The Impact of Approaches to Learning on Early Academic Performance

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Purpose

This study examines the association between approaches to learning (ATL) and academic performance within and across elementary school grades using a recent longitudinal dataset (Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 - ECLS-K 2011). The purpose of this study is to investigate two research questions:

(1) How do changes in students' ATL relate to changes in reading and mathematics achievement in kindergarten, first or second grade?

(2) Is ATL associated with reading and mathematics achievement over time (from kindergarten through fourth grade)?

Literature

ATL indicate students' behaviors, strategies and attitudes in learning or educational tasks with components such as self-regulation, persistence and attentiveness (Li-Grining, Votruba-Drzal, Maldonado- Carreño, & Haas, 2010). There is an increasing interest to investigate the importance of these learning-related skills for students, especially in early childhood.

Existing research has found learning-related behaviors predict a large proportion of the variation of school success (McDermott, Leigh, & Perry, 2002). ATL are strongly related to kindergarten retention (Hong & Raudenbush, 2005) and are one of the most important school readiness indicators (Eisenberg, Valiente, & Eggum, 2010).

More importantly, an individual's learning ability relates to his or her academic outcomes. Previous research has shown ATL successfully predicts student achievement (McClelland et al., 2014; McWayne, Fantuzzo, & McDermott, 2004). Li-Grining and colleagues (2010) found a positive association between ATL and reading and mathematics achievement from kindergarten to fifth grade. Hong and Yu's (2007) reported that higher ATL ratings are related with higher academic outcomes in reading and mathematics.

Data

ECLS-K is a longitudinal survey that has collected data from children, their families, teacher, and schools across the U.S. Students were tracked from kindergarten through fifth grade. From kindergarten to second grade data were collected both in fall and spring. Staring at third grade students were only measured in the spring.

Variables
Children's reading and mathematics IRT scores are the dependent variables.

The main independent variable (ATL) is a teacher reported variable that consists of seven items about students: keeps belongings organized; shows eagerness to learn new things; works independently; easily adapts to changes in routine; persists in completing tasks; pays attention well and follows classroom rules. A four-point Likert scale was used for each item (never (1), sometimes (2), often (3), very often (4)). Higher scale scores indicate positive learning behaviors (Tourangeau et al., 2018). The ATL variable was constructed by ECLS-K.

Student fixed effects estimation was used to analyze the data to take into account the influence of time-constant variables. Appropriate time-varying variables were included in the estimation as control variables (e.g., Body Mass Index - BMI). In the across-grade analysis (K-4), parental involvement, teacher (i.e., certification, education) and school (i.e., enrollment and

composition) variables were also included in the model. Whether students changed schools was also controlled for.

Statistical Analysis

Student fixed effects estimation diminishes selection bias due to unobserved individual time-constant variables (Wooldridge, 2010). The fixed effects analysis produces coefficients of interest (e.g., ATL) where the impact of the time-invariant variables is removed. The estimation is appropriate for panel data.

To address the first research question fixed effects for two time periods (fall and spring within a grade) was used. The dependent variable is the change in reading or mathematics between fall and spring and the independent variables are the changes in ATL, BMI, and changing schools between fall and spring (within a grade). This approach controls for all time-constant individual effects. Past changes in ATL were added in some models to examine lagged effects.

To address the second research question fixed effects for five time points (K-4 spring assessments) was used. Time dummies were included to account for aggregate changes over time (the reference group was spring kindergarten). Past ATL variables were added in some models to examine lagged effects. All analyses produced clustered and robust standard errors to correct for heteroskedasticity and dependency in the residuals.

Results

The results are summarized in Tables 1-5. Within-grade results are reported in Tables 1 and 2. In Table 1 the ATL estimate indicates that changes in ATL significantly impacted changes in reading and mathematics in grades K-2, the only exception being in first grade mathematics. The coefficients of ATL are larger in reading than in mathematics in all three grades, which indicated a stronger association between changes in ATL and changes in reading achievement. This result may be due to ATL having a stronger connection with reading performance, such as attention.

Within-grade results that indicate lagged effects are reported in Table 2. In the second grade, changes in ATL in first grade were significantly related to both reading and mathematics net of the effects of changes in ATL in grade 2. Thus, there is evidence of lagged effects from first grade.

Across-grade results are reported in Tables 3-5. In Table 3 results show a significant association between ATL and reading and mathematics. Higher scores in ATL lead to higher achievement performance from kindergarten to fourth grade. Again, the relationship between ATL and reading achievement is stronger than that in mathematics. Table 4 shows that past (one time period) ATL measures are significantly related both to reading and mathematics achievement in the presence of current ATL measures. This is evidence of lagged ATL effects. When past (two time periods) ATL measures were added in the model prior grade ATL measures were positively and significantly associated with reading and mathematics achievement in the presence of current ATL measures. As a result, there is evidence of lagged effects from the previous grade. Lagged effects past two time periods (two grades) were observed in mathematics achievement, but not in reading. These findings to some extent suggest that ATL has a persistent effect on students' early academic performance.

In conclusion, ATL is an important predictor of student academic performance in early grades. The impact of ATL on reading is stronger than the impact on mathematics. Past ATL measures influence current achievement to a degree. Our findings suggest the importance of helping/training students build good learning skills in early grades.

