Learning-related skills and academic achievement in academically at-risk first graders

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A B S T R A C T

Using an academically at-risk, ethnically diverse sample of 744 first-grade children, this study tested a multi-method (i.e., child performance measures, teacher ratings, and peer ratings) measurement model of learning-related skills (i.e., effortful control [EC], behavioral self-regulation [BSR], and social competence [SC]), and their shared and unique contributions to children's reading and math achievement, above the effect of demographic variables. The hypothesized correlated factor measurement model demonstrated relatively good fit, with BSR and SC correlated highly with one another and moderately with EC. When entered in separate regression equations, EC and BSR each predicted children's reading and math achievement; SC only predicted reading achievement. When considered simultaneously, neither EC, BSR, nor SC contributed independently to reading achievement; however, EC had a direct effect on math achievement and an indirect effect on reading achievement via both BSR and SC. Implications for research and early intervention efforts are discussed.

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Children who start school with poor literacy skills are at increased risk of low academic performance throughout their school careers (Alexander, Entwisle, & Horsey, 1997; Sonnenschein, Stapleton, & Benson, 2010). Poor learning-related skills (LRS) such as behavioral self-regulation, prosocial skills, and the ability to maintain and focus attention, are implicated in low academic readiness (Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003; Matthews, Kizzie, Rowley, & Cortina, 2010). Furthermore, minority and children from low income families are over-represented among children with low academic readiness skills and poor LRS (KewalRamani, Gilbertson, Fox, & Provasnik, 2007; Matthews et al., 2010). Given these facts, it is important to provide effective early interventions for children most at-risk for school failure. Selecting children for early intervention programs and assessing the success of these programs requires reliable and valid measures of LRS. The purpose of the current study is to test a multi-dimensional, multi-informant measurement model of LRS appropriate for use with first grade students with low academic readiness skills, and to determine the association between distinct dimensions of LRS and reading and math achievement.

Learning-related skills

An expanding body of research has demonstrated that children's LRS, which are also referred to as approaches to learning or learning-related behaviors, play an essential role in children's successful transition to school, and in children's academic achievement during the elementary school grades. Specifically, extant research shows that aspects of children's LRS are correlated with children's academic achievement in kindergarten and other elementary school grades (e.g., Howse et al., 2003; Malecki & Elliott, 2002; Ready, LoGerfo, Burkam, & Lee, 2005). Furthermore, aspects of children's LRS, measured in kindergarten, predict growth in children's academic achievement across the elementary school grades (e.g., Li-Grining, Votruba-Drzal, Maldonado-Carreño, & Haas, 2010; Matthews et al., 2010) above and beyond the contribution of potential confounding variables (e.g., child age, IQ, economic adversity status, maternal education level, and prior academic achievement).

A longitudinal study by McClelland, Acock, and Morrison (2006) is illustrative of studies finding links between LRS and achievement. Specifically, teachers' ratings of 538 children's LRS (i.e., responsibility, independence, cooperation, and self-regulation) at kindergarten significantly predicted original levels (i.e., intercept) of math and reading, as well as growth (i.e., slope) in math and reading, between kindergarten and second grade, above children's IQ, ethnicity, age, and maternal education. Additionally, Matthews et al. (2010) demonstrated the important role that LRS play in racial and gender differences in achievement. Using teacher reports of children's LRS (i.e., task persistence, attentiveness, learning independence, eagerness to learn, and organization) and a large nationally representative sample, Matthews et al. first confirmed prior reports of the academic underperformance of African American boys compared to their female and Caucasian peers. Furthermore, in assessing the extent to which these gender and race effects were affected by measured behavior/social factors (i.e., socioeconomic status, interpersonal skills, externalizing problem behaviors, home

literacy environment, and LRS), Matthews et al. found that LRS explained the most variance between gender and race literacy gaps. Additionally, LRS had the strongest effect on literacy achievement in kindergarten, and only LRS were significantly related to literacy growth through the fifth grade for all racial/ethnic and gender groups (i.e., African American and non-Hispanic White children).

It is clear that LRS are important child academic assets. However, the variety of measures grouped under the construct of LRS creates difficulty in comparing and integrating results of different studies. Although authors acknowledge the multi-dimensional nature of LRS, few studies have tested the shared and independent contributions of distinct dimensions of LRS to academic achievement. Given the breadth of child behaviors included under the broad construct of LRS, it is important to understand the relation among various measures and the shared and independent contribution of different dimensions of LRS to children's academic achievement. Next, various conceptualities of, and measurement approaches to, LRS are reviewed.

Defining and conceptualizing LRS

Scholars generally agree that LRS are recognizable behavioral patterns and characteristics that are exhibited by children as they partake in learning tasks and classroom interactions (Fantuzzo et al., 2007; McWayne, Fantuzzo, & McDermott, 2004). Throughout the psychological literature, LRS are viewed as emanating from executive functioning skills and reflecting the social and behavioral expression of such skills (Matthews et al., 2010; McClelland et al., 2006). Although scholars have yet to produce an agreed-upon list of LRS, LRS are often cited as involving the following skills: task persistence, following directions, receptiveness to challenges, organization, cooperation, prosocial behaviors, responsibility, learning/working independence, directed attention, flexibility, and ability to plan and problem-solve (Fantuzzo, Bulotsky-Shearer, Fusco, & McWayne, 2005; Malecki & Elliott, 2002; Matthews et al., 2010; McClelland et al., 2006; McWayne et al., 2004; Stipek, Newton, & Chudgar, 2010).

