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Insights About Translation from Neuropsychology, Self-Talk Strategies, and Interventions

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Through both theoretical accounts and empirical studies, it is widely understood that writing is a complex process (Lienemann, Graham, Leader-Janssen, & Reid, 2006); therefore, determining effective instructional strategies for teaching writing and implementing writing instruction are challenges for many teachers. Nonetheless, writing is an important skill that all children need to develop. It is the primary tool for expressing knowledge and one of the main response outputs that teachers use to assess their students' educational performance (Graham & Harris, 2004). Because students use writing to collect and organize material, share and remember information and, ultimately, acquire and demonstrate knowledge, the academic development of students with writing difficulties is at risk (Graham & Harris, 2005).

Fortunately, researchers across disciplinary fields are examining written expression with particular emphasis on the associated neuropsychological processes and instructional approaches. Psychologists, educational specialists, and neuroscientists are all contributing to the scientific investigation of this multifaceted developmental process.

Even with an emphasis on written expression, the complexity of the processes involved has precluded researchers from forming a complete understanding of the cognitive and neurocognitive relationships inherent in written language. It is generally accepted that skilled writers use cognitive processes (i.e., planning, translating, reviewing, self-regulation) to manage the writing task (Graham & Harris, 1996). They are also fluent in text production processes (i.e., text generation and

transcription) and knowledgeable about writing content, audience needs, and specific genres (McCutchen, 2006). In contrast, students with writing difficulties do significantly less planning and revising and frequently just write down any information that may be relevant to the topic, paying precious little attention to the intended audience or text organization (Graham & Harris, 2009). In addition, poor writers tend to produce text that lacks clarity as well as being shorter, poorly organized, and less interesting than good writers (Hooper, Swartz, Wakely, de Kruif, & Montgomery, 2002).

In this chapter, we provide an overview of the current literature regarding beginning writers, with a particular focus on the cognitive and neuropsychological research that has implications for the translation process during writing. This overview will highlight specific theories with direct relevance to translation during writing, as well as provide a discussion of self-talk procedures and how they can provide a "window" into the various aspects of the translation process. We also discuss several evidence-based approaches to the remediation of written language problems, with a particular focus on explicit instruction and strategy instruction, and their potential impact on translation. As the reader will note, these combined efforts have yielded significant findings with respect to our understanding of early translation processes in young elementary school children, but there remains a myriad of questions to be examined in this understudied yet critical aspect of written expression.

TRANSLATION DURING COMPOSING

In order to write, a person must have an idea, know the meaning of the symbols, translate the idea to symbols, and have the ability to form the symbols. Furthermore, the writer needs to comprehend the structure (i.e., sentence, paragraph, and text), content (i.e., ideas and their relationships), and purpose (i.e., writer's goals and audience) of the writing process (Collins & Gentner, 1980). In addition to these skills, a number of neuropsychological functions are considered important for the writing process including memory, attention, graphomotor output, sequential processing, higher-order cognition, language, and visual–spatial functions (Levine et al., 1993); however, the current literature does not fully account for the relationships among these processes and some necessary functions still remain undefined. If translation is a multidimensional process, as noted in Chapter 1, then a variety of neuropsychological functions will likely be involved in the unfolding of the translation process. For example, a number of studies have shown the importance of specific linguistic factors (e.g., semantics, grammar), along with academic functions such as handwriting and spelling, as key dimensions of written expression (Berninger & Rutberg, 1992; Hooper, Wakely, de Kruif, & Swartz, 2006; Sandler et al., 1992; Wakely, Hooper, de Kruif, & Swartz, 2006); however, how these functions contribute to the translation of ideas into text continues to require scientific examination. Further, the developmental process of writing and its associated cognitive underpinnings in young children is an area that has received relatively little attention (Hooper et al., 2006), but the application of these findings to the translational process may hold critical clues for increasing our understanding of

this aspect of written expression. A better understanding of these relationships may also improve efforts to facilitate the translational aspects of written expression in young children.

SELECTED THEORETICAL MODELS

One of the primary theoretical approaches researchers have used is cognition. The origins of this approach can be traced to the Dartmouth Seminar, a multidisciplinary conference conducted at Dartmouth College in 1966 consisting of researchers who sought to examine writing using information emerging from cognitive psychology (see Hooper, Knuth, Yerby, & Anderson, 2009). This approach to writing research spawned key theories and studies of written expression, and provided clues for increasing our understanding of the translational process in writing. Cognitive process research, as applied to the understanding of the links among writing, thinking, and learning, has undoubtedly influenced the development of the process approach to writing (Hayes & Flower, 1980). Several theoretical models have been proposed to describe the cognitive functions involved in written expression (Berninger & Winn, 2006; Ellis, 1983; Kellogg, 1996; Roeltgen, 1985).

Hayes and Flower Model

The model proposed by Hayes and Flower (1980) over 30 years ago, and subsequently revised by Hayes (1996, 2000), has been one of the most influential in the broad field of written expression (see Chapter 2). It is considered the gold-standard cognitive model that includes planning, translating, and revising. Although the planning and revising aspects to this model have received attention, in conjunction with the goals of this volume, it is the translating process that has received less scientific scrutiny.

Hayes and Flower described a complex problem-solving process, operating within the task environment and the writer's long-term memory (Hayes, 1996; Hayes & Flower, 1980). It was developed based on research with adults, which posited that writing was ultimately a cognitive problem-solving task used to convey one's knowledge, opinions, and emotions to a potentially unknown or invisible audience. The model is presented as a problem-solving approach because the author must strategize and develop a number of solutions across all of the stages of the writing process—including translating—to create an effective final product. To engage in effective translating, the author has to (a) manage factors related to the task such as the topic, the audience, the amount of time available, and the quality of the text produced; (b) utilize the cognitive processes found to contribute to more understandable and coherent writing such as efficient retrieval of knowledge related to the assigned topic, understanding of the audience, and utilization of previously effective writing plans from long-term memory; (c) utilize planning strategies that facilitate goal setting and organization of ideas given the writing assignment; (d) effectively translate the ideas into written text—the text generation process; (e) engage in continuous self-monitoring and editing of generated text; and (f) perform postproduction revision and editing of the written text

(Hayes & Flower, 1980; also Chapter 2). The Hayes and Flower model and its subsequent revisions have been extraordinarily successful in generating much of the cognitively based research in written language over the past several decades, and it remains a key model for encouraging scientific efforts to understand the multidimensional aspects of translation in children's (Berninger & Winn, 2006) and adults' (Alamargot & Chanquoy, 2001) writing.

