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Opportunity for Whom? Understanding Curriculum-Oriented Out-of-School Time Math Learning

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Abstract

Learning opportunities outside of traditional school times can be important factors for cognitive and noncognitive development, as well as for gaps between advantaged and less-advantaged students. Although out-of-school time (OST) education is of great significance in research and practice worldwide, less is known about the ways in which OST learning shapes patterns of educational stratification due to the variety of OST programs and the hidden decision-making processes of participation. The current study focused on curriculum-oriented OST math learning and examined its participation patterns and relevance to academic and non-academic skill development among 15-year-old students in the U.S. Utilizing multilevel ordered logistic regression, the study found that African American students, academically struggling students, and students attending schools with certain teacher and school characteristics were more likely to participate in OST math education. Given the endogenous nature of OST math learning, the study incorporated propensity score weighting in the regression analyses to understand the connections between OST math learning and skills. It is revealed that more hours of OST math learning weekly were related to better skill development in positive study behaviors in math. This study situated the findings within the socio-ecological contexts of education and discussed the interconnected relationships between schooling and OST learning. It is concluded that time and space beyond schooling is a critical component of education and should be included in the discourse of educational justice.

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Opportunity for Whom? Understanding Curriculum-Oriented Out-of-School Time Math Learning

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Learning opportunities outside of traditional school times can be important factors for cognitive and noncognitive development, as well as for gaps between advantaged and less-advantaged students. Although out-of-school time (OST) education is of great significance in research and practice worldwide, less is known about the ways in which OST learning shapes patterns of educational stratification due to the variety of OST programs and the hidden decision-making processes of participation. The current study focused on curriculum-oriented OST math learning and examined its participation patterns and relevance to academic and non-academic skill development among 15-year-old students in the U.S. Utilizing multilevel ordered logistic regression, the study found that African American students, academically struggling students, and students attending schools with certain teacher and school characteristics were more likely to participate in OST math education. Given the endogenous nature of OST math learning, the study incorporated propensity score weighting in the regression analyses to understand the connections between OST math learning and skills. It is revealed that more OST math learning were related to better skill development in positive study behaviors in math. This study situated the findings within the socio-ecological contexts of education and discussed the interconnected relationships between schooling and OST learning. It is concluded that time and space beyond schooling is a critical component of education and should be included in the discourse of educational justice.

Keywords: Academic performance | educational disparities | math study behaviors and attitudes | non-traditional classes | out-of-school time math learning

It is widely acknowledged that achievement gaps contribute to patterns of educational stratification, such as different high school placements, modes of high school exit, and postsecondary attendance (Alexander et al., 2007). It is also increasingly recognized that schooling accounts for a small amount of the variation in students' academic achievement and that the majority of the learning differences along socioeconomic lines emerge when school is out of session (Alexander et al., 2007; Leos-Urbel & Aber, 2012; Rothstein, 2004). High school students, in particular, are more vulnerable to out-of-school high-risk behaviors, such as crime and violence, as they experience a complex bundle of emotions and desires during puberty (Stacki, 2015). Therefore, well-structured and supervised out-of-school time activities may compensate for a lack of educationally enriching experiences for disadvantaged students' (Alexander et al., 2007). In addition to their academic needs, this may also address a number of social and emotional needs for adolescent students (Stacki, 2015).

The current study focused on academically oriented out-of-school time (OST) learning, where students could acquire curricular knowledge outside of regular school hours. This focus is warranted for several reasons. First, OST curricular instruction is becoming an increasingly common after-school context for school-aged children. For example, the 21st Century Community Learning Center's (21st CCLCs) programs, which started in 1994 under the Elementary and Secondary School Act, now serve over 2 million low-income students and their family members in all 50 states, ensuring that students have a safe place to receive academic enrichment (U.S. Department of Education, 2018). Secondly, literature on whether and how OST curricular instruction shapes academic and other important skills is inconclusive. Several studies identified a positive association between OST learning and academic skills (e.g., Mahoney et al., 2005; U.S. Department of Education, 2018), whereas others found null effects or negative associations (e.g., Bissell et al., 2002). The current study had a more specific focus in the subject of math, in that math is not only a foundational subject within STEM (science, technology, engineering, and math) education, but also a gateway course to the development of human capital and technological advancement on a global scale. To understand the extent to which OST math education is an important tool for academic development and beyond, this study was structured to identify the participation patterns of OST math education, as well as to evaluate its associations with academic and non-academic skill development (e.g., math performance and study behaviors in math).

Background

Academically Oriented OST Education in the U.S.

