

# Chapter 10

## Cogni–Prelit: Empowering Executive Functions Embedded With Preliteracy Learning in Preschool Children at Risk for Reading Difficulties

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### ABSTRACT

*Some preschool children are at risk for reading difficulties because of inadequate emergent literacy skills. Recent studies have found evidence of the bidirectionality between executive function skills (Efs) and young children's preliteracy skills. This chapter aims to discuss the development and the efficacy of Cogni-Prelit (Cognition and Preliterature) digital application, which stimulates and enhances core Efs integrated with preliteracy activities, in children at risk for reading difficulties. A group of 30 preschool children took part in a pre-test assessment of preliteracy skills and core Efs. Children were then randomly assigned to either an experimental (n = 15) or a passive control group (n = 15). The experimental group participated in 2 30-min sessions of the Cogni-Prelit training program per week, for 12 weeks. Significant differences between control and experimental groups were observed in the post-test assessment, with the latter performing better on both measures.*

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## INTRODUCTION

Efs refer to cognitive processes that are necessary for goal-oriented behavior. Although the concept of Efs has rapidly grown into an umbrella term for many automatic and conscious learning processes, there is a general consensus that there are three core Efs that underlie these processes (Diamond, 2013). Those core functions are inhibition, working memory (WM) and cognitive flexibility, mainly because they are clearly outlined and therefore their operation can be defined with relative accuracy.

Inhibition refers to the ability to deliberately inhibit dominant, automatic responses. Cognitive flexibility involves moving backwards and forwards between multiple tasks, operations, or mental sets. WM requires monitoring and coding of incoming information and appropriately revising the items held in short-term memory by replacing no-longer-relevant information with new, more relevant information (Miyake, Freidman, Emerson, Witzki, & Howerter, 2000).

Many researchers have examined the predictive role of the three core executive function (EF) components -WM, inhibition and cognitive flexibility- on later academic achievement in typically developing children, due to the rapid advances in Efs that take place during preschool years (Garon, Bryson, & Smith, 2008; Zelazo, Müller, Frye, & Marcovitch, 2003). Most importantly, individual variations in Efs may explain differences in learning skills across domains of reading achievement and math (Liu et al., 2018), with the deficits of WM having particularly strong effect (Morgan et al., 2017).

Individual variations and deficits in Efs may intervene in the later-emerging differences in learning skills and academic outcomes in typical development as well as in atypical conditions (Jackson, 2019). In particular, associations between all EF components and preliteracy skills development in preschool children have been documented in recent research (Peng et al., 2018; Veraksa, Bukhalenkova, & Kovyazina, 2018).

Besides, poor reading skills result in lower overall academic achievement (Eissa, 2014). At least twenty percent of children have difficulty mastering the skills required to become proficient readers, while eight to ten percent of kindergarteners exhibit significant delays (Toste et al., 2014). As a result, researchers have called for earlier identification and effective programming for children who may be at risk for reading difficulties (Lonigan et al., 2013; Suggate, 2010). In general, these interventions show positive effects on children's phonological awareness, letter knowledge and later reading skills. Additionally, Efs have shown to be an important prerequisite for a prospective early literacy development (Ashkenazi, Black, Abrams, Hoeft, & Menon, 2013; Cartwright, 2012).

EF deficits have been recently seen as promising targets for intervention and extremely positive beliefs have emerged regarding the use of computer-assisted instruction in training Efs. There is a plethora of software, online and mobile applications which claim that they improve the cognitive skills related to the Efs in children, with some of them supported by empirical data (Rachanioti, Bratitsis & Alevriadou, 2018). Nevertheless, the transferability of the training gains to untrained tasks and abilities is remarkably disputable in the field of cognitive research (Strobach, & Karbach, 2016). The doubtful benefits of training specific Efs in isolation has been recently questioned (Kassai, Futo, Demetrovics, & Takacs, 2019).

The present chapter includes evidence on the bidirectional associations of Efs with preliteracy learning in preschool children at risk for reading difficulties, including also recent research on the manifestation of EF insufficiency in preschool children with reading difficulties. Then, the utilization of computer-assisted instruction in training Efs and the remarkably questionable, in the field of cognitive training research, transferability of training gains to untrained tasks and abilities will be discussed. Finally, data

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