Not-So-Simple View of Writing

Based on the foundational work of Hayes and Flower (1980), Berninger and Winn (2006) provided a modified model applicable to children: the not-so-simple view of writing. The basic components of this model include transcription, executive functions, and text generation, with working memory supporting the translation process including the "cognitive flow." In this model, working memory may activate both long-term and short-term memory during the translating process. For example, long-term memory is activated during planning, composing, reviewing, and revising, whereas short-term memory is activated during reviewing and revising output. What is new in this model is the claim that externalizing cognition through writing and other activities may overcome some of the limitations of internal working memory. In addition, Berninger and Winn review evidence regarding word storage and processing units (i.e., orthographic, phonological, and morphological), a phonological loop, and executive supports (e.g., for managing supervisory attention including focus on relevant information while ignoring irrelevant information, changing attention between mental sets, and attention maintenance for staying on task). In addition, other executive functions may support conscious attention (e.g., metalinguistic and metacognitive awareness), cognitive presence, and cognitive engagement (Berninger & Winn; also see Chapters 3 and 5 in this book).

NEUROPSYCHOLOGICAL FINDINGS RELATED TO TRANSLATION IN YOUNG WRITERS

Translation during composition requires integration of a variety of neuropsychological processes (e.g., language, working memory, and attention/executive functions) that appear to be mediated by developmental constraints; however, most of the research to date has focused on the concurrent and predictive value of these processes, or how they can differentiate between groups of writers, as opposed to experimental studies of how these processes may directly or indirectly affect the translational processes (but see Chapters 3, 6, 7, 11 through 13 for an increase in experimental studies). For instance, Berninger and Swanson (1994) reviewed a series of studies of two subprocesses in children in grades 1–3 or 4–6: transcription and text generation. They found that speeded orthographic coding and motor integration uniquely predicted handwriting, and orthographic and phonological coding uniquely predicted spelling. In another study with a sample of grades 1–6, this research group used structural equation modeling to show that a handwriting factor consistently explained unique variance in composition length and quality,

whereas a spelling factor did at some grade levels (Graham, Berninger, R. Abbott, S. Abbott, & Whitaker, 1997). Taken together, these investigators concluded that transcription may impose constraints on compositional quality. Intact handwriting and spelling may facilitate good translation of thought into text, but even individuals with good core handwriting and spelling skills may experience difficulties in translating their thoughts efficiently and effectively into text, perhaps secondary to other neuropsychological functions (e.g., planning) that may be developing more slowly and/or in a dysfunctional fashion (Graham et al., 2009; also see Chapter 5 in this book, for such evidence). In other words, good transcription does not guarantee good translation!

Although the predictive value of transcription functions is critical to our understanding of written expression of ideas, and in the prediction of writing trajectories (Hooper, Roberts, Nelson, Zeisel, & Kasambira-Fannin, 2010), other research has focused on the processes that contribute to transcription. For example, one function necessary for transcription into written word spelling is phonemic awareness. Phonemic awareness is essential in literacy acquisition (Edwards, 2003; Juel, Griffith, & Gough, 1986), that is, the development of both reading and spelling (Mehta, Foorman, Branum-Martin, & Taylor, 2005). Children will not acquire spelling-sound correspondence knowledge until a prerequisite amount of phonemic awareness is attained; moreover, such constraints due to lack of spelling-sound correspondence knowledge will likely place limitations on transcription and thus on a young writer's ability to translate ideas into writing (Puranik, Lonigan, & Kim, 2011).

Indeed, Abbott, Berninger, and Fayol (2010) found a relationship across adjacent grades from word spelling to text composition, suggesting that individual differences in spelling are related to individual differences in written composition, but this relationship was found consistently from spelling to text composition across grades 1–7 but only from text composition to spelling at some grade levels. Berninger, Abbott, Nagy, and Carlisle (2010) also provided longitudinal findings showing that phonological, orthographic, and morphological linguistic awareness undergoes growth (developmental change) in the first four grades, which has implications for spelling development, as shown with additional new analyses reported in Chapter 4 in this book. Research has also shown that task requirements in the curriculum change in the upper grades when children also have to integrate reading and writing during the translation process for writing (Altemeier, Abbott, & Berninger, 2008; Altemeier, Jones, Abbott, & Berninger, 2006). Considerable research points to the translation process for writing becoming more complex with increasing age (Caravolas, Hulme, & Snowling, 2001; Ehri, 1997; Foorman, Francis, Novy, & Liberman, 1991; Juel, 1988; Mehta et al., 2005; Shanahan, 1984).

In addition to transcription skills, core linguistic capabilities, and selected aspects of short- and long-term memory abilities, another critical set of neuropsychological functions that have been shown to influence written expression development is the various executive functions (Hooper et al., 2002; Repovš & Baddeley, 2006). Executive functions include multiple neurocognitive abilities such as planning/problem solving, inhibitory control, and set shifting, but also working memory (Hayes & Chenoweth, 2006; Swanson & Berninger, 1994). Research examining the role of executive functions in the writing process has indicated that

poor writers in elementary school are less proficient in certain executive functions (Hooper et al., 2002). For example, Hooper et al. (2002) reported that children with writing problems experienced significantly greater difficulties in their initiation and set-shifting executive functions, functions that could be directly linked to their translation abilities, but not sustaining and inhibitory control abilities when compared to typical writing peers. Other research has studied the executive functions in integrating reading and writing during note taking and report writing in elementary school students (Altmeier et al., 2006). Inhibition and set shifting have longer developmental trajectories than other executive functions, but their contribution to written expression has only begun to be examined. Furthermore, it is important to remember that executive functions vary by grade and may be influenced by developmental level for other neuropsychological skills. For example, first and second grade students do not have as much automaticity with tasks as do their older counterparts, and consequently they will be in need of more external support for planning abilities than older students (Altemeier et al., 2006). How these various executive functions change over time, particularly in relationship to translation, remains an active topic of investigation.

The contributions of working memory to writing is well established (e.g., Lea & Levy, 1999; McCutchen, 2000). Whether working memory is poorly developed for an individual (Vanderberg & Swanson, 2007) and/or if there are increased demands placed on the working memory system by task requirements such as graphic execution and control (Bourdin & Fayol, 1994), studies of translation should examine working memory. The working memory systems 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, 1999); thus, working memory undoubtedly contributes to the translation (Vanderberg & Swanson, 2007; Whitaker, Berninger, Johnston, & Swanson, 1994). More generally, working memory has been found to make both general and domain-specific (e.g., verbal versus visual–spatial) contributions to the writing process (Hooper et al., 2006; McCutchen, 1996; Swanson & Berninger, 1994). A breakdown in working memory may lead to problems with written output (Levy & Marek, 1999), perhaps secondary to its influence on translating ideas into text. 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 changes in this system contribute to deficits or facility in the translation process remains to be determined.

