Journal of Experimental Child Psychology 124 (2014) 124–131

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

Brief Report

Home sweet home: Does where you live matter to working memory and other cognitive skills?

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ARTICLE INFO

Article history:
Received 16 July 2013
Revised 15 November 2013
Available online 6 February 2014

Keywords:
Socioeconomic status (SES)
Learning outcomes
Working memory
Nonverbal IQ
Phonological awareness
Sentence memory

ABSTRACT

Learning outcomes are associated with a variety of environmental and cognitive factors, and the aim of the current study was to compare the predictive power of these factors in longitudinal outcomes. We recruited children in kindergarten and tested their learning outcomes 2 years later. In kindergarten, children completed tests of IQ, phonological awareness, and memory (sentence memory, short-term memory, and working memory). After 2 years, they took national assessments in reading, writing, and math. Working memory performance was not affected by socioeconomic status (SES), whereas IQ, phonological awareness, and sentence memory scores differed as a function of SES. A series of hierarchical regression analyses indicated that working memory and phonological awareness were better predictors of learning than any other factors tested, including SES. Educational implications include providing intervention during the early years to boost working memory and phonological awareness so as to prevent subsequent learning difficulties.

Introduction

Socioeconomic status (SES) has long been linked with school success (Brooks-Gunn & Duncan, 1997; Kagan, 1999; Kaplan et al., 2001). The income–achievement gap is evident in kindergarten and accelerates over time, with this relationship reportedly being as high as .80 (see Johnson, McGue, & Iacono, 2007). Students from economically disadvantaged families often achieve lower test scores

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http://dx.doi.org/10.1016/j.jecp.2013.11.012

and are more likely to drop out of school (Eamon, 2005; Hochschild, 2003) and are also at increased risk of developing language problems (Hoff, 2003).

In the current study, we investigated the link between SES and a key cognitive skill linked with learning—working memory. It is our ability to process and recall information (Baddeley, 1996; Cowan, 2006; Engle, Tuholski, Laughlin, & Conway, 1999), and it is linked to a range of cognitive activities during the school years, from reasoning tasks to verbal comprehension (see Cowan & Alloway, 2008, for a review). In typically developing children, working memory scores predicted reading achievement independent of measures of phonological skills (Swanson & Beebe-Frankenberger, 2004). Working memory is also linked to math outcomes; low working memory scores were closely related to poor performance on arithmetic word problems (Swanson & Sachse-Lee, 2001; see also Alloway & Passolunghi, 2011) and poor computational skills (Bull & Scerif, 2001; Geary, Hoard, & Hamson, 1999). Working memory skills at 5 years of age were an excellent predictor of academic success 6 years later (Alloway & Alloway, 2010).

Findings on the link between SES and working memory skills are mixed; some researchers report a differentiation of working memory performance as a function of SES levels (Noble, McCandliss, & Farah, 2007; Noble, Norman, & Farah, 2005), whereas others suggest that working memory is relatively impervious to such environmental influences. For example, children from low-SES areas in South America did not differ significantly from their middle-SES peers in some working memory tests, although their vocabulary scores, reflecting knowledge-based skills, were considerably worse (Engel, Heloisa Dos Santos, & Gathercole, 2008). Dutch researchers investigating differences between immigrant children who typically reside in low-income areas and comparatively wealthier native Dutch speakers found that the former group performed at the same level as their native Dutch peers in working memory tests when tested in their own native language (Messer, Leseman, Boom, & Mayo, 2010; see also Leseman, Scheele, Mayo, & Messer, 2007).

The disparities in SES patterns could be explained by sample age and working memory tasks. Sample age can affect findings; the chronic stress hypothesis suggests that the prolonged exposure to poverty can result in chronic stress, which in turn leads to reductions in working memory performance (Evans & Schamberg, 2009). Support for this hypothesis comes from comparing reports from younger samples with those from older participants. Studies with young populations reported that working memory was relatively unaffected by SES levels (with British 4- and 5-year-olds: Alloway, Gathercole, Willis, & Adams, 2004; with Brazilian 6- and 7-year-olds: Engel et al., 2008; with Dutch 4-year-olds: Messer et al., 2010). One exception is a study with first graders in New York City (Noble et al., 2005; Noble et al., 2007, discussed in detail below). On the other hand, studies with older samples found differences in spatial memory and the *n*-back task as a function of SES (with 17-year-olds: Evans & Schamberg, 2009; with 10- to 13-year-olds: Farah et al., 2006).

The tasks used to measure working memory can also affect findings, with some studies using tasks that are similar to short-term memory tasks (e.g., Noble et al., 2007). Such tasks do not involve any processing of information, which is reflective of working memory, and may rely more on knowledge structures (see Alloway, Gathercole, & Pickering, 2006). As a result, performance may be more sensitive to SES variations, which may account for Noble and colleagues' (2007) findings (see Farah et al., 2006, for further discussion).

Given the discrepancy in findings between SES and working memory, we wanted to explore this issue in more detail. The first aim was to investigate whether SES affects performance in working memory and other cognitive skills associated with learning outcomes, such as IQ and phonological awareness, at the critical time of school entry. We tested students during the first year of formal education, prior to any potential impact of poverty or chronic stress. The second research question was whether SES is a unique predictor of subsequent learning outcomes. We included national assessments in reading, writing, and math taken 2 years later.

There is extensive literature indicating that IQ scores predict academic achievement; the correlation between IQ scores and grade point average (GPA) is around .50 (see Neisser et al., 1996). However, IQ tests are sensitive to SES, such as maternal education level (Groth, 1975), caregivers' attitude toward education (Reynolds, Wilson, & Ramsey, 1999), and cultural differences (Brody & Flor, 1998), which can disadvantage students from lower income backgrounds.