

The role of executive functions in reading fluency among children with dyslexia

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Summary of the contribution:

Purpose: To determine the role of executive functions in reading fluency among 8-12-year-old children with dyslexia using an executive-functions-based reading intervention. This reading program embeds executive functions principles by deleting the letters from the screen speedily and including comprehension questions following each sentence. This manipulation trains the working memory capacity and visual attention while tracking the letters, as well as prevents regressions to the beginning of the sentence (i.e., trains inhibition).

Methods:

Behavioral and neurobiological data were collected from English-speaking children with dyslexia and typical reader participants before and after eight weeks of training with the EF-based computerized reading program. Functional MRI data were collected using a lexical decision task and resting state condition, pre and post-intervention. The long-term effect was determined three months post-intervention. Functional connectivity matrices within and between EF networks and visual/auditory networks were defined and compared between the participants and conditions. Prediction models connecting behavioral and neurobiological changes were conducted as well using regression analysis.

Results/conclusions: Improved reading fluency and greater executive function abilities, as well as increased functional connectivity within and between executive functions and attention networks, were found in children with dyslexia. Greater short-term executive function gains (inhibition and speed of processing) moderated long-term reading fluency gains (3 months following training). The results of these studies point to the central role of executive functions in reading fluency and support the studies suggesting these components should be considered as part of the Simple View of Reading model.

Abstract

Dyslexia, a developmental reading difficulty, is characterized by slow and inaccurate reading, which continues into adulthood, despite repeated exposure to literacy. One of the theories explaining the causes of the lack of reading fluency in dyslexia is the asynchrony theory, suggesting that a lack of synchronization between the auditory and visual modalities underlies their reading difficulty. In this talk, findings from training with an executive-functions-based reading program, based on the speed of processing, visual attention, working memory and inhibition among 8-12 y.o children with dyslexia and typical readers, will be shared. Findings suggest that improved reading fluency in children with dyslexia was associated with improved executive functions as well as greater involvement of neural circuits supporting visual and auditory modalities as well as executive functions. The results of these studies point at the central role of executive functions in reading fluency, an important component of the reading process (see also the Simple View of Reading model). It may also suggest that this specific executive-functions-based reading intervention increases the synchronization between the auditory and visual modalities by engaging executive functions. Doing that, it may reduce the neural noise in children with dyslexia.