

Book review

Executive Functions and Writing

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Written composition has long been regarded as a cognitively challenging task. It simultaneously makes significant demands on language, memory, and thinking. For lengthy compositions, the writing process entails multiple work sessions extending over days, weeks, months, and even years. The diligence required can be challenging emotionally as well as cognitively. At the heart of meeting these demands is the capacity for self-regulation. Not surprisingly, then, the psychological research on executive functions has much to say about writing skill—both its successes and failures.

Limpo and Olive (2021) have gathered experts on the writing process and executive functions to produce an informative and welcome volume of current research on the topic. The chapters collectively address the complexities of defining and measuring executive functions as well as the challenges of assessing both the process and product of writing. The book covers executive functioning across the life span from its development in children and adolescence, through skilled writing in adulthood, to the aging writer. It addresses both basic research issues and their applications in education.

Executive functioning is a central theoretical concept in psychology with an extensive history (Goldstein, Naglieri, Princiotta, & Otero, 2014). Higher-order cognitive processes such as planning, initiation and inhibition, attention and working memory, and self-monitoring and self-regulation have traditionally been associated with the functioning of the prefrontal cortex of the brain. From the origin of the cognitive revolution in psychological theory in the 1950s, the distinction between these higher-order control processes were contrasted with automatic processes.



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By the mid-1970s, cognitive control was seen as a specialized executive component of the brain's attentional systems (Posner & Snyder, 1975). The seminal model of working memory—a form of short-term memory actively used to accomplish intellectual tasks such as reading and writing—posited a control component called the central executive (Baddeley, 1986). Up to the present, research on these ideas has flourished with at least 30 constructs identified as executive functions (Goldstein et al., 2014).

The diversity, while challenging for the authors of the volume under review, mostly reflects different levels of theoretical analysis rather than basic disagreement in the field. Some investigators fractionate the central executive into a small number of basic constructs, such as cognitive control through inhibition, updating the contents of working memory, and multitasking by shifting task goals (Miyake, Friedman, Emerson, Witski, Howerter, & Wager, 2000). Others consider working memory, taken as a whole, to be an executive function along with goal-shifting or cognitive flexibility and planning (Diamond, 2013). The latter is interesting because of its importance in goal-directed behavior of any kind, including written composition. Planning along with sentence generation and reviewing were posited as fundamental writing processes in the seminal model of composition (Hayes & Flower, 1980). This underscores that executive functions and writing are deeply intertwined, the major premise of the book. In my own work, the research evidence indicated that the central executive is the only component of Baddeley's (1986) model of working memory necessary for planning, sentence generation, and reviewing (Kellogg, 1996). The phonological loop or verbal store of working memory and the visual-spatial store play more peripheral, supporting roles.

Organization

The book includes 13 chapters arranged into five sections. Teresa Limpo and Thierry Olive open the book in the introductory section with a chapter that documents why it is important to examine the relationship between executive functions and writing. They further provide an overview of the sections to follow. The second section provides the theoretical background for the themes of the book. Michael Willoughby and Kesha Hudson address the conceptualization and measurement of executive functions. Steve Graham presents his writer(s)-within-community model of composition in relation to the concept of executive functioning. The third section addresses methods for assessing writing and executive functions. Helen St. Clair-Thompson and Yunhong Wen focus on the measurement of executive functioning in children, while Julie Dockrell and Vincent Connelly address the challenges of assessing the writing process and the produced text with an emphasis on student writing.

The fourth section is the most expansive. It offers five chapters with a life-span perspective on writing development and skill. The section opens with a chapter by Stephen Hooper, Lara Costa, Edmund Fernandez, Alexandra Barker, Courtney Valdes,

Stephanie Catlett, and Melissa Green on developmental associations and disassociations between executive functions and writing skills. Marisa Filipe then asks how neurodevelopmental disorders affect writing. The active promotion of executive functions to aid with writing skill is next addressed in a chapter by Linda Mason and Stacie Brady. Thierry Olive then considers executive functions in skilled adult writers and the section is closed with a chapter by São Luís Castro and Regina Abreu on cognitive aging and writing. The final section of the book offers conclusions and speculates on future directions. In three chapters by George McCloskey, George Georgiou, and lastly Sam Goldstein with Keith McGoldrick, the authors comment on the themes of the book and offer their own insights on the key questions.

