

RELATIONSHIP BETWEEN EXECUTIVE FUNCTION AND READING COMPREHENSION: A SYSTEMATIC REVIEW

**Sandi Gomes Neres, Gabriela dos Santos Franco Liporaci,
Bianca Rodrigues dos Santos, & Simone Aparecida Capellini**

*Investigation Learning Disabilities Laboratory (LIDA), Department of Speech and Hearing Sciences,
São Paulo State University "Júlio Mesquita Filho" (UNESP), Marília, São Paulo (Brazil)*

Abstract

Introduction: In Brazil, difficulties with reading comprehension are identified later in the school context, usually after repeated failures that can lead to not only academic problems but also behavioral changes in children. **Objective:** The aims of this study was to conduct a systematic literature review to verify the relationship between executive function and reading comprehension. **Materials and Methods:** This is a systematic review study conducted using the PCC strategy, an acronym for Population, Concept, and Context (Peters, et al., 2020), to define the guiding question of the study: "What is the relationship between executive function and reading comprehension?". The literature review conducted to answer the guiding question followed these steps: a) Search strategies: the search for scientific articles was carried out over the last 11 years, from 2010 to 2025. The Pubmed, Scopus, and Web of Science databases were used for the search; b) Search strategy, inclusion and exclusion criteria: The terms used for the data search and applied to the combination of keyword groups in Portuguese were: leitura, compreensão de leitura, função executiva. In English, they were: reading, reading comprehension, executive function; c) Study eligibility criteria: Data extraction was performed using keywords based on the PCC strategy. Original articles published in full in national and international journals were included. **Results:** Thirty articles were found (100%), however, 19 articles (63%) were excluded because they dealt with the topic involving schoolchildren with neurodevelopmental disorders and intervention studies, leaving only 11 articles (37%) for full reading. **Conclusion:** The results of this study revealed that the executive functions of inhibitory control, working memory, and planning showed a relationship with reading comprehension in all the articles analyzed. Therefore, there is a need for this study to continue in order to broaden the discussions of this relationship also in the context of clinical and educational intervention.

Keywords: *Executive function, reading comprehension, learning.*

1. Introduction

Executive functions have a broad influence on academic performance due to their association with cognitive, emotional, behavioral, and social development and regulation (Diamond, 2013), with their typical development being directly related to school success in children at the beginning of formal learning and throughout their academic career (Blair & Razza, 2007; McClenlland et al., 2007; Jacobson et al., 2011).

Reader development is a long-term process that requires mastery of a highly complex task. Comprehension demands the coordinated participation of numerous mental processes at both basic and higher levels. Competent textual comprehension involves multiple skills of distinct natures such as decoding, making inferences, oral comprehension skills, world knowledge and knowledge of textual structure, vocabulary (Cain & Oakhill, 2011; Kim, 2017; Perfetti & Stafura 2014) and, moreover, depends on a long period of successful reading practices, capable of assisting in the construction of good models of how to read strategically and efficiently (Graesser, 2007; Sánchez et al., 2010).

The great challenge for students is to begin this journey without many of the linguistic and cognitive processes and skills involved in reading competencies (decoding and comprehension) being fully developed. Therefore, they must learn to read at their own pace of acquisition and development, even though reading is already pedagogically required as an important tool for acquiring and consolidating new knowledge. This peculiarity makes the formation of a competent reader an enormous challenge (Kida & Bustos, 2020).

The first challenge faced by the reader occurs in the early years of elementary school: mastering the components of decoding. Phonological decoding in word recognition is the ability to transform letters into sounds before identifying meaning. For these skills to develop, phonological processing abilities need to be well-developed and require constant use to make this task progressively faster, allowing access to the individual meaning of the words read (Wagner & Torgesen, 1987; Lundberg et al., 1988). Orthographic decoding, involved in word recognition, is the moment when there is the ability to create and store specific visual representations of the word. This is the second important step in creating speed and efficiency in word decoding (Barker et al., 1992). This gradual change occurs more strongly in the early years of elementary school (first to third grade) and depends directly on reading experience and frequency (Sticht & James, 1984; Aarnoutse et al., 2001).

2. Objective

The objective of this study was to conduct a systematic literature review to verify the relationship between executive function and reading comprehension.

3. Materials and methods

This is a systematic review study conducted using the PCC strategy, an acronym for Population, Concept, and Context (Peters, et al., 2020), to define the guiding question of the study: "What is the relationship between executive function and reading comprehension?"

