Abstract Title Page
Not included in page count.

Title: Examining the role of early academic and non-cognitive skills as mediators of the effects of City Connects on middle school academic outcomes

Authors and Affiliation: Laura M. O'Dwyer**,** Terrence Lee -St. John, Anastasia E. Raczek, Diego A. Luna Bazaldua, Mary Walsh; Boston College

Email Addresses: laura.odwyer@bc.edu; tjleestjohn@gmail.com; raczek@bc.edu; mary.walsh@bc.edu

Abstract Body

Limit 4 pages single-spaced.

Background / Context

Out-of-school factors can significantly impact students' readiness to learn and thrive in school. Research confirms that larger social structures and contexts beyond the school are critical, accounting for up to two-thirds of the variance in student achievement (Coleman et al., 1966; Rothstein, 2010; Phillips, Brooks-Gunn, Duncan, Klebanov, & Crane, 1998; Leventhal & Brooks-Gunn, 2000). These out-of-school factors can be particularly pernicious in the context of poverty. For children living in poverty, limited resources and chronic stressors can result in poor attendance, high mobility, social-emotional dysfunction, and lack of readiness for school (Dearing, 2008). Even in the face of significant family strengths (Strauss, 2013), poverty can limit families' abilities to invest money, time and energy in children's growth and expose children to chaos and environmental contagions (Brooks-Gunn & Duncan, 1997; Evans, 2004). Many have argued that schools cannot hope to close the achievement gap without addressing out-of-school factors (Berliner 2013; Bryk, et al., 2010).

Historically, schools have addressed some of these factors through the work of school nurses, counselors, social workers, and psychologists, but student support has varied widely, without a standardized set of practices (Lean & Colucci, 2010). The research described here was conducted as part of the evaluation of City Connects, a theoretically-guided, evidence-based approach to addressing out-of-school barriers to achievement and thriving in high-poverty urban elementary schools. City Connects is grounded in best practices for systematizing student support work (Marx, Wooley & Northrop 1998; Adelman & Taylor 2006) and guided by contemporary understandings of child development (Masten 2001; Bronfenbrenner & Morris 1998; Eccles, Alexander, & Entwisle, 1988). This intervention is: (a) systemic, optimizing resources and structures already present in the school, making student support a codified and core function that permeates the work of a school; and (b) tailored, identifying each and every student's strengths and needs in academic, social-emotional, physical and family domains and leveraging community-based services aligned with these strengths and needs.

City Connects is currently implemented in 72 schools across four states. Quasi-experimental studies have found that, on average, children who attended City Connects schools outperform comparison peers never enrolled in City Connects in school grades and standardized achievement test scores in English Language Arts and Mathematics (Walsh, et al., 2014). First generation immigrant students who enrolled in City Connects schools have higher standardized test scores compared to their counterparts in non-intervention schools (Dearing et al., 2015).

Purpose / Objective / Research Question / Focus of Study

This study extends prior research by examining the mechanisms that lead to the positive impact of City Connects on later academic achievement. The research question is: *Are the positive effects of City Connects on student academic achievement (standardized test scores) mediated by students' early academic and non-cognitive skills (effort, behavior, work habits)?*

Setting

The setting is the Boston Public School (BPS) district, drawing on data from school years 2001-02 through 2012-13. During these years, the intervention was implemented in 18 elementary and K-8 schools in several geographic areas across the city; all other elementary and

K-8 schools in the district serve as comparisons. Among students in BPS elementary and K-8 schools, about 90% are students of color, with over 80% eligible for free or reduced-price lunch.

Population / Participants / Subjects

The treatment sample with complete data in the mediators and outcomes for this study consists of 14 elementary/K-8 schools that implemented City Connects, and 3,384 students enrolled in those schools at any point during grades K-5. The comparison sample includes all 66 non-City Connects elementary/K-8 schools in the district, and 17,368 students who were never enrolled in a City Connects school. The two samples have similar proportions of males, students with special educational needs and students eligible for reduced-price lunch. See Table 1 for school-level sample characteristics.

Intervention / Program / Practice

City Connects has developed a systemic practice and school-based infrastructure to link students and schools with services and enrichments provided by community agencies and the school district. A full-time Coordinator in each school (Masters'-trained, licensed school counselor or social worker) meets every year with each classroom teacher in a school to discuss every student in his or her class. The review conversations draw on guiding questions that focus on student strengths and needs across four developmental domains (academic, social/emotional/behavioral, health, and family). Based on these strengths and needs, the coordinator connects each student with a tailored set of supports and services. Using a secure web-based tool, the coordinator records and tracks student service plans. Specific providers are identified based on factors such as service type, ages served, geographic location, and family capacity to support participation. Coordinators monitor service quality and fit, maintain partnerships with community service providers, and serve as a point of contact for families. A documented, standardized set of practices and fidelity tools guide implementation across sites.