Themes

The first and overriding theme of the book is the critical importance of self-regulation in written composition. It has long been established in the writing literature that the demands of planning ideas, generating sentences, and the reviewing and revising of ideas and texts can overload the limited capacity of attention and working memory of even experienced writers. The empirical evidence supporting this claim are reviewed in the chapter by Olive. Baddeley's (1986) central executive is thought to play a central role in composition. Yet, as Olive points out, there have not been systematic experimental studies on executive functions, as commonly defined by Miyake et al. (2000) and Diamond (2013), in skilled writers. For example, when precisely is working memory updated during, say, sentence generation, or how exactly is inhibition used to shift from sentence generation to reviewing? The concurrent activation of both high-level cognitive processes, such as planning or sentence generation, and low-level motor transcription in handwriting or typing characterizes skilled writers. As Olive documents, less skilled, beginning writers are limited by a lack of such concurrent activation. Understanding the role of executive functions in the flexible coordination of such production processes is thus critically important for advancing the science of writing and developing effective educational interventions.

Self-regulation is not exclusively driven by cognitive factors. Graham's chapter highlights the social context in which written composition occurs. As a form of communication, writing is inherently a social act, embedded in a linguistic community. Other members of the community as well as the author constrain, support, and structure the way writing unfolds. The goals and norms of writing, for example, shape both what is written and how writers and their collaborators accomplish the task. The members of the community might modify the writing assignment or encourage collaborative rather than solo writing as a means of exercising executive control, for example. In his chapter, Graham focuses on ways of strengthening executive control in young writers such as teaching self-regulation strategies and social modeling of the writing process.

Mason and Brady's chapter reviews the empirical evidence that poor writers struggle with knowing how to guide their own writing process and when to exert

executive control. They stress the importance of effective writing for success in primary and secondary schools. A variety of techniques are well-established for improving proficiency in sentence writing (e.g., sentence combining exercises) as well as self-regulation of the writing process (e.g., Self-Regulated Strategy Development or SRSD). The SRSD approach explicitly teaches students how to self-regulate their writing performance and is scaffolded to improve systematically their executive functions (e.g., Harris, Graham, & Mason, 2006). McCloskey's chapter in the concluding section pulls together this first theme in arguing that the SRSD writing interventions are well-grounded in evidence-based practices to enhance executive functions in a variety of educational contexts. McCloskey's own research has provided a general framework for such practices that guide students toward a mastery of executive functions with a goal of independent, self-regulated performance.

The second theme is the challenges involved in validly and reliably measuring executive functions and writing. In Chapter 2, Willoughby and Hudson survey efforts to conceptualize and measure executive functions using either performance in standardized tasks or questionnaires asking about one's functioning in everyday contexts. Because the two approaches at times do not provide similar results, new functional assessments based on real-world tasks performed in virtual or augmented reality are being explored. Their aim is to enhance the ecological validity of the assessment over laboratory inspired tasks and self-report questionnaires. Developmental research on executive functions has been particularly informative. Qualitative as well as quantitative changes take place in early childhood, through late childhood, and adolescence that bear on the capacity to compose written texts. In Chapter 4, St. Clair-Thompson and Wen build on these ideas with their review of the issues associated with measuring executive functioning in children. They describe several cognitive tasks that can be used to assess executive functions and compare them with self-report measures using questionnaires completed by parents and teachers. Their goal is to guide in the selection of an appropriate assessment of executive functioning in children for a particular research purpose.

The ecological validity problem also arises in writing assessment, as covered in the chapter by Dockrell and Connelly. A standardized test of writing skill provides a single snapshot of performance that is limited by the time allowed and the task demanded. Such a form of summative assessment may miss aspects of a writer's abilities on a variety of tasks carried out over an extended period. Multiple assessment tasks are needed in part because a single written product fails to portray accurately writing competence across different genres. The authors review evaluations of written products using holistic scoring measures, analytic measures, and dimensions of the written product such as quality versus productivity. They further consider efforts to measure the cognitive processes involved in composition, such as planning ideas versus translating ideas into sentences.

The final theme stems from the origin of the concept of executive functioning in clinical neurology and injuries to the prefrontal cortex. Although the book does not

include a chapter on recent work in neuroimaging of the brain during the act of writing, it nevertheless addresses some of the neurobiological aspects of writing in relation to executive functions. Willoughby and Hudson note the traditional association of the prefrontal cortex with planning and other executive functions, but caution that some assessments of executive functioning do not engage this region of the brain. Moreover, as they point out, it is better based on contemporary research to regard the frontal lobe as segmented into specific regions (e.g., the dorsolateral prefrontal cortex) that support specific executive functions. Though not mentioned in their chapter, it is now also known that the executive attention system responsible for cognitive control includes regions in the posterior of the brain as well as in the frontal lobe (Petersen & Posner, 2012).