The literature review conducted to answer the guiding question followed these steps:

a) *Search strategies*: the search for scientific articles was carried out in the last 11 years, from 2010 to 2025. The Pubmed, Scopus, and Web of Science databases were used for the search.

b) *Search strategy, inclusion and exclusion criteria*: The terms used for the data search and applied to the combination of groups of keywords in Portuguese were: leitura, compreensão de leitura, função executiva. In English, they were: reading, reading comprehension, executive function.

c) *Study eligibility criteria*: Data extraction was performed using keywords based on the PCC strategy. Original articles published in full in national and international journals were included (Table 1).

Table 1. PCC strategy applied to the systematic literature review study.

Strategy	Applicability in the study
P (Population)	Students*
C (Concept)	Reading, Reading comprehension and Executive Function
C (Context)	Clinical and Educational

*Kindergarten, Elementary Education

Thirty articles (100%) were found; however, 19 articles (63%) were excluded because they dealt with the topic involving schoolchildren with neurodevelopmental disorders and intervention studies, leaving only 11 articles (37%) for full reading. Figure 1 presents the selection process of the scientific articles that comprised the systematic review (figure 1). Only international articles were found for analysis.

Figure 1. Distribution of the number of scientific articles found in the systematic review of this study.



For the analysis of the scientific articles, a data extraction protocol was developed, consisting by: author, year, population, and study results.

4. Results

The results of the studies analyzed in the literature review of this study are presented in Table 2.

Table 2. Description of the results of the studies analyzed in the literature review.

Author/Year	Population	Matherial and Methods	Results
Cutting et al., (2009)	56 students, aged 9 to 14 years old	Tests of verbal fluency, oral language, and executive function.	Difficulties in executive function tasks compromised performance in oral language and reading comprehension tasks.
Christopher et al. (2012)	483 students, aged 8 to 16 years old	Tests of working memory, inhibitory control, rapid automatic naming, sentence comprehension, word reading, and reading comprehension.	The relationship between word reading and reading comprehension is invariable across different age groups. Working memory and processing speed are the only predictors for both tasks.
Bock et al., (2018)	84 students of 1st grade level	Tests of inhibitory control, working memory, cognitive flexibility, alphabet knowledge, reading fluency, and reading comprehension.	Switching tasks and working memory are directly related to the strategies used in reading comprehension.
Haft et al., (2019)	91 students of kindergarten, aged 5 to 6 years old	Tests of oral language, word decoding, reading comprehension, and executive function (inhibitory control and working memory).	Direct effect of executive function on word decoding and reading comprehension.
Miciack et al., (2019)	697 students of 4th grade level	Tests of inhibitory control, working memory, self-regulation, reading decoding tasks, fluency, and reading comprehension.	Students with impaired inhibitory control and working memory showed greater difficulties with reading decoding, fluency, and reading comprehension tasks.
Cirino et al., (2018)	846 students of 3rd to 5th grade level	Tests: metaphonological ability, processing speed, working memory, planning, inhibitory control, verbal fluency, metacognition, word reading, and reading comprehension.	Executive functions are strongly related to reading decoding skills, fluency, and reading comprehension.
Nouwens et al., (2020)	113 students of 4th grade level	Tests: Executive function (phonological working memory, inhibitory control, planning), decoding tasks, language tasks (vocabulary and syntactic knowledge), reading comprehension.	Direct effects of working memory and planning on reading comprehension and indirect effects of working memory and inhibitory control on reading decoding.
Spencer at al., (2020)	271 students, aged 9 to 14 years old	Tests of inhibitory control, working memory, oral language, word reading, and reading comprehension.	The executive function tasks were related to reading comprehension, word decoding, and oral language comprehension.
Spencer; Cutting (2021)	298 students of 6th to 8th grade level.	Application of the BRIEF-2 and reading comprehension test.	Executive functions were strongly correlated with the reading comprehension task.

5. Discussion

The results of the literature review conducted in this study revealed a scarcity of literature related to the relationship between the components of executive function and reading comprehension. However, it is necessary to consider that all the studies found and analyzed indicated that executive function, especially in the components of inhibitory control and working memory, is directly related to reading comprehension, particularly studies conducted with schoolchildren aged 5 to 16 years old, making explicit the need to assist readers in the execution of comprehension processes through executive function tasks.