NORTH CAROLINA WRITING SKILLS DEVELOPMENT PROJECT

Our research team has focused on the relationships and developmental stability of specific neuropsychological functions hypothesized to be involved in writing expression (Hooper et al., 2011). Relatively few researchers have empirically studied these components simultaneously and over time, which is the goal of the North Carolina Writing Skills Development Project. The primary purpose of this study

was to develop an empirical measurement model that encompassed the neuropsychological components that have been deemed as important to the development of written language. Once derived, could these neuropsychological components remain stable over first and second grades and would they show significant concurrent and predictive relationships with written expression?

The sample included 205 first grade students recruited from a single school district, some of whom were at risk for writing disabilities. We plan to track these students into the fourth grade, although our initial data analyses only report findings from students who were followed into the second grade. Measures were aligned with major neuropsychological components as extracted from key theoretical models of written expression, such as the Hayes and Flower, modified Hayes and Flower model, and the not-so-simple view of writing models, along with available empirical findings examining the neuropsychological contributors to writing in children. These included fine-motor speed, language, short-term memory, long-term memory, and targeted attention/executive functions including working memory. Using confirmatory factor analyses strategies and longitudinal structural equation modeling methods, we documented the three core latent traits that were stable at both grades 1 and 2: fine-motor, language, and attention/executive functions. These empirically derived factors were highly related to written expression and spelling at both grades 1 and 2, with the first grade latent traits accounting for 52% of the variance in second grade written expression and 55% for spelling. At both grades, the language and attention/executive functions latent traits were more highly associated with written expression and spelling than the fine-motor latent trait (Hooper et al., 2011).

This model provides a foundation for researchers who desire to examine the neuropsychological contributors to writing development in the early grades. We discovered that the impact of fine-motor, language, and attention/executive functions on written expression and spelling was stable from first to second grade. The language and attention/executive function abilities were likely to be particularly important mediators of the translation process in early writing.

SELF-TALK STRATEGIES AND TRANSLATION

Closely related to neuropsychological functions and translation are the connections between inner thoughts and written output and the related processes for making these connections, which are often studied using qualitative assessment strategies, such as self-talk and think-aloud strategies. Although the major cognitive models and associated neuropsychological findings provide significant clues with respect to *what* may be contributing to the translating process of writing, they do not necessarily inform *how* this process may be evolving during the actual writing task. Understanding the cognitive processes involved in writing and how they develop over time still leaves questions as to how the processes are effectively utilized during writing. Further, given known individual differences across nearly all cognitive abilities, it remains to be seen how students with differing skill levels of writing utilize these self-talk processes during the translational process, or even if they are aware of these processes.

Self-talk and think-aloud strategies also hold promise for increasing understanding of metacognitive functions, self-regulation, and self-efficacy (Graham et al., 1997; Graham & Harris, 2000; Graham, Harris, & Mason, 2005; Hooper et al., 2006; also see Chapter 5 in this book, for examples of oral think alouds for different cognitive processes in writing), all of which may play a role in the translation process. These strategies provide investigators and evaluators with a method to examine the process of translation during composing by directly engaging students in how and what they think before, during, and after the writing task. For these think-aloud strategies, students are asked to describe verbally their thought processes in detail as they move through a writing task, thereby providing a "window" into the translating process. Researchers have noted that the familiarity with the style of writing or prompt, the amount of structure and instruction provided, and the student's individual metacognitive ability are all factors to consider in evaluating this process (e.g., Englert, Raphael, Anderson, Anthony, & Stevens, 1991; Klein, 2000; Simpson, 1994a). Successful writers are aware of the writing process and the role of knowledge throughout the process (Englert et al., 2000). We suspect that their ability to articulate their underlying thoughts should increase our understanding of the entire writing process.

Early efforts (e.g., Mayer, 1987; Pressley & Levin, 1983; Wittrock, 1990) that examined learning strategies found that they could stimulate students to become more active learners, often having students generate an observable artifact to document their processing and progress. Less research has examined students' verbal productions as a measure of studying their text or utilized the notion that oral language, such as writing, might assist students in becoming more active learners. The notion here is that developing an inner speech or dialogue about one's writing, talking to others, and reflecting on one's writing throughout the task (Daiute, 1985) may assist children to activate and use metacognitive awareness and self-regulation strategies as they engage in the writing process. Inner speech is undoubtedly important in planning and regulating one's activity, based on the theoretical tenet that cognitive development results from social collaboration that, in turn, gives way to internal collaboration with oneself (Vygotsky, 1978). Successfully self-activating and regulating are essential to the development of a student's metacognition (Paris, Lipson, & Wixson, 1983), and mature writers have been found to engage in this type of inner dialogue (Daiute, 1985; Dyson, 1987). During writing, this internal egocentric speech becomes the invisible cognitive infrastructure for planning, drafting, and revising text. Understanding this aspect of translation, teachers presumably could model this "think-aloud" strategy and help scaffold the learner's development of new skills and abilities in the writing process.

Englert and colleagues (Englert, 2009; Englert & Raphael, 1980; Englert et al., 1991) documented results that supported the importance of instruction that makes the writing processes and strategies visible to the student through teacher–student and student–student dialogues. Under these conditions they found that students were able to internalize the dialogue (making it "inner dialogue"), which translated into gains in metacognitive knowledge and, ultimately, increased gains in writing. They based their study on previous research that suggested students would benefit from writing instruction that was focused on the mental processes and strategies

that guide writers (Englert & Raphael, 1989), and that writing instruction needs to make the process of writing and the strategies for performing these processes visible to students (Raphael & Englert, 1990). Their research sought to provide scaffolding as an intervention through development and use of curriculum materials, and built upon the emphasis and movement toward a "process approach" to writing in the regular education classroom. In many respects, Raphael and Englert were visionary in their initial scientific efforts to make translation processes visible. Indeed, more contemporary efforts have supported these initial assertions, particularly from an instructional perspective (e.g., Harris & Graham, 2009).

Similarly, Simpson (1994b) modified a post-reading strategy called the "talk through." The term was originally coined by Nist and Diel (1990) and applies to a procedure where students rehearse important content concepts out loud as if they had an audience for their private speech. The strategy requires students to be involved in three general classes of study processes that have been determined to characterize successful independent learning: selective allocation, generation, and cognitive monitoring. *Selective allocation* includes the ability to encode key concepts (Einstein, Morris, & Smith, 1985). *Generation* involves students in transforming and reorganizing information using their own words and structures, and then elaborating or adding to what is being learned with their own images, examples, applications, or analogies (Day, 1986; Gagne, Weidemann, Bell, & Anders, 1984). Finally, *cognitive monitoring* occurs when students determine whether or not they understand what they have read, evaluate their state of memory and their strategy selection, and employ appropriate corrective action when failures of comprehension have been detected (Brown, Campione, & Day, 1981). Simpson found that these "talk throughs" were a successful form of active rather than passive learning because they allowed students to transform ideas into their own words and spontaneously elaborate upon ideas that, in turn, can enhance understanding and remembering. Students who were trained to conduct their own "talk throughs" improved their conceptual understanding and were able to demonstrate increased understanding through recognition or recall measures (Simpson, 1994a, 1994b).

