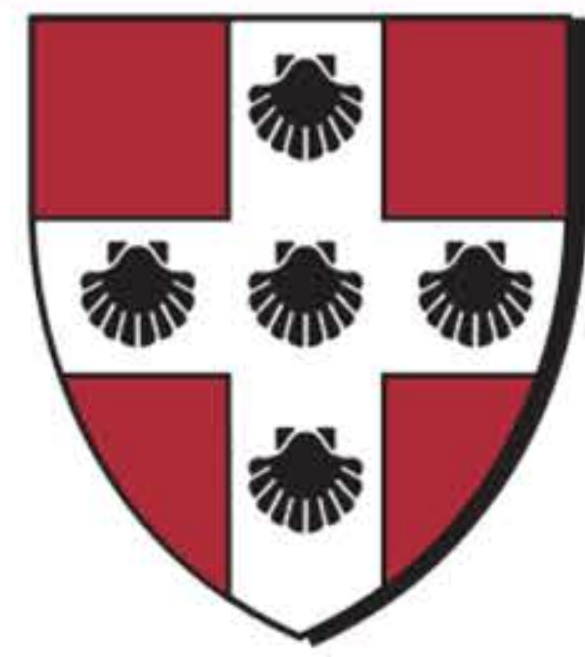


# Time to Learn: How instructional time affects student achievement

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## Introduction

In a time when America is pushing to reform its education system, President Obama and Secretary of Education Arne Duncan have emphasized that increased instructional time can be a useful tool in turning around low-performing schools. In fact, increasing learning time is required for all schools that are using transformation and turnaround SIG (School Improvement Grant) models. However, this is not a new idea: both *A Nation at Risk* (1983) and *Prisoners of Time* (1994) argued for increased instructional time in America’s schools.

Several recent studies have been conducted arguing that increased instructional time positively affects student achievement (Dobbie and Fryer 2011, Farbman and Kaplan 2005, Hoxby and Murarka 2008, etc.). However, what few of these studies look at is specifically *who* benefits from increased instructional time. Our study looks at the relationship between the achievement gap and increased instructional time. Can increasing instructional time have an effect on closing the achievement gap?

## Data and Methods

The data used in this study are taken from the Early Childhood Longitudinal Study (ECLS) kindergarten class of 1998-99 cohort. This is a nationally representative sample of children that were studied from kindergarten through eighth grade.

The main independent variables in this study are total amount of time per week that students spend on math and total amount of time per week that students spend on reading. We also created variables to look at the interaction effect of SES and time for both math and reading.

The key independent variables in our study are math IRT scores and reading IRT scores for waves 2, 4, 5, and 6. These variables were taken directly from the ECLS dataset. These variables, in addition to the math and reading IRT scores from wave 1 (fall kindergarten), were then used to create IRT gain score variables.

We divided the covariates in our study into four blocks based on the type of variable. The first block includes variables related to school and neighborhood characteristics, the second block is teacher characteristics, the third block is student and family characteristics, not including socioeconomic status, and the fourth block is socioeconomic status of the family.

Initially we conducted a set of OLS regressions to look at the relationship between time and math and reading achievement. This was done using both spring IRT scores and the gain scores that we created. Because our dataset had many missing observations, we performed multiple imputation in order to increase the sample. Using this larger dataset, we created multi-level models, nesting students within classrooms within schools.

## Results

Wave 2: Kindergarten IRT Math Gain Scores

	Time with no covariates (2)	Time with student-level SES (3)	Time with school and student-level SES (4)	Time with student-level SES and controls (5)	Time with school and student-level SES and controls (6)
Time for math instruction	.00001794** [6.54e-06]	.00002226*** [6.37e-06]	.00002373*** [6.40e-06]	.00002733*** [6.49e-06]	.00002736*** [6.50e-06]
Student-level SES		.94018137*** [.0799273]	.83913545*** [.0883175]	.29003595* [.1348308]	.28421713* [.1352103]
Mean school SES			.47723593** [.1722954]		.06814297 [.2337933]
Intercept	9.9730324***	9.891517***	9.869378***	8.4104192***	8.4300822***
BIC	113192.484	113018.816	113019.006	113258.448	113266.042
N	17295	17295	17295	17295	17295

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Wave 4: Grade 1 IRT Math Gain Scores

Time for math instruction	.00002392* [.0000118]	.00003176** [.0000116]	.00003356** [.0000117]	.00003577** [.0000119]	.00003558** [.0000119]
Student-level SES		2.1226055*** [.1166557]	1.8244939*** [.1395811]	.98422838*** [.2396153]	.89861184*** [.2429585]
Mean school SES			1.0509236*** [.2500022]		.53604311 [.324842]
Intercept	23.689746***	23.543761***	23.534912***	18.26699***	18.511694***
BIC	131358.292	131004.78	130996.91	131097.958	131105.244
N	17404	17404	17404	17404	17404

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Wave 5: Grade 3 IRT Math Gain Scores

Time for math instruction	.0000271 [.000015]	.00003974** [.0000143]	.00004485** [.0000144]	00003563* [.000015]	.00003506* [.0000149]
Student-level SES		3.0985871*** [.1446711]	2.4551825*** [.1767491]	1.8146806*** [.368711]	1.5159238*** [.3671591]
Mean school SES			1.8938186*** [.3145458]		1.5201746*** [.3678353]
Intercept	33.121299***	32.968858***	32.917949***	28.68707***	29.016616***
BIC	121026.604	120581.162	120548.886	120630.122	120620.648
N	15163	15163	15163	15163	15163

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Wave 6: Grade 5 IRT Math Gain Scores

Time for math instruction	.00006592*** [.0000196]	.0000686*** [.0000198]	.00006684*** [.00002]	.00006868*** [.0000206]	.00006866*** [.0000206]
Student-level SES		.25616623 [.2046714]	.38922299 [.2681482]	-.02987485 [.4045338]	-.02667609 [.4219219]
Mean school SES			-.30926993 [.3829715]		-.01282483 [.4686739]
Intercept	19.604828***	19.545069***	19.579412***	10.054407***	10.046657***
BIC	40670.4334	40677.1246	40684.4736	40964.7348	40973.0584
N	5389	5389	5389	5389	5389

\*p<0.05, \*\*p<0.01, \*\*\*p<0.001

Notes:  
-Models 5 & 6 control for school & neighborhood characteristics, teacher characteristics, and student & family characteristics.  
-Standard error in brackets  
-The boxed model represents the best fit model

## Conclusions

Our initial OLS models found no effect of time on student achievement. When we looked at an interaction effect between SES and time in an OLS regression, there were no statistically significant findings. However, further investigation found a suppressor effect of socio-economic status (SES) and time. Once we controlled for SES, we saw that time had a positive effect on student achievement. This can perhaps be explained by the fact that schools serving low-SES students likely have more instructional time than schools serving high-SES students.

When looking at the multi-level models for the math gain score variables, time for math instruction was positively associated with math gain scores in waves 2 and 4. When controlling for student-level SES, the time coefficients were slightly higher; they increased slightly again when adding in a control for school-level SES. These were all very statistically significant findings as the p-values were quite low. The same held true for wave 5, although the only statistically significant findings were in models 3 and 4 (which controlled for student-level SES and then added in school-level SES).

In wave 6, the time coefficient increased slightly when controlling for school-level SES (although it was still higher than when no controls were present). The coefficients rose again when controlling for the covariates. All of the wave 6 math models had p-values of less than 0.001, making the findings extremely statistically significant.

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