Abstract Title Page

Title: Self-Regulation Predicts Both State and Trait Effects of Early Literacy

Authors and Affiliations: M. Paula Daneri, New York University
Background
Recent years have seen a resurgence of efforts to improve school readiness through early education programs. As greater investments are made in these programs, it is important to develop strong evidence about the factors that support early academic development. Theoretical models of school readiness point to self-regulation as central to a successful transition into elementary school (Shonkoff & Phillips, 2000). Self-regulation skills, which are related to the control of thoughts, emotions, and behaviors (Blair & Ursache, 2011), are foundational for adapting to and learning in the classroom (Blair & Raver, 2015). A broad empirical literature demonstrates positive correlations between self-regulation in preschool and kindergarten, and early academic abilities (Allan & Lonigan 2014; Yeniad, Malda, Mesman, van IJzendoorn, & Pieper, 2013).

Much of this prior work examining relations between self-regulation and academic ability is based on analyses of multiple regression on correlational data, which can only partially account for possible third variable effects. Even autoregressive models, which have become more popular as a way to examine relations between self-regulation and academic ability across time (e.g., Fuhs, Nesbitt, Farran, & Dong, 2014), are known to overestimate the strength of longitudinal relations (Berry & Willoughby, 2017). Bailey and colleagues (in press) recently proposed that modelling academic ability over time using latent state-trait models, which partition variance into longitudinally-stable and time-point specific components, may provide less biased estimates of longitudinal relations than commonly used models like multiple regression and autoregressive models. In their analyses, Bailey and colleagues (in press) showed that correlations between state effects of math ability over time in a state-trait model closely approximated effect sizes from a math intervention, whereas estimates from autoregressive paths were much larger.

Thus far, Bailey and colleagues’ work on latent state-trait models has focused solely on academic ability. In the current study we extend this literature by examining the effect of self-regulation, a factor theorized to support early academic ability, on latent and state effects of literacy from kindergarten through first grade. By modelling literacy within the latent state-trait framework, we arrive at less biased estimates of the relation between early self-regulation and later literacy, a much needed area of inquiry in the field of self-regulation (Jacob & Parkinson, 2015).

Research Question
In the current study, we examine whether self-regulation at kindergarten entry predicts trait literacy and state literacy in the spring of kindergarten and first grade.

Participants
Participants for this study included a nationally representative sample of 18,174 children who participated in the Early Childhood Longitudinal Study-Kindergarten (ECLS-K) Class of 2010-2011.

Research Design
Data for the ECLS-K were collected through teacher surveys and direct child assessments.

Self-Regulation. Teachers completed three self-regulation scales for each child in the fall of kindergarten. One was Approaches to Learning, which consists of seven items pertaining to
children’s learning behaviors in the classroom, such as following classroom rules. Teachers also completed two subscales from the Children’s Behavior Questionnaire (CBQ; Putnam & Rothbart, 2006): inhibitory control, which consists of six items such as moves from one task to another without finishing any of them; and attentional focusing, which consists of six items such as is easily distracted when listening to a story. All three scales showed high internal reliability at all three time points (α > .87).

**Literacy.** Students completed direct assessments of literacy in the fall of kindergarten, spring of kindergarten, fall of first grade, and spring of first grade. The literacy assessment measured a variety of skills, including vocabulary, letter recognition, phonological awareness, and reading comprehension. All children completed the first 20 items of the assessment, and based on their performance on those items were routed to complete another set of either easy, medium, or difficult items. The literacy assessment was scored using item response theory (IRT) to account for the fact that students received items of varying difficulty levels. The literacy assessment showed high reliability across each wave of data collection (θ = .93 - .95).

**Analysis Plan**

We first modelled a latent variable of self-regulation using the three scales and separately modelled literacy from fall of kindergarten to spring of first grade using the latent state-trait model. Then, we examined whether self-regulation at kindergarten entry predicted trait effects of literacy, as well as state effects at subsequent time points. All analyses were completed in Mplus 8.0 using Full Information Maximum Likelihood (FIML) to deal with missing data and cluster-robust standard errors to account for the fact that children were nested within classrooms.

**Results**

As shown in Figure 1, the latent model of self-regulation was just identified; therefore, we could not examine model fit. Loadings for the three self-regulation scales, however, were high (β = .89 - .91), suggesting they all load strongly on the latent variable. The latent state-trait model of literacy, shown in Figure 2, fit the data well, $\chi^2 (1) = 72.427, p < .001; \text{CFI} = .99, \text{RMSEA} = .066 \text{[.054, .080]}. \text{Trait accounted for 59% to 30% of the variance in literacy at each time point.}$

In our final model we predicted literacy from latent self-regulation at kindergarten entry. As shown in Figure 3, self-regulation predicted trait effect of literacy, $\beta = .38, p < .001,$ and state effects at each subsequent time point ($\beta$s = .06 - .11, $p < .001$).

**Conclusion**

The current study examined the relation between self-regulation and literacy in early elementary school. We found that even when accounting for longitudinally-stable sources of variance on literacy across kindergarten and first grade, self-regulation at kindergarten entry predicted literacy at subsequent time points. Effect sizes were small, however, suggesting that prior correlational studies may have overestimated the strength of this relation (Allan & Lonigan, 2014). These findings are supported by the small effects of self-regulation interventions on literacy (Blair & Raver, 2014).

In the future, we plan on building upon these analyses in two ways: 1) we will examine associations between self-regulation and math using a latent state-trait model, and 2) we will examine whether the association between early self-regulation and later academic ability holds when accounting for later self-regulation ability.
References


Figure 1. Latent model of self-regulation at Kindergarten entry

\[
\chi^2 (0) = 0, \ p < .001; \ CFI = 1.0, \ RMSEA = .000
\]
Figure 2. Latent state-trait model of literacy

χ² (1) = 72.427, p < .001; CFI = .99, RMSEA = .066 [.054, .080]
Figure 3. Predicting Literacy from Self-Regulation at Kindergarten Entry

\[ \chi^2 (8) = 269, p < .001; \text{CFI} = .99, \text{RMSEA} = .045 \ [0.040, 0.049] \]