the same preschool variables that have been found to predict later reading skills—also predicting later writing skills. In addition to socioeconomic status and classroom literacy, these variables include receptive vocabulary, letter-word knowledge, invented spelling, phonological processing, orthography, letter naming, letter writing, ideational fluency, and exposure to print concepts (Diamond, Gerde, & Powell, 2008; Juel et al., 1986; Mäki, Voetens, Vauras, & Poskiparta, 2001). The development of these early skills during the preschool years, particularly phonological awareness and letter knowledge, has been associated with significant gains for at-risk preschoolers in reading (Dickinson, McCabe, Anastasopoulos, Peisner-Feinberg, & Poe, 2003) and, perhaps, in written language (Lonigan, Anthony, Bloomfield, Dyer, & Samuel, 1999). Further, the consolidation of the alphabetic principle is critical to early literacy, and its automaticity likely frees up cognitive resources for higher-level text generation (Jones & Christensen, 1999). This increased automaticity, in turn, likely facilitates the writing–reading interaction.

With these potentially shared cognitive underpinnings, there may be shared benefits for both reading and written expression. Emergent research has noted a powerful association between reading and writing in the classroom setting (Graham & Herbert, 2011), thus it seems logical that written expression can help to improve reading. Further, reading comprehension and reading fluency can be improved by writing about the subject of the text that has been read by using techniques such as notetaking and concept mapping. The process of creating text also should make the writer more thoughtful in reading text from others. In this regard, Graham and Hebert (2011) recommended four effective writing tasks to improve reading comprehension: extended writing, summary writing, notetaking, and answering/generating questions. Graham and Hebert (2011) also reported that teaching spelling and sentence construction skills improved reading fluency for students in grades 1 through 7, and spelling instruction improved word reading for students in grades 1 through 5. Given their interrelationship, the demands on connecting reading and writing

in school curricula undoubtedly increase with advancing grades (Altemeier et al., 2008); consequently, there is an inherent need to understand this relationship to a greater degree.

## The North Carolina Writing Skills Development Project

The North Carolina Writing Skills Development Project (WSDP) was unique in that we used a longitudinal design to examine writing performance and response to instruction. We followed students for 4 years, examining the relationships and developmental stability of fine-motor speed, language, short-term memory, long-term memory, and a number of executive functions. The participants included 205 students from a single school district, with approximately two thirds of the students being defined as having a writing disability (i.e., falling in the bottom quartile). To date, this study has documented the relative stability of key cognitive constructs in written expression (i.e., fine-motor, language, executive functions; Hooper et al., 2013) and has shown modest effects for selected Process Assessment of the Learner (PAL) lesson plans for written language in a randomized, controlled intervention trial (Costa, Hooper, McBee, Anderson, & Yerby, 2012; Hooper et al., 2011). These findings notwithstanding, the WSDP also provides an opportunity to examine the interrelationship between early writing skills and word reading in young elementary school students with writing problems. Our data allow a closer look at the co-occurrence of word reading problems in a sample of students with writing disabilities (WD) in grades 1 through 4; the probability of having a reading disability (RD) at different grades in the presence of an already-established WD; similarities and differences in the cognitive contributors to WD-only versus WD + RD; and finally, a peek at how word reading skills might change when students with WD participate in a targeted writing intervention using selected PAL lesson plans. Taken together, these data may provide additional clues as to the nature of the writing–reading connection.

***Rate of Co-Occurrence of Reading Disability in Students with Writing Disabilities*** Although the rate of co-occurrence of writing and reading problems has been speculated to be high, to date there are few empirical data documenting this rate and certainly no data documenting this rate over multiple grade levels. The WSDP collected both writing and reading scores for each year of the 4-year longitudinal project and has generated some preliminary data showing the rate of co-occurrence of these problems in elementary school students at risk for writing difficulties. For this initial examination, a disability was defined by a score on the Wechsler Individual Achievement Test-II (WIAT II) written expression and/or word reading subtests falling within the bottom quartile.