Research Design

In this study, outcomes for City Connects and comparable non-treatment schools were compared in an Average Treatment Effect on the Treated (ATT) estimation strategy. First, to examine the likelihood that selection effects bias school-level treatment estimates, treatment and comparison schools were compared across a number of observed demographic variables correlated with achievement. Standardized bias statistics were calculated as the group difference in mean proportions divided by the standard deviation of the treatment group (Harder, Stuart, & Anthony, 2010). School-level ATT propensity weights (Cook & Steiner, 2010; Guo &Fraser, 2010; Steiner & Kim, 2015) were then calculated via a main effects logistic regression in the manner discussed by Hirano and Imbens (2001) and applied to the analytic sample; covariate balance was then re-calculated. Individual-level treatment and comparison school characteristics were compared to determine whether student-level propensity weights would also be required, but the weighted standardized bias estimates (see Table 1) indicated that the samples were balanced once school-level ATT weights were applied.

Multi-level models building on a series of steps from elementary school participation in City Connects to elementary academic and non-cognitive skills and to middle-school achievement outcomes were estimated to examine mediation pathways (Baron & Kenney, 1986; MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002; Rucker, Preacher, Tormala, & Petty, 2011).

Data Collection and Analysis

Data are drawn from a district longitudinal dataset made available by BPS, and span school years 2001-02 through 2013-14. The analysis uses middle school outcome data from students who were also enrolled in the district during elementary school. Figure 1 displays the structure of available data. School year is shown along the vertical axis and Cohort year (school year enrolled in kindergarten) is shown along the horizontal axis. Each cell value displays the grade level of available data. The analytic sample for this study is restricted to students from cohorts 2001-02 through 2005-06 because they could have participated in City Connects during K-5th grade and have 8th grade outcome data by 2013-14.

Measures. The hypothesized mediators, academic and non-cognitive skills at grade 5, are measured by teacher-rated report card scores in math, reading, writing, effort, academic work habits, and classroom behavior. Each teacher rating is represented by a multi-item scale of all items in that domain from the district-wide report card, summed to produce a total score. Grade 8 student achievement is measured by scores on the standardized Massachusetts Comprehensive Assessment System, required of all public school students. Student raw test scores were standardized to a mean of 0 and a standard deviation of 1 by subject, grade, and school year using means and standard deviations for the total sample. Due to student mobility and school closings, treatment students were exposed to the intervention for varying amounts of time and at different grades, so analyses also account for student-level variation in treatment exposure.

Analysis Methods. To investigate the mediating role of grade 5 skills in the relationship between participation in City Connects and scores on the grade 8 statewide test, we used multilevel regression modeling (Baron & Kenny, 1986; MacKinnon et al., 2002; Shrout & Bolger, 2002; Kenny et al., 2003; Bauer, Preacher, & Gil, 2006; McKinnon & Dwyer, 1993). In addition, we calculated the Aroian version of the Sobel test statistic for testing the significance of the indirect effect (Krull & MacKinnon, 1999). This approach allowed us to correctly model the dependence among students' scores (Raudenbush & Bryk, 2002) and to examine whether student-level non-cognitive measures and skills mediate the relationship between schools' participation in the intervention and student test scores (Krull & MacKinnon, 1999, 2001; Kenny, Korchmaros, & Bolger, 2003). Figure 2 summarizes the mediation model and the statistical models used to test mediation effects.

In Model 1, we regressed the hypothesized mediators on a dichotomous variable indicating school treatment status (City Connects = 1, Comparison = 0) to estimate path *a*. An indicator for number of years in City Connects, or "dosage," was included at the student level. Other student-level covariates were gender, race, free/reduced price lunch eligibility, English Language Learner, Special Education, and foreign-born. In all models, the relationship between hypothesized mediators and achievement was fixed across schools. In Model 2, we regressed students' grade 8 mathematics scores on the City Connects participation indicator to estimate path *c*, the total effect. Covariates were also included in the model. Finally, in Model 3 we added the hypothesized student-level mediators to the previous model as a predictor to estimate path *b*. The large sample size increases the chance of seeing significance even for small differences, therefore, our discussion will focus on effect sizes (coefficient significance levels will be presented).