Much is known today about brain maturation; the fact that the frontal lobe, so critical to self-regulation, matures most slowly has implications for understanding writing development (Kellogg, 2008). The chapter by Hooper and colleagues address the development of inhibitory control, cognitive flexibility, working memory, and planning in children. They marshal arguments for associations among chronological age, executive functions, and writing performance. Emergent literacy, handwriting, spelling, and written expression in childhood and adolescence are all predictable to a degree from understanding the development of executive functions.

The next chapter by Filipe continues with the third theme by examining how neurodevelopmental disorders impact writing ability. Autism Spectrum Disorder (ASD), Attention Deficit/Hyperactivity Disorder (ADHD), and Specific Learning Disorder (SLD) are each highly informative because of their known impairments in executive functioning. ADHD is especially relevant in that it is characterized by deficits in working memory and inhibitory control. That these disrupt writing performance and impede writing development confirms the theoretical models that have been proposed in the literature. Besides their research value, Filipe addresses ways to employ self-regulation interventions developed by Graham and his colleagues to improve writing skills in neuroatypical students.

Finally, the fourth section is concluded with a chapter on the effects of aging on the process and product of writing. Castro and Abreu point out that there is a well-established literature on how language comprehension and production changes as a function of cognitive aging. It is also well-known that processing speed and working memory functioning declines with normal aging. The writing of older adults is not uniformly in decline, however. For example, impaired retrieval of orthography results in more misspellings and working memory limitations reduce the use of embedded clauses and lessen textual cohesion. On the other hand, syntactic correctness is preserved, narrative structures are more complex and elaborate in older adults, and their ability to summarize draws on more main ideas and is more concise. Explaining the preservation of writing skills in older adults is controversial. It might entail enhanced reliance on long-term memory through years of deliberate practice that circumvents age-related limitations in working memory. It might also involve the

superior use of cognitive strategies for managing available cognitive resources. Castro and Abreu close their chapter with a consideration of writing impairments as a marker of dementia and the use of writing-based interventions for healthy aging.

To conclude the book, Georgiou in Chapter 12 and Goldstein and McGoldrick in Chapter 13 continue with the neurobiological theme by returning to the work of the noted Russian physiologist A. R. Luria (1963; 1966; 1993). For Luria, planning was a major function of the frontal lobe of the brain and is also central to composing texts. As Georgiou notes: “In some of his classic studies, Luria used poor composition as an index of deficits in frontal lobe functions” (p. 281). Tests that hone-in on planning might provide a valuable metric of writing ability, particularly if they gauge planning in a “hot” or emotional context. Goldstein and McGoldrick remind us of Luria’s neurodevelopmental model of cognition and its relation to brain maturation and how these are shaped by environmental experiences. In their view, the development of executive functions plays a pivotal role in the success of students in school. Beginning in elementary school, children depend on basic executive functioning to attend to new information and store it memory. Advanced strategies for learning and retaining information—such as rehearsal—hinge on executive functioning. The transition to middle school involves an increase in workload and the need to multitask across different classes. Managing peer interactions and maintaining self-control in the classroom further strain executive capacities. These demands only increase as students progress into high school. Given their centrality to writing as well as other aspects of the school environment, Goldstein and McGoldrick anticipate that the next thirty years will see an increasing focus on how best to assess and foster executive functions in our educational systems.

Readership and significance

Executive Functions and Writing will be essential reading for writing researchers and writing educators. It fills an important gap by drawing on the voluminous literature on executive functioning in psychology and education to understand the complex art of written composition. Limpo and Olive hoped “...to identify gaps in the literature that can inspire and stimulate researchers to deepen our knowledge in the topic through well-designed empirical research” (p. 5). In that aim they should succeed admirably. The book also provides a thorough introduction to the importance of executive functions in written composition and educational success. Educators interested in promoting executive functioning to improve writing skills will be advised to begin with this volume.

I would further recommend the book to colleagues in the cognitive sciences who study the well-plowed fields of research on memory, problem solving, decision making, and reading. Writing, by comparison, is still relatively neglected as a research topic and ripe for fresh discoveries. Most important, it is an ideal task to investigate to shed light on complex intellectual activities dependent on the executive functions of the human brain. A. R. Luria’s insight that written composition provides a

window on executive functioning—the pinnacle of the brain’s capabilities—merits the full attention of cognitive scientists today.

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