As can be seen in Figure 3.1, for first-grade students with WD, there was approximately a 27% rate of co-occurring RD. For second-grade students with WD, the rate of co-occurring RD increased to approximately 35%. The rate continued to climb to 42% for third-grade students and to 46% for fourth-grade students. These preliminary findings point to a significant and potentially increasing rate of co-occurrence of RD in students with WD; however, the data also suggest that reading and writing are largely separate problems, particularly in the early elementary school years. Conversely, it is suspected that these rates of co-occurrence are driven, in part, by early deficits in phonological awareness and orthographic structures of words. It remains unknown, however, if these rates would replicate in a sample of students with RD (Hooper et al., 2013).

***The Probability of an Reading Disability in Typically Developing Writers and Students with Writing Disabilities*** We have also looked at the North Carolina WSDP data to examine the relationship between writing and reading with respect to the

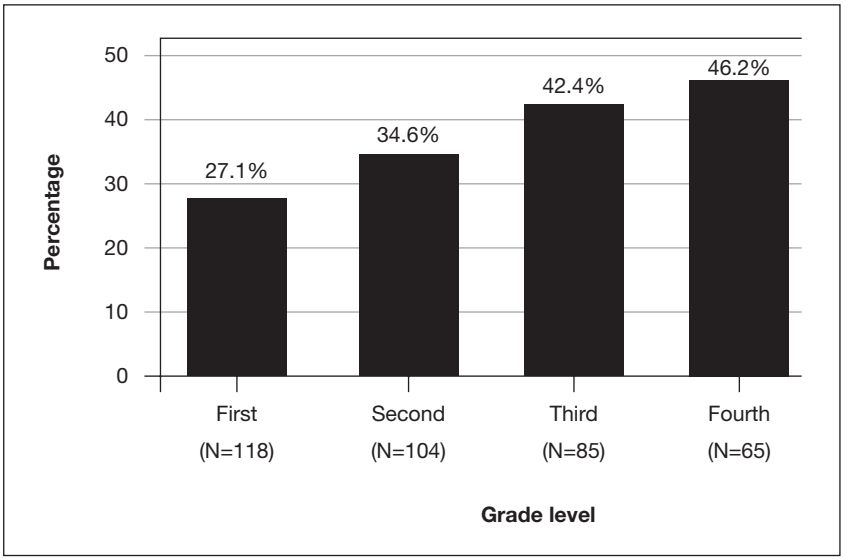


**Figure 3.1.** Percentages of children with a writing disability and concomitant reading disability in grades 1 through 4.

probability of having a reading problem in the presence of a writing problem at different points in time. The primary question here is if being classified as a struggling writer in earlier grades (i.e., first, second, and third) is predictive of the likelihood of being classified as a struggling reader in subsequent grades (i.e., second, third, and fourth). Students were classified as WD or RD as noted earlier (i.e., age-based standard scores falling in the bottom quartile). Results indicated that two of the models (i.e., first grade predicting second grade and third grade predicting fourth grade) were perfectly predictive of later success. Further, our data showed there to be a 26% chance that students who were struggling with writing in first grade would struggle with writing and reading in third grade, whereas typical students in first grade had only a 5% chance of struggling with writing and reading in third grade. As well, there was a 23% chance that students who were struggling with writing in first grade would struggle with writing and reading in fourth grade, whereas typically developing first-grade students had only a 6% chance. Similarly, we found there to be a 25% chance that students who were struggling with writing in second grade would struggle with writing and reading in third grade, whereas typical students had only a 5% chance. Finally, we found there to be a 26% chance that students who were struggling with writing in first grade would struggle with writing and reading in third grade, whereas typical students had only a 4% chance.

***Writing Disabilities-Only versus Writing Disabilities + Reading Disability: Cognitive Comparisons*** With respect to the writing–reading connection, another important question pertains to the cognitive burden that might be present for students with WD-only versus those with WD + RD. Using the WSDP data, we compared the performance of these subgroups of second graders in addition to a typically developing group of second-grade students across measures of fine-motor, language, and executive functions. As can be seen in Table 3.1, after adjusting for chronological age and maternal education, significant group differences were obtained across each of the three cognitive domains, with most of the individual tasks showing the suspected better performance for the typically developing group versus the two disability groups. Of