Findings / Results

Table 1 presents sample characteristics and corresponding unadjusted and post-weighting standardized bias statistics. Prior to adjustment, represented in Table 1 under "Unadjusted Standardized Bias," covariate imbalance existed across treatment and comparison schools on the

percent of Asian and percent of English Language Learners. The ATT weights substantially reduced bias across all cells ("Weighted Standardized Bias" column in Table 1). After weighting, all standardized bias statistics were less than 0.05 standard deviations, a degree of balance that does not require further covariate adjustment per standards (What Works Clearinghouse, 2014). Due to space considerations, we present results for 8th grade mathematics outcomes; ELA results had similar patterns, although effect sizes were smaller. For mathematics, 10.4% of the variability in grade 8 test scores lies between schools and is predicted by the participation in City Connects.

Predicting Hypothesized Mediators: Model 1. Tables 2 and 3 present regression coefficients and associated standard errors when the school-level treatment indicator, student level treatment dosage measure, and student covariates were combined to predict hypothesized mediators. The regression coefficients of the student dosage variable indicate that students in City Connects schools were predicted to have significantly higher grade 5 math, reading, writing and effort scores than students in non- City Connects schools. After controlling for student covariates, standardized differences ranged from 0.01 to 0.04 standard deviations for each year the student was in a City Connects school. School-level treatment was not found to be an statistically significant predictor of the mediators.

Predicting Achievement: Models 2 and 3. Table 4 presents the results when grade 8 achievement in mathematics was predicted using the indicator of students' dosage at the student level and schools' participation in City Connects (Model 2). After controlling for student-level covariates, there was a 0.15 standard deviation difference between grade 8 mathematics scores for students in City Connects schools and students in non- City Connects school ($p < 0.01$).

In Model 3, the hypothesized mediators were added, one at a time, to estimate Paths *b* and *c'* (MacKinnon, et al., 2002; Kenny, et al, 2003; MacKinnon, 2008). The results are shown in Tables 5 and 6. The results indicate that, holding all other variables in the model constant, each of the grade 5 hypothesized mediators were positive predictors of students' grade 8 mathematics scores (Path *b*). However, the predicted standardized difference in achievement between City Connects schools and non-treatment schools is not reduced after controlling for each of the hypothesized mediators and student covariates in the model; the conditional 0.15 standard deviation difference between City Connects and non-City Connects schools observed in Model 2 was not attenuated when the hypothesized mediators were added in Model 3. In addition, the student-level does becomes not significant in Models 2 and 3. Since the hypothesized mediators are fixed across schools, the total effect (*c*) equals the direct effect (*c'*) plus the indirect effect (*ab*) or $c = c' + ab$.

Path *a* and Path *b* coefficients are summarized in Table 7, along with the Aroian version of the Sobel test for the significance of the indirect effect of the City Connects intervention through the hypothesized mediators. For grade 5 mathematics, reading, and writing report card scores, and for grade 5 effort scores, the test statistics were not significantly different from zero. Against our original hypothesis, these results indicate that the indirect effect of City Connects on mathematics achievement through the grade 5 academic measures and through effort are not significantly different from zero.

Conclusions

Despite the mediation hypothesis was not confirmed by the data at hand, the study provides evidence that with high-quality elementary school student support, early academic and non-cognitive skills lead to later achievement. Moreover, the application of school-level weights is a novel approach for addressing selection threats at the school level.

Appendices

Not included in page count.

Appendix A. References

References are to be in APA version 6 format.

Adelman, H. & Taylor, L. (2006). The implementation guide to student learning supports in the classroom and schoolwide: New directions for addressing barriers to learning. Thousand Oaks, CA: Sage Publications.

Alexander, K. L., & Entwisle, D. R. (1988). Achievement in the first two years of school: Patterns and processes. *Monographs of the Society for Research in Child Development, 53*(2), 1-157.

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Bauer, D. J., Preacher, K. J., & Gil, K. M. (2006). Conceptualizing and testing random indirect effects and moderated mediation in multilevel models: New procedures and recommendations. *Psychological Methods, 11,* 142-163.

Berliner, D. (2013). Effects of inequality and poverty vs. teachers and schooling on America's youth. Teacher's College Record, 116(1).

Bronfenbrenner, U. & Morris, P. A. (1998). The ecology of developmental processes. In W. Damon & R. M. Lerner (Eds.), Handbook of child psychology, Vol. 1: Theoretical models of human development (5th ed., pp. 993-1023). New York: John Wiley and Sons, Inc.

Brooks-Gunn, J., & Duncan, G. J. (1997). The effects of poverty on children. The Future of Children, 7(2), 55-71.

Bryk, A. S., Sebring, P. B., Allensworth, E., Luppescu, S., & Easton, J. Q. (2010). Organizing schools for improvement: Lessons from Chicago. Chicago, IL: University of Chicago Press.

City Connects (2014). The Impact of City Connects: Progress Report 2014. Chestnut Hill, MA: Center for Optimized Student Support.