Helping to understand is a long-term process, carried out through guided or collaborative reading practices in which a specialist guides a beginner in the task of reading and interpreting a text. In this practice, teacher and students have a defined role, and the objective is to ensure that the student successfully achieves the experience of understanding the text, building an efficient model of how to read, modifying the students' attitude towards reading, facilitating the task and promoting comprehension (Sánchez et al., 2008). Furthermore, this form of intervention teaches understanding while guaranteeing access to the information

transmitted by the texts, and therefore, something is learned from them. This is an advantage that also addresses the need to use reading for learning (Kida & Bustos, 2020).

Bustos et al. (2019) investigated the effect of reading planning assistance in three experimental conditions: a group of students who performed autonomous reading (n=100), a group of students who only had oral planning assistance (n=90); a group of students who had oral planning assistance and collective oral reading of the text (n=90) by developing readers in the third year of elementary school. The effect of these aids was investigated for the comprehension of narrative and expository texts.

Text planning is a set of verbal aids given by the teacher before and during reading that aims to: 1. Activate prior knowledge about the text's theme; 2. State the theme; 3. Explicitly determine the reading goal, assisting the reader in effectively understanding the essential aspects of the text; 4. Stimulate the desire and belief that the task of reading is feasible, actively engaging the reader in the task; 5. Instruct on how to operate during reading, helping the student in the search for the best information and in the intuitive recognition of the textual structure; 6. Help to recall the established reading objective (Mc Crudden & Schram, 2007; Bustos, 2019).

Therefore, based on the results presented, we can affirmatively answer the study's question, that is, there is a relationship between executive functions and reading comprehension, since they are involved in underlying skills such as word reading skills, and these functions are an important and relevant factor in the ability to understand read text.

6. Conclusion

The results of this study revealed that the executive functions of inhibitory control, working memory, and planning showed a relationship with reading comprehension in all the articles analyzed.

Therefore, there is a need for this study to continue in order to broaden the discussions of this relationship also in the context of clinical and educational intervention.

References

- Aarnoutse, C., Van Leeuwe, J., Voeten, M., & Oud, H. (2001). Development of decoding, reading comprehension, vocabulary and spelling during the elementary school years. *Reading and Writing*, 14(1–2), 61–89. <https://doi.org/10.1023/A:1008128417862>
- Barker, T. A., Torgesen, J. K., & Wagner, R. K. (1992). The role of orthographic processing skills on five different reading tasks. *Reading Research Quarterly*, 27, 335–345. <https://doi.org/10.2307/747673>
- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development*, 78(2), 647–663. <https://doi.org/10.1111/j.1467-8624.2007.01019.x>
- Bock, A. M., Cartwright, K. B., McKnight, P. E., Patterson, A. B., Shriver, A. G., Leaf, B. M., Mohtasham, M. K., Vennergrund, K. C., & Pasnak, R. (2018). Patterning, reading, and executive functions. *Frontiers in Psychology*, 9, 1802. <https://doi.org/10.3389/fpsyg.2018.01802>
- Bustos, A. et al. (2019). En las salas de primaria ¿cómo se lee para aprender? *Revista Espacios*, 40(41), 25–36.
- Cain, K., & Oakhill, J. (2011). Matthew effects in young readers: Reading comprehension and reading experience aid vocabulary development. *Journal of Learning Disabilities*, 44(5), 431–443. <https://psycnet.apa.org/doi/10.1177/0022219411410042>
- Cirino, P. T., Ahmed, Y., Miciak, J., Taylor, W. P., Gerst, E. H., & Barnes, M. A. (2018). A framework for executive function in the late elementary years. *Neuropsychology*, 32(2), 176–189. <https://doi.org/10.1037/neu0000427>
- Cutting, L. E., Materek, A., Cole, C. A. S., Levine, T. M., & Mahone, E. M. (2009). Effects of fluency, oral language, and executive function on reading comprehension performance. *Annals of Dyslexia*, 59(1), 34–54. <https://doi.org/10.1007/s11881-009-0022-0>
- Christopher, M. E., Miyake, A., Keenan, J. M., Pennington, B., DeFries, J. C., Wadsworth, S. J., Willcutt, E., & Olson, R. K. (2012). Predicting word reading and comprehension with executive function and speed measures across development: a latent variable analysis. *Journal of experimental psychology. General*, 141(3), 470–488. <https://doi.org/10.1037/a0027375>
- Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, 64, 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>
- Graesser, A. C. (2007). An introduction to strategic reading comprehension. In D. S. McNamara (Ed.), *Reading comprehension strategies: Theories, interventions, and technologies* (pp. 3–26). Lawrence Erlbaum Associates.