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Tables

Table 1. Within-Grade Estimation

	Kindergarten Achievement Gain		Subsample K Achievement Gain		First Grade Achievement Gain		Second Grade Achievement Gain	
	Reading	Mathematics	Reading	Mathematics	Reading	Mathematics	Reading	Mathematics
ATL Change	1.678*	1.189*	1.534*	1.160*	1.833*	0.521	1.244*	0.671*
	(0.132)	(0.121)	(0.236)	(0.220)	(0.331)	(0.311)	(0.256)	(0.272)
BMI Change	−0.082	0.044	−0.191	0.185	0.010	0.096	−0.034	−0.116
	(0.065)	(0.060)	(0.120)	(0.112)	(0.141)	(0.133)	(0.086)	(0.091)
School Change	1.289*	1.627*	0.637	2.539*	−0.678	−1.326	−2.601	3.521
	(0.568)	(0.520)	(1.363)	(1.271)	(0.774)	(0.727)	(4.306)	(4.568)
N of Observation	13589		4101		3845		3651	

$p^* < .05$. Standard Error is shown in the bracket.

Table 2. Within-Grade Estimation with Lagged ATL Change

	First Grade Achievement Gain		Second Grade Achievement Gain		Second Grade Achievement Gain	
	Reading	Mathematics	Reading	Mathematics	Reading	Mathematics
2nd ATL Change			1.336* (0.266)	0.677* (0.281)	1.430* (0.278)	0.476 (0.292)
1st ATL Change	1.819* (0.342)	0.482 (0.321)	−0.588* (0.270)	0.584* (0.285)	−0.636* (0.279)	0.624* (0.293)
K ATL Change	0.396 (0.316)	0.242 (0.298)			0.086 (0.254)	0.272 (0.267)
BMI Change	0.079 (0.146)	0.085 (0.137)	−0.031 (0.090)	−0.124 (0.095)	−0.024 (0.095)	−0.130 (0.100)
School Change	−0.753 (0.808)	−0.798 (0.760)				
N of Observation	3586		3377		3161	

$p^* < .05$. Standard Error is shown in the bracket.

Table 3. Across-Grade Estimation

	Reading Achievement	Mathematics Achievement
Approaches to Learning (ATL)	1.311* (0.103)	0.760* (0.093)
BMI	−0.001 (0.035)	−0.118* (0.032)
Parent Involvement	−0.054 (0.070)	0.068 (0.064)
Teacher's Certification	0.011 (0.069)	0.057 (0.062)
Teacher's Highest Degree	0.233* (0.091)	0.106 (0.086)
School Enrollment	−0.081 (0.103)	−0.144 (0.110)
Percent of Non-White Students in School	0.028 (0.147)	0.110 (0.130)
School Change	−0.234 (0.248)	0.661* (0.226)
Individual Fixed Effects	63.843* (0.849)	49.461* (0.766)
Time Dummies (Reference group: kindergarten spring)		
$D_{1spring}$	25.715* (0.132)	24.343* (0.122)
$D_{2spring}$	39.973* (0.142)	41.302* (0.130)
$D_{3spring}$	49.177* (0.163)	53.263* (0.144)
$D_{4spring}$	55.198* (0.170)	60.860* (0.159)
N of Observation in each time period	6448	

$p^* < .05$. Clustered robust standard error is shown in the bracket.

Table 4. Across-Grade Estimation with One Lagged ATL

	Reading Achievement	Mathematics Achievement
Approaches to Learning (ATL)	1.078*	0.628*
	(0.116)	(0.106)
L1.ATL	0.435*	0.443*
	(0.113)	(0.106)
BMI	0.065	−0.023
	(0.039)	(0.037)
Parent Involvement	−0.068	0.116
	(0.075)	(0.070)
Teacher's Certification	−0.013	0.021
	(0.073)	(0.067)
Teacher's Highest Degree	0.110	0.135
	(0.098)	(0.094)
School Enrollment	−0.164	−0.152
	(0.108)	(0.101)
Percent of Non-White Students in School	0.115	0.055
	(0.157)	(0.144)
School Change	−0.569*	0.326
	(0.258)	(0.237)
Individual Fixed Effects	88.146*	71.242*
	(1.058)	(0.981)
Time Dummies (Reference group: first grade spring)		
$D_{2spring}$	14.224*	16.901*
	(0.116)	(0.117)
$D_{3spring}$	23.388*	28.800*
	(0.149)	(0.137)
$D_{4spring}$	29.357*	36.319*
	(0.163)	(0.157)
N of Observation in each time period	6448	

$p^* < .05$. Clustered robust standard error is shown in the bracket.

Table 5. Across-Grade Estimation with Two Lagged ATL

	Reading Achievement	Mathematics Achievement
Approaches to Learning (ATL)	0.773*	0.639*
	(0.126)	(0.116)
L1.ATL	0.459*	0.495*
	(0.130)	(0.126)
L2.ATL	0.179	0.325*
	(0.124)	(0.118)
BMI	−0.004	−0.024
	(0.041)	(0.041)
Parent Involvement	−0.060	0.171*
	(0.080)	(0.073)
Teacher's Certification	0.037	0.041
	(0.079)	(0.070)
Teacher's Highest Degree	−0.028	0.112
	(0.091)	(0.099)
School Enrollment	−0.134	−0.029
	(0.106)	(0.099)
Percent of Non-White Students in School	−0.143	−0.134
	(0.171)	(0.150)
School Change	−0.117	0.462
	(0.285)	(0.248)
Individual Fixed Effects	104.481*	86.815*
	(1.281)	(1.225)
Time Dummies (Reference group: second grade spring)		
$D_{3spring}$	9.200*	11.903*
	(0.110)	(0.100)
$D_{4spring}$	15.247*	19.30*
	(0.124)	(0.120)
N of Observation in each time period	6448	

$p^* < .05$. Clustered robust standard error is shown in the bracket.