Coleman, J. S., Campbell, E. Q., Hobson, C. J., McPartland, J., Mood, A. M., Weinfeld, F. D., & York, R. L. (1966). Equality of educational opportunity. Washington, DC: US Department of Health, Education, and Welfare, Office of Education.

Cook, T. D., & P. M. Steiner. (2010). Case matching and the reduction of selection bias in quasi-experiments: The relative importance of covariate choice, unreliable measurement, and mode of data analysis. *Psychological Methods*, *15*(1), 56–68. doi:10.1037/a0018536

Dearing, E., Walsh, M., Sibley, E., Lee-St. John, T., Raczek, A., & Foley, C. (2015, in press). Can community and school-based supports improve the achievement of first-generation immigrant children attending high-poverty schools? Child Development.

Dearing, E. (2008). The psychological costs of growing up poor. Annals of the New York Science Academy of Sciences, 1136, 324-332.

Evans, G. W. (2004). The environment of childhood poverty. *American Psychologist* 59(2), 77-92.

Guo, S., & Fraser, M. W. (2010). *Propensity score analysis: Statistical methods and applications*. Thousand Oaks, CA: Sage.

Harder, V.S., Stuart, E.A., and Anthony, J. (2010). Propensity Score Techniques and the Assessment of Measured Covariate Balance to Test Causal Associations in Psychological Research. *Psychological Methods,* 15(3): 234-249.

Hirano, K., Imbens, G., & Ridder, G. (2003). Efficient Estimation of Average Treatment Effects using the Estimated Propensity Score. *Econometrica*, 71, 1161-1189.

Kenny, D. A., Korchmaros, J. D., & Bolger, N. (2003). Lower level mediation in multilevel models. *Psychological Methods, 8,* 115-128.

Krull, J. L., & MacKinnon, D. P. (1999). Multilevel mediation modeling in group-based intervention studies. *Evaluation Review, 23*(4), 418-444.

Krull, J. L., & MacKinnon, D. P. (2001). Multilevel modeling of individual and group level mediated effects. *Multivariate Behavioral Research, 36,* 249–277.

Lean, D. S. & Colucci, V. A.(2010). Barriers to learning: The case for integrated mental health services in schools. Lanham, MD: Rowman & Littlefield.

Leventhal, T., & Brooks-Gunn, J. (2000). The neighborhoods they live in: The effects of neighborhood residence upon child and adolescent outcomes. Psychological Bulletin, 126(2), 309-337.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7,* 83-104.

MacKinnon, D. P. (2008). *Introduction to statistical mediation analysis*. Mahwah, NJ: Erlbaum.

MacKinnon, D. P., & Dwyer, J. H. (1993). Estimating mediated effects in prevention studies. *Evaluation Review, 17,* 144-158.

Marx, E., Wooley, S., & Northrup, D. (1998). Health is academic: A guide to coordinated school health programs. New York: Teachers College Press.

Masten, A. (2001). Ordinary magic: Resilience processes in development. American Psychologist, 56(3), 227-238.

Phillips, M., Brooks-Gunn, J., Duncan, G., Klebanov, P. & Crane, J. (1998). "Family background, parenting practices, and the black–white test score gap," in C. Jencks and M. Phillips, Eds., The Black-White Test Score Gap. Washington, D.C.: Brookings Institution Press.

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods.* Sage Publications: London.

Rothstein. R. (2010). How to fix our schools: It's more complicated, and more work, than the Klein-Rhee 'manifesto' wants you to believe. (Policy Brief #286). Washington, D.C.: Economic Policy Institute.

Rucker, D. D., Preacher, K. J., Tormala, Z. L., & Petty, R. E. (2011). Mediation analysis in social psychology: Current practices and new recommendations. *Social and Personality Psychology Compass, 5/6,* 359-371.

Shrout, P. E., & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods, 7*(4), 422-445.

Steiner, P.M., & Kim, J-S. (2015, March). *Estimating treatment effects via multilevel matching within homogenous groups of clusters.* Paper presented at the SREE Spring 2015 Conference.

Strauss, V. (2013, October 28). Five stereotypes about poor families and education. The Answer Sheet, Washington Post. http://www.washingtonpost.com/blogs/answer-sheet/wp/2013/10/28/five-stereotypes-about-poor-families-and-education

Walsh, M. E., Madaus, G. F., Raczek, A. E., Dearing, E., Foley, C., An, C., Lee-St. John, T. J., & Beaton, A. (2014). A new model for student support in high-poverty urban elementary schools: Effects on elementary and middle school academic outcomes. American Educational Research Journal, 51(4), 704-737.