- Haft, S. L., Caballero, J. N., Tanaka, H., Zekelman, L., Cutting, L. E., Uchikoshi, Y., & Hoeft, F. (2019). Direct and Indirect Contributions of Executive Function to Word Decoding and Reading Comprehension in Kindergarten. *Learning and individual differences*, 76, 101783. <https://doi.org/10.1016/j.lindif.2019.101783>
- Jacobson, L. A., Williford, A. P., & Pianta, R. C. (2011). The role of executive function in children's competent adjustment to middle school. *Child Neuropsychology*, 17(3), 255–280. <https://doi.org/10.1080/09297049.2010.535654>
- Kida, A. S. B., & Bustos, A. (2020). Fonoaudiologia educacional e a formação de professores. In S. A. Capellini, J. L. Zorzi, & B. Queiroga (Eds.), *Tratado de fonoaudiologia*. Artesã Editora.
- Kim, Y. S. G. (2017). Why the simple view of reading is not simplistic: Unpacking component skills of reading using a direct and indirect effect model of reading (DIER). *Scientific Studies of Reading*, 21(4), 310–333. <https://doi.org/10.1080/10888438.2017.1291643>
- Lundberg, I., Frost, J., & Petersen, O. (1988). Effects of an extensive program for stimulating phonological awareness in pre-school children. *Reading Research Quarterly*, 23, 263–284. <https://psycnet.apa.org/doi/10.1598/RRQ.23.3.1>
- McClelland, M. M. et al. (2007). Links between behavioral regulation and preschoolers' literacy, vocabulary, and math skills. *Developmental Psychology*, 43(4), 947–959. <https://doi.org/10.1037/0012-1649.43.4.947>
- McCrudden, M. T., & Schraw, G. (2007). Relevance and goal-focusing in text processing. *Educational Psychology Review*, 19(2), 113–139. <https://doi.org/10.1007/s10648-006-9010-7>
- Miciak, J., Taylor, W. P., Denton, C. A., & Fletcher, J. M. (2015). The effect of achievement test selection on identification of learning disabilities within a patterns of strengths and weaknesses framework. *School Psychology Quarterly: the official journal of the Division of School Psychology, American Psychological Association*, 30(3), 321–334. <https://doi.org/10.1037/spq0000091>
- Nouwens, S., Groen, M. A., Kleemans, T., & Verhoeven, L. (2021). How executive functions contribute to reading comprehension. *The British journal of educational psychology*, 91(1), 169–192. <https://doi.org/10.1111/bjep.12355>
- Peters, M. D. J., Marnie, C., Tricco, A. C., Pollock, D., Munn, Z., Alexander, L., McInerney, P., Godfrey, C. M., & Khalil, H. (2020). Updated methodological guidance for the conduct of scoping reviews. *JBIM evidence synthesis*, 18(10), 2119–2126. <https://doi.org/10.11124/JBIES-20-00167>
- Perfetti, C. A., & Stafura, J. Z. (2014). Word knowledge in a theory of reading comprehension. *Scientific Studies of Reading*, 18(1), 22–37. <https://doi.org/10.1080/10888438.2013.827687>
- Sánchez, E., García, R., & Bustos, A. (2017). Does rhetorical competence moderate the effect of rhetorical devices on the comprehension of expository texts beyond general comprehension skills? *Reading and Writing*, 30(3), 439–462.
- Sánchez, E., García, R., & Rosales, J. (2010). *La lectura en el aula: Qué se hace, qué se debe hacer y qué se puede hacer*. Graó.
- Spencer, M., & Cutting, L. E. (2021). Relations Among Executive Function, Decoding, and Reading Comprehension: An Investigation of Sex Differences. *Discourse processes*, 58(1), 42–59. <https://doi.org/10.1080/0163853X.2020.1734416>
- Spencer, M., Richmond, M. C., & Cutting, L. E. (2020). Considering the Role of Executive Function in Reading Comprehension: A Structural Equation Modeling Approach. *Scientific studies of reading: the official journal of the Society for the Scientific Study of Reading*, 24(3), 179–199. <https://doi.org/10.1080/10888438.2019.1643868>
- Sticht, T. G., & James, J. H. (1984). Listening and reading. In P. D. Pearson (Ed.), *Handbook of reading research* (Vol. 1, pp. 293–318). Longman.
- Wagner, R. K., & Torgesen, J. K. (1987). The nature of phonological processing and its causal role in the acquisition of reading skills. *Psychological Bulletin*, 101, 192–212. <https://psycnet.apa.org/doi/10.1037/0033-2909.101.2.192>