Comparing working memory in bilingual and monolingual Hispanic/Latino preschoolers with disruptive behavior disorders

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Abstract

The current study examined differences in working memory (WM) between monolingual and bilingual Hispanic/Latino preschoolers with disruptive behavior disorders (DBDs). A total of 149 children ($M_{age} = 5.10$ years, $SD = 0.53$; 76% male) with elevated levels of DBDs, as indicated by their parents or teachers, were recruited to participate in an 8-week summer program prior to the start of kindergarten (Summer Treatment Program for Pre-Kindergarteners). Prior to the start of treatment, parents completed several measures about their children’s behavior and executive function, and children were administered two subtests of the Automated Working Memory Assessment to examine their current WM capabilities. After controlling for demographic variables (i.e., age, sex, socioeconomic status, IQ, and diagnostic status), no significant differences were observed between bilingual and monolingual children in verbal WM performance ($\beta = .03, p > .05$). However, children who were bilingual did perform better than monolinguals on spatial WM tasks ($\beta = .23, p < .01$). Finally, parent reports of WM corroborated these findings such that bilingual children were reported as having fewer WM problems by parents ($\beta = -.19, p < .05$) and teachers ($\beta = -.22, p < .05$). Whereas WM deficits are often found among children with DBDs, the current findings suggest that bilingualism may serve as a protective factor for preschoolers with DBDs.

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Introduction

The transition from preschool to kindergarten is an important milestone in a child's life, often labeled as a "sensitive period" for determining later school success (Rimm-Kaufman & Pianta, 2000). A critical component of early school success is a child’s executive function (EF) abilities (Blair, 2002), which refers to higher-order mechanisms necessary for the self-regulation of emotions, thoughts, and actions (Zelazo et al., 2003). These neurocognitive processes typically include inhibition, working memory (WM), and cognitive flexibility/task shifting (Blair & Razza, 2007). Of particular interest to the current study was preschoolers’ WM abilities. WM is typically conceptualized as the short-term retention of information during the active manipulation of such information (Baddeley, 1986; Gathercole, Pickering, Ambridge, & Wearing, 2004).

WM is composed of the central executive, which controls how resources are allocated between two subsystems: the visuospatial sketchpad and the phonological loop (Baddeley, 2007; Baddeley & Hitch, 1974; Swanson, 2011). Both verbal and spatial WM deficits have been implicated in children’s behavioral and academic functioning (Alloway, Gathercole, Kirkwood, & Elliott, 2009; Aronen, Vuontela, Steenari, Salmi, & Carlson, 2005; Gathercole, Brown, & Pickering, 2003). For example, children with better WM performance tend to score higher on academic achievement scores (Barker, 2016; Owens, Stevenson, Norgate, & Hadwin, 2008) and have better social outcomes (i.e., better liked by peers and teachers; de Wilde, Koot, & van Lier, 2016). More specifically, during the preschool period, spatial WM abilities are highly associated with performance on mathematical tasks because these tasks are underscored by the emerging ability to visually represent numbers (Rasmussen & Bisanz, 2005). Verbal WM abilities, on the other hand, are associated with language and early literacy skills (Blything & Cain, 2016). Hence, identifying factors that promote WM abilities in young children has significant implications for children’s school readiness (Tsetlin et al., 2012).

Working memory and language

Given the increased number of minority children in the U.S. population (Carlson & Meltzoff, 2008; La Greca, Silverman, & Lochman, 2009), more recent efforts have focused on the influence of language on the development of various executive functions, including WM, by comparing bilingual and monolingual children (Bialystok, 2011a, 2011b). A growing body of literature suggests that there is an association between neurocognitive factors and bilingualism. For example, a previous systematic review identified small to large positive effect sizes between bilingualism and several neurocognitive factors such as attentional control, metalinguistic awareness, and WM (Adesope, Lavin, Thompson, & Ungerleider, 2010). Furthermore, a study by Morales, Calvo, and Bialystok (2013) showed that 5-year-old bilingual children were comparable to 7-year-old monolingual children on their performance during a visuospatial WM task. More recently, Lonigan, Lerner, Goodrich, Farrington, and Allan (2016) found that preschoolers proficient in English and Spanish outperformed primarily Spanish-speaking preschoolers across several domains of EF such as inhibitory control and verbal WM. However, it is important to note that the literature does remain mixed given that several studies have not replicated similar benefits of bilingualism. For example, Namazi and Thordardottir (2010) found no differences in attentional control during a Simon task among children who were French–English bilinguals and those who spoke either only French or only English. In addition, a longitudinal study following children from kindergarten to second grade failed to find any benefits in verbal WM among children with prolonged exposure to a second language (Engel de Abreu, 2011).

Given the aforementioned mixed empirical evidence, it is not surprising that there are several mechanistic theories proposed to explain the link between bilingualism and neurocognitive functioning. On the one hand, children who are bilingual may have an underdeveloped phonological loop due to the difficulty in switching between languages (Bialystok, Luk, Peets, & Yang, 2010; Ivanova & Costa, 2008). On the other hand, from a multiple-resource model, the repeated rehearsal/switching between the dominant and secondary languages’ lexical schemas may enhance the central executive, arguably
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