What Work Clearinghouse. (2014). Procedures and standards handbook (Version 3.0). Available: http://ies.ed.gov/ncee/wwc/pdf/reference_resources/wwc_procedures_v3_0_standards_handbook.pdf .

Appendix B. Tables and Figures

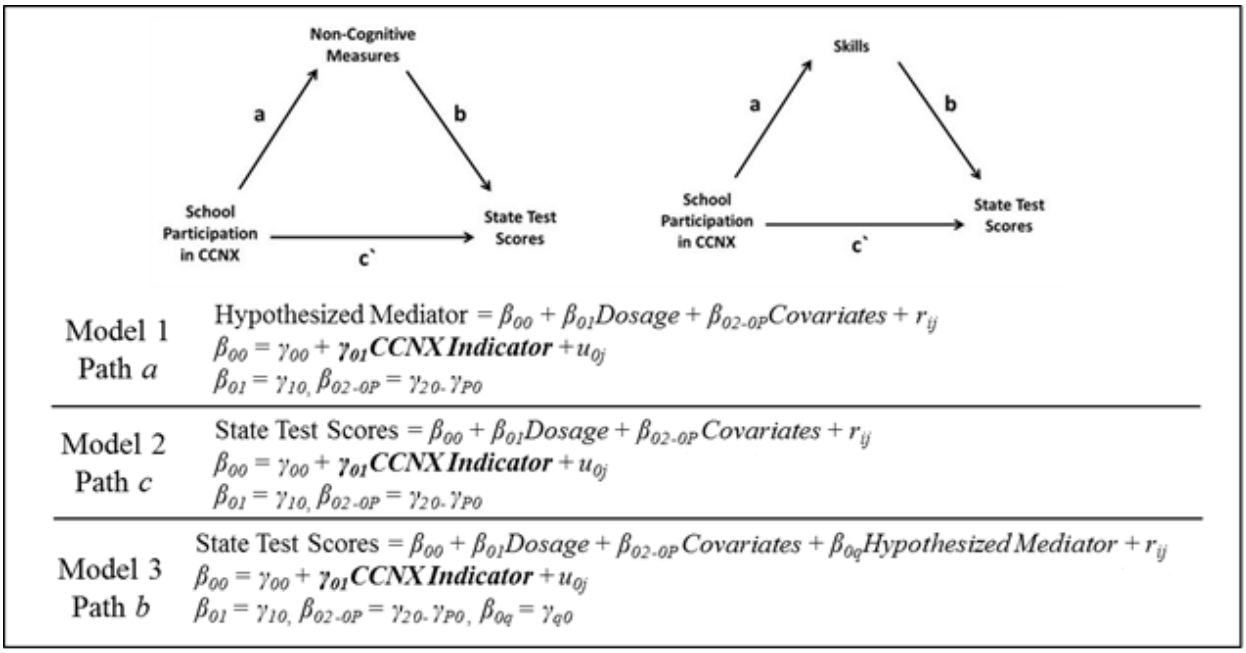
Not included in page count.

Cohort Year	2001-02	2002-03	2003-04	2004-05	2005-06
School Year					
2001-02	K				
2002-03	1	K			
2003-04	2	1	K		
2004-05	3	2	1	K	
2005-06	4	3	2	1	K
2006-07	5	4	3	2	1
2007-08	6	5	4	3	2
2008-09	7	6	5	4	3
2009-10	8	7	6	5	4
2010-11		8	7	6	5
2011-12			8	7	6
2012-13				8	7
2013-14					8

Measurement of hypothesized mediators (grade 5report cards and non-cognitive measures)

Measurement of academic outcomes (grade 8 state test scores in mathematics)

Figure 1 Data Structure



Model 1 Path *a*

$$\text{Hypothesized Mediator} = \beta_{00} + \beta_{01}Dosage + \beta_{02\text{-}0P}Covariates + r_{ij}$$
$$\beta_{00} = \gamma_{00} + \boldsymbol{\gamma_{01}CCNX\,Indicator} + u_{0j}$$
$$\beta_{01} = \gamma_{10}, \beta_{02\text{-}0P} = \gamma_{20}\text{-}\gamma_{P0}$$

Model 2 Path *c*

$$\text{State Test Scores} = \beta_{00} + \beta_{01}Dosage + \beta_{02\text{-}0P}Covariates + r_{ij}$$
$$\beta_{00} = \gamma_{00} + \boldsymbol{\gamma_{01}CCNX\,Indicator} + u_{0j}$$
$$\beta_{01} = \gamma_{10}, \beta_{02\text{-}0P} = \gamma_{20}\text{-}\gamma_{P0}$$