**Table 3.1.** Neuropsychological burden for typically developing, writing disability-only (WD), and writing disability + reading disability (WD + RD) second-grade students

| Measures | Typical (1)M (SD) | WD-only (2)M (SD) | WD + RD (3)M (SD) | F-value | Partial eta$^2$ | Pairwise comparisons |
|---|---|---|---|---|---|---|
| Fine-motor | | | F (6, 298) = 9.03, p < .001 | | | |
| PAL alphabet writing | –0.30 (.76) | –1.22 (.48) | –1.00 (.71) | 28.67*** | 0.28 | 1 > 2, 1 > 3 |
| Sequential finger movements (D) | –0.17 (.45) | –2.67 (.44) | –0.21 (.54) | 1.22 | 0.02 | — |
| Sequential finger movements (ND) | –0.19 (.43) | –2.14 (.43) | –0.24 (.61) | 1.66 | 0.35 | — |
| Language | | | F (6, 132) = 9.39, p < .001 | | | |
| PAL word choice | 0.64 (.72) | –0.33 (1.22) | –1.62 (1.12) | 26.48*** | 0.44 | 1 > 2, 2 > 3 |
| PAL syllables | 0.13 (.59) | –0.41 (.75) | –0.86 (.86) | 3.85* | 0.10 | 1 > 3 |
| PAL phonemes | 0.52 (.79) | –0.38 (.75) | –0.97 (.70) | 18.36*** | 0.35 | 1 > 2, 1 > 3 |
| Executive functions | | | F (14, 284) = 4.28, p < .001 | | | |
| Vigil CPT omissions | 42.63 (20.93) | 45.41 (16.73) | 55.43 (25.94) | 2.50 | 0.21 | — |
| Vigil CPT commissions | 66.32 (57.50) | 85.72 (66.73) | 81.61 (78.18) | 1.72 | 0.03 | — |
| WJ-III planning | 105.47 (8.02) | 103.22 (8.40) | 96.54 (11.93) | 8.42*** | 0.10 | 1 > 3, 2 > 3 |
| WJ-III retrieval fluency | 101.37 (12.13) | 96.00 (13.38) | 87.07 (21.14) | 7.21** | 0.09 | 1 > 3 |
| RAN letters/digits | 12.27 (2.52) | 10.75 (2.85) | 8.68 (3.56) | 19.76*** | 0.21 | 1 > 2, 2 > 3 |
| WISC-IV digits reverse | 10.80 (2.54) | 9.28 (3.99) | 9.07 (3.73) | 3.15* | 0.05 | 1 > 2, 1 > 3 |

*Note:* Process Assessment of the Learner (PAL), Continuous Performance Test (CPT), Woodcock Johnson (WJ), Rapid Automatized Naming (RAN), Wechsler Intelligence Scale for Children (WISC).

* = p < 0.1

** = p < 0.05

*** = p < 0.01

importance to the writing–reading connection, however, is whether the cognitive burden is greater, or perhaps different, for the WD + RD group than the WD-only group. Within the fine-motor domain, there were no differences noted between these groups; however, significant group differences were noted in the language and executive functions domains. Specifically, the WD-only group performed significantly better on tasks measuring orthographic processing, planning, and rapid naming, perhaps reflecting the influence of key reading-related skills. In contrast, the groups performed similarly in phonological processing, attention regulation, and inhibitory control. These findings suggest that, within a group of young elementary students with writing problems, those who have co-occurring reading problems show poorer performance in selected reading related skills, but there does appear to be an overlap for other core reading skills, with attention-regulation capabilities appearing to be similar between the groups. Taken together, these findings suggest that reading and writing share some underlying cognitive abilities at this developmental