Klein (2000) sought to examine the cognitive processes through which writing contributes to learning in a group of fourth through eighth grade students in their science classes. The students carried out science experiments, stated explanations about the phenomena that occurred, and then wrote journal style notes while thinking aloud. In this science task, the intervention contributed significantly to the likelihood of explanatory gains (i.e., the students' ability to explain and understand the phenomena as a measure of learning), whereas text production (i.e., amount of text produced) contributed marginally to these gains. Four aspects of the data were analyzed: writing operations, transitional sequences among writing operations, text features, and strategies for generating content. Analysis of the data yielded seven factors: producing, searching from experiment, brainstorming, elaborating genre, goal setting, searching from text, and reviewing beliefs; however, Klein found that most of the variance could be attributed primarily to three of the seven factors that significantly predicted learning during writing: brainstorming, searching from text, and searching from experiment. Klein noted that these three factors comprise the discrete strategies (rather than components of a single strategy or coordinated

strategies) for developing goal-setting statements, explicitly reviewing the text for the purpose of generating ideas, and utilizing reflective selection to choose among the ideas—potentially key facets of translation in the writing process.

Finally, Green and Sutton (2003) investigated how providing support during writing, in the form of "think-aloud" strategies, to 600 11-year-old students contributed to improving the writing process. Students were asked to verbalize their thoughts as they planned a piece of writing, fill out planning sheets, and participate in a semistructured interview about the writing process. The goal here was to probe qualitatively children's thinking as they faced a writing stimulus and planned their writing, and to understand the children's own perceptions of their strengths and weaknesses as well as their strategies in planning their written work. Results suggested that writing performance improved when the students considered the audience and purpose of the writing task. These findings provided important clues to key components of the translation process during written language in children.

EVIDENCE-BASED INSTRUCTION FOR FACILITATING TRANSLATION

Several evidence-based efforts have been successful in improving the translation process for children at risk for writing problems. The overarching question here is whether translation of thought into text can be facilitated or improved by specific instructional strategies. And, if so, how does this occur? One basic comparison among treatment approaches differentiates those that rely primarily on explicit skill instruction versus those that primarily depend on strategy instruction, either of which can be implemented within a longitudinal efficacy design as explained in the section "Longitudinal Efficacy in Writing."

Explicit Writing Instruction

One evidence-based instructional approach aims at improving translation by improving transcription through explicit instruction (e.g., see Chapter 7 in this book). When transcription skills in children with low handwriting skills are improved, some transfer to improved composition has been observed (Berninger et al., 1997; also studies reviewed in Chapter 7). Improving transcription may improve translation in children by overcoming the "bottleneck" responsible for the struggle to get their ideas down on paper or on the computer screen, but these children may also benefit from explicit instruction in translation as well (Berninger, 2009; Berninger & Abbott, 2002). From a cognitive perspective, instructional approaches that improve the automaticity of transcription free-up working memory that supports the other ongoing processes during translation (see Chapter 7). Many schools are not providing explicit, systematic instruction in transcription skills, and those for whom this may be an impediment to their writing may experience associated problems during translation.

Other research is examining optimal transcription mode for individual writers, for example, handwriting or keyboarding. Although developmental research

showed that second, fourth, and sixth graders wrote longer essays at a faster rate and expressed more ideas, much remains to be learned about tailoring optimal transcription mode to individual child writers during writing instruction. Children with transcription disabilities require not only accommodation but also specialized instruction.

Research has shown that for students with writing problems, explicit writing instruction appears to be essential (Berninger, 2009; Gleason & Isaacson, 2001; Hooper et al., 2009; Troia, 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; Harris & Graham, 2009). In general, the magnitude of the treatment effects has ranged from small (Berninger & Abbott, 2002; Hooper et al., 2011) to large (Englert et al., 2009; Graham & Perin, 2007), depending on the outcome variables used, instructional formats employed, the age of the students, and the specific interventions that were implemented. But see Berninger et al. (2000) for a double dose approach to getting all low achieving spellers up to at least average range for grade.

Longitudinal Efficacy in Writing

In *The North Carolina Writing Development Project*, we are conducting an ongoing evidence-based intervention for early elementary school students at risk for writing problems (Hooper et al., 2011). This study will provide us with some of the first longitudinal efficacy data in teaching writing skills. In general, longitudinal efficacy refers to following the same group of students over time after an intervention or series of interventions during this time period. Figure 8.1 depicts this longitudinal treatment design in which at-risk students are identified by a targeted screening at Time 1 and then randomly assigned to an explicit treatment versus

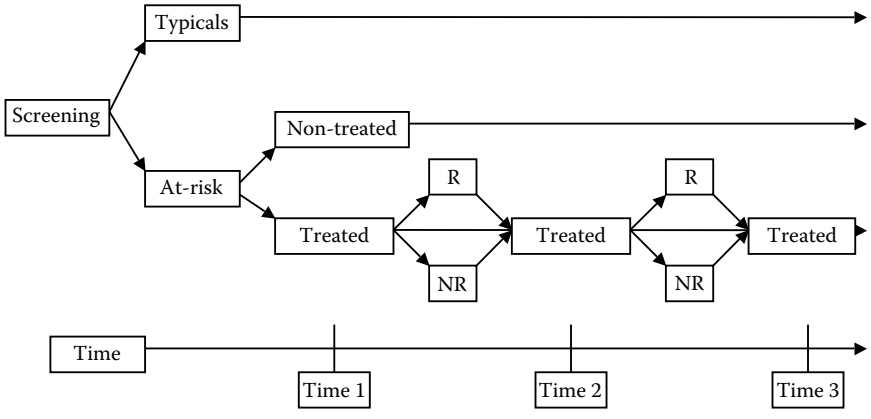

Figure 8.1 Longitudinal treatment design.

other (e.g., alternative treatment) and/or no treatment (e.g., business-as-usual) conditions. It is important to note that typical or nonaffected students are also identified by the initial screening. Although not a necessary component to treatment efficacy, this group allows for the comparison of learning slopes to typical, nonaffected students in an effort to determine if the intervention(s) can "normalize" a student's performance in a specific academic area. Once the groups are determined, students receive ongoing assessments (e.g., pretest and posttest) to determine who responds (R) and who does not respond (NR) to Time 1 treatment. Some longitudinal efficacy studies simply track students over multiple time points following the designated intervention; however, other studies track students over multiple time points following multiple interventions. In the latter condition, response-to-treatment then becomes a variable for inclusion in the next round of data analyses.