Consistent with the view that LRS represent a multi-dimensional construct, researchers have posited three distinct, yet interrelated dimensions: 1) effortful control; 2) behavioral self-regulation; and 3) social competence (Berhenke, Miller, Brown, Seifer, & Dickstein, 2011; Li-Grining et al., 2010; McClelland, Cameron, Wanless, & Murray, 2007). Each of these areas is briefly discussed below.

Effortful control (EC) is an important, temperamentally based predisposition that is essential to inhibitory control, a component of executive function. Generally, EC has been conceptualized as involving the abilities to enjoy activities of minimal intensity, to shift and focus attention in a deliberate manner, and to inhibit or initiate a response as required by particular circumstances (Gartstein, Putnam, & Rothbart, 2012; Putnam, Gartstein, & Rothbart, 2006). As in this study, some authors define EC in a more specific manner, specifying EC as "a temperamentally based ability to inhibit a dominant response and activate a subdominant response" (Murray & Kochanska, 2002, p. 503). Because EC permits individuals to voluntarily modulate their state of arousal and impulsive tendencies, behavioral rating scales of EC likely assess impulsivity and emotionality as well (Eisenberg, Smith, Sadovsky, & Spinrad, 2004). For these reasons, researchers recommend that child performance measures be used to assess EC (Diamond & Taylor, 1996; Eisenberg et al., 2004; Murray & Kochanska, 2002).

Some studies have demonstrated that children's EC has direct effects on their academic achievement in general (e.g., Blair & Razza, 2007; Liew, Barrois, McTigue, & Hughes, 2008; Obradović, 2010), whereas other studies (e.g., Lan, Legare, Ponitz, & Morrison, 2011) report that inhibition (to which EC plays an essential role) serves as a unique predictor of children's math skills, but not children's reading skills. A stronger connection between EC and math has been explained in terms of the fact that performing math calculations and problems is associated with activation of the prefrontal context, where EC is neurologically housed (Blair, Knipe, & Gamson, 2008).

Researchers have hypothesized that the ability to voluntarily inhibit a predominant response may be related to academic achievement via its effects on children's behavioral and emotional regulation (Eisenberg, Sadovsky, & Spinrad, 2005). Classrooms place significant demands on young children's self-regulatory abilities, as they must wait their turn, share with others, stay in their seat, monitor the accuracy of their work, manage emotions when provoked by peers, etc. Children who succeed in meeting these demands are better liked and achieve more. Consistent with this reasoning, EC has been described as "situated at the intersection of the temperament and behavioral regulation literatures" (Rothbart, Ellis, & Posner, 2004, p. 362) and as "underlying behavioral self-regulation" (Li-Grining et al., 2010, p. 1062). A number of studies have demonstrated that children's EC has indirect effects on their academic achievement through aspects of behavioral self-regulation and social competence (e.g., Neuenschwander, Röthlisberger, Cimeli, & Roebers, 2012; Valiente et al., 2011). For example, in a sample of 264 7- to 12-year-old children, Valiente, Lemery-Chalfant, Swanson, and Reiser (2008) found that social competence and aspects of behavioral self-regulation (i.e., classroom participation) partially mediated the effects of EC on change in achievement across one school year.

Behavioral self-regulation (BSR) entails the ability to apply executive function to behavioral doings (e.g., a child's ability to complete tasks, plan forthcoming tasks, and clean up after him or herself; Jahromi, Bryce, & Swanson, 2013; McClelland et al., 2007; Morrison, Ponitz, & McClelland, 2010). BSR is typically measured via behavioral ratings from parents (e.g., Jahromi et al., 2013) and teachers (e.g., Matthews et al., 2010; McClelland et al., 2006); although, peer sociometric measures (e.g., Wu, West, & Hughes, 2008), and direct observational measures (e.g., Greenwood, 1991) are also used. BSR has been shown to predict children's academic achievement above relevant covariates (e.g., DiPerna, Lei, & Reid, 2007; Howse et al., 2003).

Finally, a child's *social competence* (SC) may be broadly defined as the ability to incorporate cognition, behavior, and affect to attain constructive developmental outcomes and to successfully engage in particular social tasks (Conduct Problems Prevention Research Group, 1999; Weissberg & Greenberg, 1998). In addition, SC represents "the outward manifestation of both executive function and behavioral self-regulation, with a particular focus on social interactions" (McClelland et al., 2007, p. 91). McClelland et al. (2007) specify that SC is comprised of several components, including cooperation (i.e., prosocial behavior). Specifically, cooperation entails a child's ability to share, work, and play well with peers. Compared to EC and BSR, SC exists at the most contextualized level (i.e., the level that is the most responsive to aspects of the environment) of these three areas of focus in the study of LRS. Thus, like BSR, SC is often measured with parent (e.g., Valiente et al., 2008), teacher (e.g., Ponitz, McClelland, Matthews, & Morrison, 2009), and peer ratings (e.g., Zeller, Vannatta, Schafer, & Noll, 2003). Studies have also demonstrated the importance of SC to children's academic performance and transition to school (e.g., Malecki & Elliott, 2002; Welsh, Parke, Widaman, & O'Neil, 2001).

Scholars have also investigated the joint effects of BSR and SC components on children's academic success. For example, in a three-year longitudinal study of 671 elementary school children, Hughes, Luo, Kwok, and Loyd (2008) found that teachers' ratings of BSR (i.e., behavioral engagement in learning) predicted their academic achievement above the effects of previous levels of academic achievement and teacher-rated social competence (example items include "gets along well with other children," "tries to take advantage of others" (reverse scored), and "considerate and thoughtful"). However, children's SC failed to predict their academic achievement once previous levels of academic achievement and BSR were taken into account. These authors suggested that BSR and SC have their origins in temperament-based self-regulatory competence; however, "the aspects of self-regulatory competence that affect achievement are only those