Model 3 Path *b*

$$\text{State Test Scores} = \beta_{00} + \beta_{01}Dosage + \beta_{02\text{-}0P}Covariates + \beta_{0q}Hypothesized\,Mediator + r_{ij}$$
$$\beta_{00} = \gamma_{00} + \boldsymbol{\gamma_{01}CCNX\,Indicator} + u_{0j}$$
$$\beta_{01} = \gamma_{10}, \beta_{02\text{-}0P} = \gamma_{20}\text{-}\gamma_{P0}, \beta_{0q} = \gamma_{q0}$$

Figure 2 Hypothesized mediation models

Table 1. School-Level Group Equivalence Before and After ATT Weighting

	Comparison		City Connects		Unadjusted Standardized Bias	Weighted Standardized Bias
	Unadjusted Mean %	Weighted Mean %	Unadjusted Mean %	Unadjusted SD		
% Male	52.5	52.2	52.3	49.9	-0.006	0.001
% Black	38.8	35.5	34.4	47.5	-0.093	-0.024
% White	15.0	13.4	12.8	33.5	-0.065	-0.016
% Asian	4.6	8.9	10.3	30.4	0.187	0.047
% Hispanic	39.7	40.1	40.4	49.1	0.014	0.006
% Native American	0.3	0.4	0.3	5.9	0.001	-0.010
% Multi-racial/Other	1.5	1.7	1.7	13.1	0.018	0.004
% Reduced Price Lunch	7.3	6.7	7.7	26.7	0.015	0.039
% Free Lunch	68.3	70.4	70.0	45.8	0.036	-0.009
Special Educational Status						
% <25% time out classroom	8.3	7.7	7.7	26.6	-0.023	-0.001
% 25-60% time out classroom	6.5	6.5	6.2	24.2	-0.013	-0.010
% English Language Learners	9.8	14.8	14.2	34.9	0.125	-0.019
% Foreign Born	11.3	14.7	14.6	35.3	0.092	-0.003

Table 2. Predicting the Hypothesized Mediators for Cognitive Outcomes: Model 1, Path *a*

	Dependent Variables								
	Grade 5 Math Report Cards			Grade 5 Reading Report Cards			Grade 5 Writing Report Cards		
	Coeff.	SE	P-value	Coeff.	SE	P-value	Coeff.	SE	P-value
Intercept	0.78	0.10	<0.001	0.91	0.10	<0.001	0.94	0.10	<0.001
School Predictors									
CCNX Participation	-0.03	0.08	0.739	-0.03	0.09	0.774	-0.06	0.10	0.549
Student Predictors									
Dosage	0.04	0.01	<0.001	0.03	0.01	0.027	0.04	0.01	0.004
Male	-0.02	0.02	0.283	-0.16	0.02	<0.001	-0.29	0.02	<0.001
Black	-0.48	0.04	<0.001	-0.48	0.05	<0.001	-0.41	0.05	<0.001
Asian	0.32	0.07	<0.001	-0.05	0.08	0.559	0.09	0.08	0.277
Hispanic	-0.36	0.05	<0.001	-0.39	0.04	<0.001	-0.33	0.05	<0.001
Native American	-0.31	0.14	0.027	-0.12	0.10	0.253	-0.14	0.10	0.184
Multi-racial/ other	-0.17	0.07	0.02	-0.32	0.09	<0.001	-0.29	0.07	<0.001
SPED - <25% out of class time	-0.40	0.03	<0.001	-0.49	0.04	<0.001	-0.47	0.03	<0.001
SPED - % 25-60% out of class time	-0.78	0.03	<0.001	-0.86	0.04	<0.001	-0.77	0.03	<0.001
Reduced Lunch	-0.26	0.06	<0.001	-0.22	0.06	<0.001	-0.21	0.07	0.003
Free Lunch	-0.42	0.05	<0.001	-0.32	0.07	<0.001	-0.36	0.08	<0.001
English Lang. Learner	-0.14	0.03	<0.001	-0.28	0.03	<0.001	-0.30	0.04	<0.001
Foreign born	-0.04	0.04	0.337	-0.22	0.05	<0.001	-0.21	0.05	<0.001

* The coefficients were rescaled to indicate the predicted change in the dependent variable for a 10% increase in the percentage of Asian students in the school.