In the North Carolina Project, employing a randomized control trial design, students were identified as being at risk (n = 138) or typical (n = 67) in writing in grade 1, and the at-risk group was randomly assigned to treatment (n = 68) or business-as-usual conditions (n = 70) for grade 2. The writing intervention comprised Lesson Set 4 from the *Process Assessment of the Learner (PAL) Reading and Writing Lessons* for second graders with spelling problems (Berninger & Abbott, 2003), with the intervention occurring in small groups of 3–6 students twice a week over the course of 12 weeks during the spring of second grade. Our results indicated the overall rate of growth in writing skills significantly accelerated following the treatment for the at-risk treatment group when compared to the nontreatment at-risk group. Although the children in our studies were identified using different inclusion criteria (at risk in a variety of writing problems) than those in the studies on which the lessons were based, which included only second graders with spelling disabilities (Lesson Set 4 *PAL Reading and Writing Lessons*), improvement in translation could be inferred by the improvement in the writing products in our study. Of interest to how neuropsychological functions interact with treatment, we did not uncover any significant moderator effects from our neurocognitive variables (fine-motor, language, executive functions). However, the findings suggested that examination of these types of interactions could yield important findings in future studies, particularly with respect to response-to-intervention methods (also Figure 3.1 is relevant to this claim). Following the longitudinal efficacy design, our students have now completed the third grade intervention using Lesson Set 7 in the *PAL Reading and Writing Lessons*, and a fourth grade intervention is planned, and findings from those interventions are forthcoming.

To summarize, the findings from the North Carolina Writing Development Project suggest the need for ongoing exploration of evidence-based treatments in writing, particularly with respect to longitudinal efficacy, and support further ongoing examination of possible neuropsychological moderators for effective treatment in samples with a variety of writing or writing-related problems rather than a specific one. Further research is needed to determine whether explicit instruction has to be related to specific diagnosed writing deficits to be optimally effective in improving the translation process.

Self-Regulated Strategy Instruction for Translation

The self-regulated strategy approaches develop a schema to move students through the translation process in an efficient and effective fashion. To date, there have been a number of strategy-based interventions proposed and studied to address the text generation needs of students who may be at risk for writing problems. Many of these interventions have been devoted to the higher-order aspects of composing, such as planning and revising (Wong, Butler, Ficzere, & Kuperis, 1997), organization and self-monitoring (Isaacson, 1995), and metacognition and self-regulation strategies (Englert et al., 2009; Therrien, Hughes, Kapelski, & Mokharti, 2009). In this regard, the work of Graham and Harris (2009) provides an excellent example of these evidence-based, strategy interventions.

The self-regulated strategy development (SRSD) model is a multifaceted instructional framework that integrates self-regulation and cognitive skills to improve writing skills. The SRSD model was designed as a framework to facilitate the development of self-regulation and associated cognitive skills to improve written language. Specifically, this model was developed to address the written language needs of children with learning disabilities (Graham & Harris, 2009) and, more recently, emotional disabilities (Lane et al., 2008), and it has been studied with children from middle elementary school to high school. In this model, written language is considered a problem-solving process that involves planning, knowledge transfer, and various skills (Harris et al., 2008) and focuses on three areas: (1) explicit writing instruction, (2) explicit instruction in self-regulation strategies, and (3) development of positive self-efficacy about writing (Graham & Harris, 2009; Harris & Graham, 2009). The SRSD model has a well-founded scientific basis with research evidence from over 40 single-subject studies (Rogers & Graham, 2008), a number of small group studies (Graham & Harris, 2003), and several key meta-analyses documenting the effectiveness of this model (Graham, 2006; Graham & Perin, 2007; Rogers & Graham, 2008). The evidence demonstrating a positive impact of SRSD on written expression is clear and compelling (Graham & Perin, 2007).

With respect to translation, the SRSD model provides an avenue to understand how strategies facilitate text production. The SRSD model provides a clear algorithm for translating thoughts into an organized text. This algorithm provides the vehicles for the execution of clear and specific strategies designed to facilitate the infrastructure for written output such that the written output is genre specific and appropriate for a specific audience. In this fashion, the SRSD model addresses many of the key facets comprising translation and provides an evidence-based intervention for students who may be struggling with a specific written task. Although it is unclear how variability in specific neuropsychological functions, or specific learning impediments, will interact with the scaffolding provided by this model, efforts to date have demonstrated its educational utility for students in regular education and special education settings (Graham & Harris, 2009; Harris & Graham, 2009).

Based on the cumulative findings from the SRSD model, Graham, Olinghouse, and Harris (2009) have asserted 12 evidence-based recommendations for writing

instruction (e.g., teach strategies for planning, revising, and editing; set clear and specific goals for what writers are to accomplish in their writing product) that have evolved from use of the SRSD model. Taken together, these strategies have helped students improve five main areas in writing: the genre needs in writing, the quality of the written output, the knowledge of writing, the approach to writing, and a student's self-efficacy for writing. Improvements have also been reported in core components of writing such as planning, revising, content-specific messages, and mechanics. Maintenance and generalization of these skills have been demonstrated across genres, students with different needs, and educational settings (Harris & Graham, 2009). Furthermore, the teaching of strategy development with students in late elementary school and beyond coincides with what is known about development of the prefrontal cortex and associated brain functions at this developmental time period (Hooper et al., 2002).

As well, there is a strong match between the ascendance of executive functions with respect to their importance to writing as children age, and the use of instructional strategies that capitalize on their capabilities to learn and deploy such strategies. The instruction that occurs via the SRSD approach for specific strategies is directly tied to the writing process as well as the writing product. The specific features of each strategy not only relate to how the students will change their approach to the writing task but also have an effect on how they move through the writing process, including the translational phase. Consequently, this evidence-based intervention likely holds significant promise for modifying the translation process during written expression in positive ways.

CONCLUSIONS

In accordance with the focus of this volume, more research is needed on the translation process during composing. Cognitive models have provided many key components that are needed to engage in successful and consistent translation, but more remains to be learned. The not-so-simple view of writing encourages the field to investigate how writing supports externalizing cognition, that is, access to thoughts and thinking by producing products of translation which can be visibly inspected and reinspected, thus overcoming limitations in internal working memory from which stored contents may disappear and not be readily accessed over time. In this chapter, we emphasized the theoretical models and empirical support for neuropsychological functions critical to the translation process in the written language of young elementary school children. Key among these are neuropsychological functions for language, executive functions, and working memory. These processes may not only predict translation during composing across development but also may be influenced by developmental changes in translation and can inform instruction. Moreover, these neuropsychological processes may be the window on individual differences that may place qualifications on all the other models and frameworks—how translation works may be influenced to some degree by individual differences in an individual writer's neuropsychological processing.