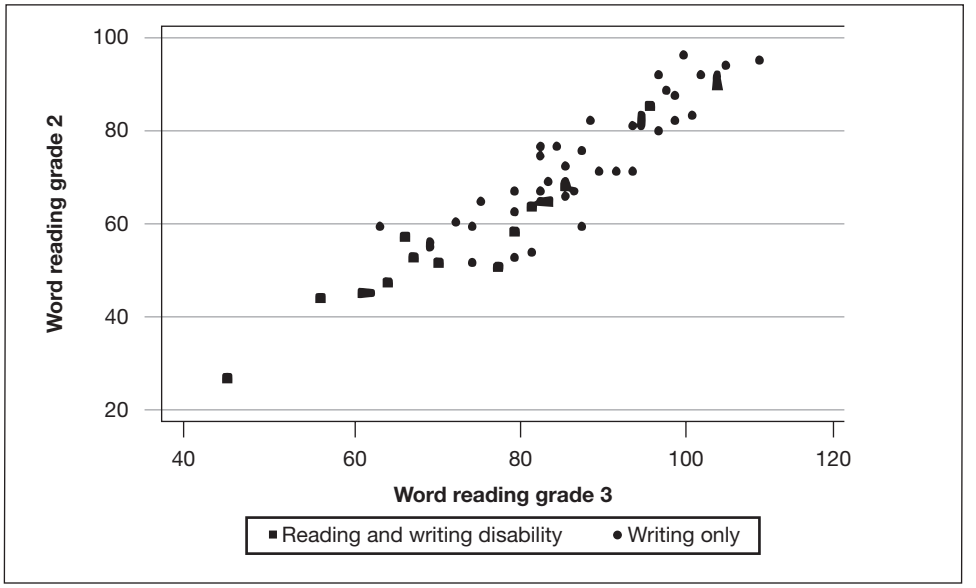


**Figure 3.2.** Reading skill gains in response to a written expression intervention in grade 2 for writing disability–only versus writing disability + reading disability groups in grade 3.

level, as suspected; however, there does appear to be a dissociation between other underlying skills (Hooper et al., 2013).

***WD-Only versus WD + RD: Reading Growth in Response to a Written Expression Intervention*** A final question related to the writing–reading connection pertains to how reading changes for students with WD-only in a writing intervention when compared to those with WD + RD. For the second-grade children who went through the PAL intervention, an Analysis of Covariance (ANCOVA) was conducted to evaluate the participants' word reading scores preintervention versus postintervention for the WD-only group ($n = 49$) versus the WD + RD group ($n = 16$). These findings are depicted in Figure 3.2. After controlling for preintervention scores on reading, the results indicated no significant main effects for the subgroups, $F(1, 62) = 1.00$, $p = 0.329$, and no significant interaction between subgroup status and word reading scores postintervention, $F(3, 62) = 1.40$, $p = 0.271$; however, the effect size was large (partial $eta^2 = 0.84$), suggesting that significant postintervention changes might have been present with a larger sample size. These preliminary findings indicate that students who participated in a targeted intervention for written expression and have either a WD-only or a WD + RD will benefit similarly in their reading skills from the PAL intervention; however, it remains unconfirmed whether the reading skills for one group benefits more from the PAL intervention than the other group, or how response to treatment may change with age or another type of writing intervention.

## CONCLUSION

This chapter has approached the writing–reading connection from the writing side of the fence. Several key conceptual models for written expression were presented, which provide a necessary foundation for how writing and reading interrelate. For example, within the Hayes

(2012) model, it is clear that reading is a critical part of the writing process, as reading what one has written contributes to the recursive nature of the writing process. This is nicely illustrated by the text-written-so-far component of the model wherein the individual must read and comprehend what has been written so as to make edits and adjustments to the written text. The Not-So-Simple View of Writing model provides an even more explicit linkage to reading by noting specific linguistic skills that subserve both writing and reading, including word storage, orthographic, phonological, and morphological capabilities. The developmental nature of this model and its associated components also provides an avenue for increasing our understanding of how both writing and reading develop from the preschool years and beyond.

Although there appears to be a significant overlap in a number of cognitive abilities that appear critical to both reading and writing skills, how these evolve over time in tandem with reading and written expression remains to be determined. The interventions that have been proposed to improve written expression may positively affect reading, especially those that contain instructional components for phonological and orthographic processing, but even the strategy development approaches may affect reading. Preliminary data from our elementary school students in the WSDP provided some initial evidence examining the writing–reading relationship in a sample of students identified as at risk for writing disabilities and suggested that writing and reading, although they share a number of commonalities, should be treated differently from an instructional perspective. The findings indicate the need for ongoing examination of the writing–reading connection with respect to topography, etiology, prognosis, and response to intervention, with a particular focus on how these core academic skills converge and diverge over the course of development. Although the scientific basis of the writing–reading connection is only beginning to be examined, future findings should contribute to improved instruction for this literacy component.

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