Table 3. Predicting the Hypothesized Mediators for Affective Outcomes: Model 1, Path *a*

	Dependent Variables								
	Grade 5 Effort			Grade 5 Work Habits			Grade 5 Behavior		
	Coeff.	SE	P-value	Coeff.	SE	P-value	Coeff.	SE	P-value
Intercept	0.86	0.08	<0.001	0.81	0.08	<0.001	0.62	0.08	<0.001
School Predictors									
CCNX Participation	0.04	0.10	0.655	-0.08	0.10	0.429	-0.03	0.09	0.763
Student Predictors									
Dosage	0.02	0.01	0.05	0.02	0.01	0.049	0.01	0.01	0.275
Male	-0.32	0.02	<0.001	-0.40	0.02	<0.001	-0.35	0.02	<0.001
Black	-0.41	0.05	<0.001	-0.38	0.05	<0.001	-0.36	0.05	<0.001
Asian	0.23	0.09	0.01	0.17	0.09	0.075	0.19	0.09	0.038
Hispanic	-0.29	0.05	<0.001	-0.23	0.04	<0.001	-0.19	0.04	<0.001
Native American	-0.12	0.10	0.247	-0.01	0.17	0.975	-0.14	0.13	0.277
Multi-racial/ other	-0.20	0.07	0.003	-0.25	0.06	<0.001	-0.12	0.06	0.051
SPED - <25% out of class time	-0.32	0.03	<0.001	-0.36	0.03	<0.001	-0.17	0.03	<0.001
SPED - 25-60% out of class time	-0.53	0.04	<0.001	-0.55	0.04	<0.001	-0.27	0.04	<0.001
Reduced Lunch	-0.25	0.05	<0.001	-0.15	0.05	0.005	-0.07	0.05	0.166
Free Lunch	-0.37	0.06	<0.001	-0.31	0.05	<0.001	-0.26	0.05	<0.001
English Lang. Learner	-0.15	0.04	<0.001	-0.10	0.05	0.028	-0.07	0.06	0.257
Foreign born	-0.02	0.05	0.659	-0.02	0.05	0.656	0.00	0.04	0.916

* The coefficients were rescaled to indicate the predicted change in the dependent variable for a 10% increase in the percentage of Asian students in the school.

Table 4. Predicting Grade 8 Achievement: Model 2, Path *c'*

Dependent Variable:	Grade 8 Math		
	Coeff.	SE	P-value
Intercept	0.75	0.08	<0.001
School Predictors			
CCNX Participation	0.15	0.06	0.018
Student Predictors			
Dosage	0.00	0.01	0.957
Male	0.05	0.02	0.057
Black	-0.49	0.07	<0.001
Asian	0.57	0.08	<0.001
Hispanic	-0.33	0.06	<0.001
Native American	-0.51	0.17	0.003
Mixed race	-0.03	0.14	0.823
SPED - <25% out of class time	-0.42	0.03	<0.001
SPED - % 25-60% out of class time	-0.86	0.03	<0.001
Reduced Lunch	-0.19	0.10	0.049
Free Lunch	-0.46	0.06	<0.001
English Language Learner	-0.15	0.03	<0.001
Foreign born	0.04	0.03	0.183

* The coefficients were rescaled to indicate the predicted change in the dependent variable for a 10% increase in the percentage of Asian students in the school.

Table 5. Predicting Grade 8 Achievement with academic grade 5 hypothesized mediators: Model 3, Path *b*

	Dependent Variable								
	Grade 8 Mathematics			Grade 8 Mathematics			Grade 8 Mathematics		
	Coeff.	SE	P-value	Coeff.	SE	P-value	Coeff.	SE	P-value
Intercept	0.27	0.08	0.002	0.30	0.08	<0.001	0.32	0.07	<0.001
School Predictors									
CCNX Participation	0.16	0.07	0.017	0.19	0.06	0.002	0.18	0.05	0.001
Student Predictors									
Dosage	-0.03	0.02	0.108	-0.03	0.01	0.046	-0.02	0.01	0.087
Male	0.06	0.02	0.01	0.12	0.02	<0.001	0.16	0.02	<0.001
Black	-0.23	0.06	<0.001	-0.28	0.06	<0.001	-0.33	0.05	<0.001
Asian	0.40	0.07	<0.001	0.59	0.09	<0.001	0.52	0.08	<0.001
Hispanic	-0.15	0.06	0.008	-0.17	0.06	0.004	-0.22	0.05	<0.001
Native American	-0.27	0.16	0.088	-0.50	0.17	0.003	-0.47	0.15	0.002
Mixed race	0.02	0.16	0.92	0.08	0.14	0.563	0.06	0.14	0.653
SPED - <25% out of class time	-0.22	0.04	<0.001	-0.25	0.04	<0.001	-0.26	0.04	<0.001
SPED -25-60% out of class time	-0.50	0.04	<0.001	-0.58	0.04	<0.001	-0.62	0.04	<0.001
Reduced Lunch	0.00	0.09	0.994	-0.04	0.09	0.662	-0.05	0.09	0.547
Free Lunch	-0.15	0.06	0.018	-0.23	0.06	<0.001	-0.23	0.07	<0.001
English Language Learner	-0.06	0.03	0.015	-0.05	0.03	0.063	-0.03	0.02	0.121
Foreign born	0.05	0.02	0.03	0.11	0.03	<0.001	0.11	0.03	<0.001
Hypothesized Mediators									
Grade 5 Math Report Card	0.50	0.03	<0.001						
Grade 5 Reading Report Card				0.37	0.02	<0.001			
Grade 5 Writing Report Card							0.36	0.03	<0.001

* The coefficients were rescaled to indicate the predicted change in the dependent variable for a 10% increase in the percentage of Asian students in the school.