Although these models provide some necessary components for translation, the talk-through and self-talk strategies are promising assessment strategies designed to provide the "how" of the translation process. The self-talk strategies provide an intriguing avenue for increasing our understanding of the translation process. Although these efforts can be labor intensive, and perhaps hindered by language impairments or problems with theory of mind, they also appear to hold significant explanatory potential with respect to our understanding of the translation process in young students. Their interaction with many of the neuropsychological functions important to the writing process also warrants scientific inquiry. Although the field of written language has forged ahead with a number of evidence-based approaches for improving written language composing, whether the effect on translation is direct or indirect remains to be determined. Knowing that the translation processes involved during composing can be structured, nurtured, and actually "repaired" for young students struggling with the text production component is encouraging, but the effects of these intervention approaches on translation still requires research investigation.

In this chapter, we highlighted some findings related to the translation processes in composing of beginning and developing writers. We underscored neuropsychological and metacognitive findings, including self-talk approaches, as well as evidence-based instructional approaches related to translation. Hopefully, this chapter and volume will inspire further research on these topics.

REFERENCES

Abbott, R. D., Berninger, V. W., & Fayol, M. (2010). Longitudinal relationships of levels of language in writing and between writing and reading in grades 1 to 7. *Journal of Educational Psychology, 102*(2), 281–298.

Alamargot, D., & Chanquoy, L. (2001). Studies in writing series. *Through the models of writing* (Vol. 9). Dordrecht, the Netherlands: Kluwer Academic.

Altemeier, L., Abbott, R. D., & Berninger, V. W. (2008). Executive functions for reading and writing in typical literacy development and dyslexia. *Journal of Clinical and Experimental Neuropsychology, 30*, 588–606.

Altemeier, L., Jones, J., Abbott, R., Berninger, V. (2006). Executive factors in becoming writing-readers and reading-writers: Note-taking and report writing in third and fifth graders. *Developmental Neuropsychology, 29*, 161–173.

Baker, S. K., Chard, D. J., Ketterlin-Geller, L. R., Apichatabutra, C., & Doabler, C. (2009). Teaching writing to at-risk students: The quality of evidence for self-regulated strategy development. *Exceptional Children, 75*, 303–318.

Berninger, V. (2009). Highlights of programmatic, interdisciplinary research on writing. *Learning Disabilities Research and Practice, 24*(2), 69–80.

Berninger, V., & Abbott, R. (2002). Modeling developmental and individual variability in reading and writing acquisition: A developmental neuropsychological perspective. *Developmental variations in learning: Applications to social, executive function, language, and reading skills* (pp. 275–308). Mahwah, NJ: Lawrence Erlbaum Associates Publishers.

Berninger, V., Vaughan, K., Abbott, R., Abbott, S., Brooks, A., Rogan, L., et al. (1997). Treatment of handwriting fluency problems in beginning writing: Transfer from handwriting to composition. *Journal of Educational Psychology, 89*, 652–666.

Berninger, V., Vaughan, K., Abbott, R., Brooks, A., Begay, K., Curtin, G., et al. (2000). Language-based spelling instruction: Teaching children to make multiple connections between spoken and written words. *Learning Disability Quarterly, 23*, 117–135.

Berninger, V., & Winn, W. (2006). Implications of advancements in brain research and technology for writing development, writing instruction, and educational evolution. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 96–114). New York: The Guilford Press.

Berninger, V. W., & Abbott, S. P. (2003). *Process assessment of the learner (PAL) research-based reading and writing lessons*. San Antonio, TX: Pearson.

Berninger, V. W., Abbott, R. D., Nagy, W., & Carlisle, J. (2010). Growth in phonological, orthographic, and morphological awareness in grades 1 to 6. *Journal of Psycholinguistic Research, 39*(2), 141–163.

Berninger, V. W., & Rutberg, J. (1992). Relationship of finger function to beginning writing: Application to diagnosis of writing disabilities. *Developmental Medicine and Child Neurology, 34*, 198–215.

Berninger, V. W., & Swanson, H. L. (1994). Modifying Hayes & Flower's model of skilled writing to explain beginning and developing writing. In E. Butterfield (Ed.), *Children's writing: Toward a process theory of development of skilled writing* (pp. 57–81). Greenwich, CT: JAI Press.

Bourdin, B., & Fayol, M. (1994). Is written language production really more difficult than oral language production? *International Journal of Psychology, 29*, 591–620.

Brown, A. L., Campione, J. C., & Day, J. D. (1981). Learning to learn: On training students to learn from text. *Educational Researcher, 10*, 14–21.

Caravolas, M., Hulme, C., & Snowling, M. (2001). The foundations of spelling ability: Evidence from a 3-year longitudinal study. *Journal of Memory and Language, 45*, 751–774.

Collins, A., & Gentner, D. (1980). A framework for a cognitive theory of writing. In L. W. Gregg & E. Steinberg (Eds.), *Cognitive processes in writing: An interdisciplinary approach* (pp. 51–72). Hillsdale, NJ: Lawrence Erlbaum Associates.

Daiute, C. (1985). Do writers talk to themselves? In S. Freedman (Ed.), *The acquisition of written language* (pp. 133–159). Norwood, NJ: Ablex.

Day, J. D. (1986). Teaching summarization skills: Influence of student ability level and strategy difficulty. *Cognition and Instruction, 3*, 193–210.

Dyson, A. H. (1987). The value of "time off task": Young children's spontaneous talk and deliberate text. *Harvard Educational Review, 57*, 396–419.

Edwards, L. (2003). Writing instruction in kindergarten: Examining an emerging area of research for children with writing and reading difficulties. *Journal of Learning Disabilities, 36*(2), 137–148.

Ehri, L. (1997). Learning to read and learning to spell are one and the same, almost. In C. Perfetti, L. Rieben, & M. Fayol (Eds.), *Learning to spell: Research, theory, and practice* (pp. 237–269). Mahwah, NJ: Lawrence Erlbaum Associates.

Einstein, G. O., Morris, J., & Smith, S. (1985). Note taking, individual differences, and memory for lecture information. *Journal of Educational Psychology, 77*, 522–532.

Ellis, A. W. (1983). *Reading, writing, and dyslexia: A cognitive analysis*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Englert, C. S. (2009). Connecting the dots in a research program to develop, implement, and evaluate strategic literacy interventions for struggling readers and writers. *Learning Disabilities Research and Practice, 24*(2), 104–120.

Englert, C. S., & Raphael, T. E. (1989). Developing successful writers through cognitive strategy instruction. *Advances in Research on Teaching, 1*, 105–151.

Englert, C. S., Raphael, T. E., Anderson, L. M., Anthony, H. M., & Stevens, D. D. (1991). Making strategies and self-talk visible: Writing instruction in regular and special education classrooms. *American Educational Research Journal, 28*(2), 337–372.

Foorman, B., Francis, D., Novy, D., & Liberman, D. (1991). How letter-sound instruction mediates progress in first-grade reading and spelling. *Journal of Educational Psychology, 83*, 456–469.

Gagne, E. D., Weidemann, C., Bell, M. S., & Anders, T. D. (1984). Training thirteen-year-olds to elaborate while studying text. *Human Learning, 3*, 522–532.

Gleason, M. M., & Isaacson, S. (2001). Using the new basals to teach the writing process: Modifications for students with learning problems. *Reading & Writing Quarterly, 17*, 75–92.

Graham, S. (2006). Strategy instruction and the teaching of writing: A meta-analysis. *Handbook of writing research* (pp. 187–207). New York: Guilford Press.

Graham, S., Berninger, V., Abbott, R., Abbott, S., & Whitaker, D. (1997). The role of mechanics in composing of elementary school students: A new methodological approach. *Journal of Educational Psychology, 89*(1), 170–182.

Graham, S., & Harris, K. R. (1996). Self-regulation and strategy instruction for students who find writing and learning challenging. In C. Levy & S. Ransdell (Eds.), *The science of writing theories, methods, individual differences, and applications* (pp. 347–360). Mahwah, NJ: Lawrence Erlbaum Associates.

Graham, S., & Harris, K. R. (2000). The role of self-regulation and transcription skills in writing and writing development. *Educational Psychologist, 35*, 3–12.

Graham, S., & Harris, K. (2003). Students with learning disabilities and the process of writing: A meta-analysis of SRSD studies. *Handbook of learning disabilities* (pp. 323–344). New York: Guilford Press.

Graham, S., & Harris, K. R. (2004). Writing instruction. In B. Wong (Ed.), *Learning about learning disabilities* (3rd ed., pp. 281–313). San Diego, CA: Elsevier Science.

Graham, S., & Harris, K. R. (2005). Improving the writing performance of young struggling writers: Theoretical and programmatic research from the center on accelerating student learning. *The Journal of Special Education, 39*(1), 19–33.

Graham, S., & Harris, K. (2009). Almost 30 Years of writing research: Making sense of it all with The Wrath of Khan. *Learning Disabilities Research & Practice, 24*(2), 58–68.

Graham, S., Harris, K. R., & Mason, L. (2005). Improving the writing performance, knowledge, and self-efficacy of struggling young writers: The effects of self-regulated strategy development. *Contemporary Educational Psychology, 30*, 207–241.

Graham, S., Olinghouse, N., & Harris, K. (2009). Teaching composing to students with learning disabilities: Scientifically supported recommendations. *Instruction and assessment for struggling writers: Evidence-based practices* (pp. 165–186). New York: Guilford Press.

Graham, S., & Perin, D. (2007). A meta-analysis of writing instruction for adolescent students. *Journal of Educational Psychology, 99*(3), 445–476.

Green, S., & Sutton, P. (2003). What do children think as they plan their writing. *Literacy, 37*(1), 2–38.

Harris, K. R., & Graham, S. (2009). Self-regulated strategy development in writing: Premises, evolution, and the future. *Teaching and Learning Writing, British Journal of Educational Psychology Monograph Series II*. 6, *1*, 113–135.

Hayes, J. R. (1996). A new framework for understanding cognition and affect in writing. In C. M. Levy & S. Ransdell (Eds.), *The science of writing: Theories, methods, individual differences, and applications* (pp. 1–27). Mahwah, NJ: Lawrence Erlbaum Associates.

Hayes, J. R. (2000). A new framework for understanding cognition and affect in writing. In R. Indrisano & J. R. Squire (Eds.), *Perspectives on writing* (pp. 6–44). Newark, DE: International Reading Association.

Hayes, J. R., & Chenoweth, N. (2006). Is working memory involved in the transcribing and editing of texts? *Written Communication, 23*, 135–149.

Hayes, J. R., & Flower, L. S. (1980). Identifying the organization of writing processes. In L. W. Gregg & E. R. Steinberg (Eds.), *Cognitive processes in writing* (pp. 3–30). Mahwah, NJ: Lawrence Erlbaum Associates.

Hayes, J., & Flower, L. (1986). Writing research and the writer. *American Psychologist, 41*(10), 1106–1113.

Hooper, S. R., Costa, L.-J. C., McBee, M., Anderson, K. L., Yerby, D. C., Childress, A., et al. 2011). A written language intervention for at-risk second grade students: A randomized controlled trial of the process assessment of the learner lesson plans in a Tier 2 response-to-intervention model. *Annals of Dyslexia*.

Hooper, S. R., Costa, L.-J. C., McBee, M., Anderson, K. L., Yerby, D. C., Knuth, S. B., et al. 2011). Concurrent and longitudinal neuropsychological contributors to written language expression in first and second grade students. *Reading and Writing: An Interdisciplinary Journal*, *24*, 221–252.

Hooper, S. R., Knuth, S. B., Yerby, D. C., Anderson, K. L. (2009). A review of science supported writing instruction with implementation in mind. In V. W. Berninger & S. Rosenfield (Eds.), *Translating science-supported instruction into evidence-based practice* (pp. 49–83). New York: Oxford University Press.

Hooper, S. R., Roberts, J. E., Nelson, L., Zeisel, S., & Kasambira-Fannin, D. (2010). Preschool predictors of narrative writing skills in elementary school children. *Journal of School Psychology, 25*, 1–12.

Hooper, S. R., Swartz, C., Wakely, M., de Kruif, R., & Montgomery, J. (2002). Executive functions in elementary school children with and without problems in written expression. *Journal of Learning Disabilities, 35*, 37–68.

Hooper, S. R., Wakely, M., de Kruif, R., & Swartz, C. (2006). Aptitude-treatment interactions revisited: Effect of metacognitive intervention on subtypes of written expression in elementary school students. *Developmental Neuropsychology, 29*(1), 217–241.

Isaacson, S. (1995). Written language. In P. J. Schloss, M. A. Smith, & C. N. Schloss (Eds.), *Instructional methods for adolescents with learning and behavioral problems* (2nd ed., pp. 200–234). Boston: Allyn & Bacon.

Juel, C. (1988). Learning to read and write: A longitudinal study of 54 children from first through fourth grades. *Journal of Educational Psychology, 80*(4), 437–447.