Table 6. Predicting Grade 8 Achievement with non-cognitive grade 5 hypothesized mediators: Model 3, Path *b*

	Dependent Variable								
	Grade 8 Mathematics			Grade 8 Mathematics			Grade 8 Mathematics		
	Coeff.	SE	P-value	Coeff.	SE	P-value	Coeff.	SE	P-value
Intercept	0.34	0.07	<0.001	0.41	0.08	<0.001	0.56	0.08	<0.001
School Predictors									
CCNX Participation	0.13	0.06	0.041	0.18	0.07	0.01	0.13	0.07	0.059
Student Predictors									
Dosage	-0.02	0.02	0.271	-0.02	0.01	0.247	0.00	0.02	0.784
Male	0.18	0.02	<0.001	0.19	0.03	<0.001	0.14	0.03	<0.001
Black	-0.29	0.05	<0.001	-0.34	0.06	<0.001	-0.39	0.06	<0.001
Asian	0.45	0.07	<0.001	0.52	0.08	<0.001	0.55	0.08	<0.001
Hispanic	-0.21	0.05	<0.001	-0.24	0.06	<0.001	-0.27	0.06	<0.001
Native American	-0.44	0.16	0.007	-0.46	0.14	<0.001	-0.45	0.16	0.006
Mixed race	0.05	0.15	0.72	0.06	0.14	0.702	0.00	0.14	0.99
SPED - <25% out of class time	-0.27	0.04	<0.001	-0.28	0.04	<0.001	-0.38	0.04	<0.001
SPED - 25-60% out of class time	-0.67	0.04	<0.001	-0.70	0.04	<0.001	-0.83	0.04	<0.001
Reduced Lunch	-0.05	0.10	0.623	-0.09	0.10	0.339	-0.16	0.10	0.127
Free Lunch	-0.24	0.06	<0.001	-0.29	0.06	<0.001	-0.36	0.06	<0.001
English Language Learner	-0.05	0.02	0.029	-0.12	0.03	<0.001	-0.14	0.03	<0.001
Foreign born	0.04	0.03	0.155	0.05	0.03	0.186	0.04	0.03	0.189
Hypothesized Mediators									
Grade 5 Effort	0.41	0.02	<0.001						
Grade 5 Work Habits				0.34	0.02	<0.001			
Grade 5 Behavior							0.23	0.01	<0.001

* The coefficients were rescaled to indicate the predicted change in the dependent variable for a 10% increase in the percentage of Asian students in the school.

Table 7. Summary of school-level path coefficients and results of Aroian version of the Sobel test.

	Path a		Path b		Aroian Test Statistic	SE	P-value
	Coeff.	SE	Coeff.	SE			
Grade 5 Math Report Cards	-0.03	0.08	0.16	0.07	-0.31	0.01	0.76
Grade 5 Reading Report Cards	-0.03	0.09	0.19	0.06	-0.27	0.02	0.78
Grade 5 Writing Report Cards	-0.06	0.10	0.18	0.05	-0.57	0.02	0.57
Grade 5 Effort	0.04	0.10	0.13	0.06	0.40	0.01	0.69
Grade 5 Work Habits	-0.08	0.10	0.18	0.07	-0.71	0.02	0.47
Grade 5 Behavior	-0.03	0.09	0.13	0.07	-0.27	0.01	0.79

Table 8. Summary of student-level path coefficients and results of Aroian version of the Sobel test.

	Path a		Path b		Aroian Test Statistic	SE	P-value
	Coeff.	SE	Coeff.	SE			
Grade 5 Math Report Cards	0.04	0.01	-0.03	0.02	-1.50	0.00	0.13
Grade 5 Reading Report Cards	0.03	0.01	-0.03	0.01	-1.41	0.00	0.16
Grade 5 Writing Report Cards	0.04	0.01	-0.02	0.01	-1.40	0.00	0.16
Grade 5 Effort	0.02	0.01	-0.02	0.02	-0.88	0.00	0.38
Grade 5 Work Habits	0.02	0.01	-0.02	0.01	-0.91	0.00	0.36
Grade 5 Behavior	0.01	0.01	0.00	0.02	-0.20	0.00	0.84