Juel, C., Griffith, P., & Gough, P. (1986). Acquisition of literacy: A longitudinal study of children in first and second grade. *Journal of Educational Psychology, 78*, 243–255.

Kellogg, R. (1996). A model of working memory in writing. In C. Levy & S. Ransdell (Eds.), *The science of writing theories, methods, individual differences, and applications* (pp. 57–71). Mahwah, NJ: Lawrence Erlbaum Associates.

Kellogg, R. T. (1999). Components of working memory in text production. In M. Torrance & G. Jeffery (Eds.), *The cognitive demands of writing* (pp. 143–161). Amsterdam: Amsterdam University Press.

Klein, P. D. (2000). Elementary students' strategies for writing-to-learn in science. *Cognition and Instruction, 18*(3), 317–348.

Lane, K., Harris, K., Graham, S., Weisenbach, J., Brindle, M., & Morphy, P. (2008). The effects of self-regulated strategy development on the writing performance of second-grade students with behavioral and writing difficulties. *Journal of Special Education, 41*(4), 234–253.

Lea, J., & Levy, C. M. (1999). Working memory as a resource in the writing process. In M. Torrance & G. Jeffery (Eds.), *The cognitive demands of writing* (pp. 63–82). Amsterdam: Amsterdam University Press.

Levine, M. D., Hooper, S. R., Montgomery, J. W., Reed, M., Sandler, A., Swartz, C., et al. (1993). Learning disabilities. An interactive developmental paradigm. In G. R. Lyon, D. B. Gray, J. F. Kavanagh, & N. A. Krasnegor (Eds.), *Better understanding learning disabilities. New views from research and their implications for educational and public policies* (pp. 229–250). Baltimore: Paul H. Brookes Publishing Company.

Levy, C. M., & Marek, P. (1999). Testing components of Kellogg's multicomponent model of working memory in writing: The role of the phonological loop. In M. Torrance & G. Jeffery (Eds.), *The cognitive demands of writing* (pp. 25–41). Amsterdam: Amsterdam University Press.

Lienemann, T., Graham, S., Leader-Janssen, B., & Reid, R. (2006). Improving the writing performance of struggling writers in second grade. *Journal of Special Education, 40*(2), 66–78.

Mayer, R. E. (1987). Instructional variables that influence cognitive processes during reading. In B. K. Britton & S. M. Glynn (Eds.), *Executive control processes in reading* (pp. 201–216). Hillsdale, NJ: Lawrence Erlbaum Associates.

McCutchen, D. (1996). A capacity theory of writing: Working memory in composition. *Educational Psychology Review, 8*(3), 299–325.

McCutchen, D. (2000). Knowledge, processing, and working memory: Implications for a theory of writing. *Educational Psychologist, 35*, 13–23.

McCutchen, D. (2006). Cognitive factors in the development of children's writing. In C. MacArthur, S. Graham, & J. Fitzgerald (Eds.), *Handbook of writing research* (pp. 115–130). New York: The Guilford Press.

Mehta, P., Foorman, B., Branum-Martin, L., & Taylor, W. (2005). Literacy as a unidimensional multilevel construct: Validation, sources of influence, and implications in a longitudinal study in grades 1 to 4. *Scientific Studies of Reading, 9*, 85–116.

Nist, S. L., & Diel, W. A. (1990). *Developing textbook thinking: Strategies for success in college*. Lexington, MA: D.C. Heath.

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology, 8*, 293–316.

Pressley, M., & Levin, J. R. (1983). *Cognitive strategy training: Educational applications*. New York: Springer-Verlag.

Raphael, T. E., & Englert, C. S. (1990). Reading and writing: Partners in constructing meaning. *The Reading Teacher, 43*, 388–400.

Repovš, G., & Baddeley, A. (2006). The multi-component model of working memory: Explorations in experimental cognitive psychology. *Neuroscience, 139*, 5–21.

Roeltgen, D. (1985). Agraphia. In K. M. Heilman & E. Valenstein (Eds.), *Clinical neuropsychology* (pp. 75–96). New York: Oxford University Press.

Rogers, L., & Graham, S. (2008). A meta-analysis of single subject design writing intervention research. *Journal of Educational Psychology, 100*(4), 879–906.

Sandler, A. D., Watson, T. E., Footo, M., Levine, M. D., Coleman, W. L., & Hooper, S. R. (1992). Neurodevelopmental study of writing disorders in middle childhood. *Developmental and Behavioral Pediatrics, 13*, 17–23.

Shanahan, T. (1984). Nature of reading–writing relations: An exploratory multivariate analysis. *Journal of Educational Psychology, 76*, 466–477.

Simpson, M. L. (1994a). Elaborative verbal rehearsals and college students' cognitive performance. *Journal of Educational Psychology, 86*, 267–278.

Simpson, M. L. (1994b). Talk throughs: A strategy for encouraging active learning across the content areas. *Journal of Reading, 38*(4), 296–304.

Swanson, H. L., & Berninger, V. W. (1994). Working memory as a source of individual differences in children's writing. In E. C. Butterfield & J. S. Carlson (Eds.), *Children's writing: Toward a process theory of the development of skilled writing* (pp. 31–56). Greenwich, CT: JAI Press.

Therrien, W. J., Hughes, C., Kapelski, C., & Mokhtari, K. (2009). Effectiveness of a test-taking strategy on achievement in essay tests for students with learning disabilities. *Journal of Learning Disabilities, 42*, 14–23.

Troia, G. A. (2002). Teaching writing strategies to children with disabilities: Setting generalization as the goal. *Exceptionality, 10*, 249–269.

Vanderberg, R., & Swanson, H. L. (2007). Which components of working memory are important in the writing process? *Reading and Writing: An Interdisciplinary Journal, 20*, 721–752.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds. & Trans.). Cambridge, MA: Harvard University Press.

Wakely, M., Hooper, S. R., de Kruif, R., & Swartz, C. (2006). Subtypes of written expression in elementary school children: A linguistic-based model. *Developmental Neuropsychology, 29*(1), 125–159.

Whitaker, D., Berninger, V., Johnston, J., & Swanson, L. (1994). Intraindividual differences in levels of language in intermediate grade writers: Implications for the translating process. *Learning and Individual Differences, 6*, 107–130.

Wittrock, M. C. (1990). Generative processes of comprehension. *Educational Psychologist, 24*, 345–376.

Wong, B. Y. L., Butler, D. L., Ficzere, S. A., & Kuperis, S. (1997). Teaching adolescents with learning disabilities and low achievers to plan, write, and revise compare-and-contrast essays. *Learning Disabilities Research and Practice, 12*, 2–15.