OST programs are some of the complementary approaches for more systemic schooling and have become increasingly popular in the U.S. (Stacki, 2015). Kugler (2001) argued that three societal processes have contributed to the recent growth of after-school programs: (1) the lack of caregivers in the home after school, (2) the belief that economically disadvantaged children can improve their learning given more time and opportunities, and (3) the high incidence of teen crime after school. In a broader scope, OST programs offer opportunities and benefits for students, including learning new general or subject-specific academic skills to close the achievement gap and improve grades, learning sports-related skills, preparing for a career, and developing relationships (Stacki, 2015).

Academically oriented OST education also encompasses a variety of types (Park et al., 2016). This ranges from one-on-one or group tailored tutorials on a regular schedule to cram schools (specialized[UK1] schools training students to achieve high grades or pass exams) and learning centers that offer lessons after school, during weekends, and during school vacations (Park et al., 2016). Concerning who pays for the services, there are family-paid private tutoring and government-subsidized public supplementary education. Private tutoring consists of learning opportunities that families must purchase from cram schools, learning centers or tutors (Park et al., 2016). These for-profit entities (i.e., Kumon and Sylvan Learning) provide lessons in major school subjects after school, during weekends, or during school vacations. Because much of the curriculum and structure in the parallel OST sector mimics that in formal schooling, the services provided by these for-profit entities are also referred to as shadow education (Baker & LeTendre, 2005; Bray, 1999, 2017; Stevenson & Baker, 1992).

There are publicly funded academic-oriented after-school programs and summer programs in the U.S., which are providing for low-income and low-performing students (Park et al., 2016). No Child Left Behind Act (NCLB) required public schools that had not made adequate yearly progress on test scores for at least two consecutive years to offer children in low-income families the opportunity to receive supplemental educational services, in the hope of closing the achievement gap between ethnic groups and other traditionally under-served populations (Heinrich & Burch, 2011). The policy was implemented at the local level and draw mainly on the private sector to offer eligible students a range of opportunities for free tutoring outside of regular school hours (Heinrich & Burch, 2011). In these contexts, the 21st CCLCs have been established and have provided additional learning opportunities during non-school hours, particularly for students who attend high-poverty and low-performing schools (Park et al., 2016). Those public OST programs are largely remedial as they explicitly target underperforming students (Steinberg, 2011).

The Ecological Model of OST Education Development

According to Bronfenbrenner (1994), human development occurs amid a vibrant, complex environment, largely defined by social and cultural practices and institutions that provide most of the experiences that people have. To understand the ways in which social and cultural experiences interact with child's capabilities to influence human development, Bronfenbrenner introduced the ecological approach, borrowing the idea on the relationship of organisms and their environment from the field of ecology. The framework concentrates on the subsystems, or components of the human ecological niche and the ways that these subsystems interact with the influence each other (Bronfenbrenner, 1994). Conceptualizing as a series of layers, the subsystems range from the immediate, or proximal, processes of development (the microsystem), such as the family or school, to patterns of culture, such as the economy, customs, and the bodies of knowledge (the macrosystems) (Bronfenbrenner, 1994). Literature often refers to a multi-layered context to discuss the development of OST education. Adapting such a model, this study built on existing literature to synthesize the multilevel factors that shape OST education participation.

At the individual level, students' academic and nonacademic attributes are important determinants. Particularly, previous academic standing is an important predictor of not only OST participation but also the nature of it. In unraveling the motivations and goals of using OST education, prior research differentiate (1) remedial lessons designed to help students meet coursework requirements in formal schooling and (2) enrichment-oriented lessons designed to boost achievement for students already performing well in formal schools (Baker & LeTendre, 2005; Park et al., 2016). Both high-performing and struggling students may have the motivations to participate in OST curriculum instructions, yet their purposes and the nature of instructions diverge. In addition, other non-academic attributes that are closely connected with math learning, such as math anxiety (Lee & Stankov, 2013), math self-efficacy (Karakolidis et al., 2016), math self-concept (Karakolidis et al., 2016), motivation (Ryan & Deci, 2000), and attitudes towards school (Lee & Stankov, 2013), are also documented to link to out-of-school education participation.

At the meso level of the system, schooling environment matters. When the formal system is perceived to be of poor quality, families may be motivated to seek additional forms of academic learning in the private market (Bray, 1999; Dang & Rogers, 2008). Public sectors might also actively complement public schools with OST resources, such as the free tutoring provided under the accountability reform, which aims to boost student test performance and closing the achievement gap (Park et al., 2016). Family is another ecological determinant (Buchmann et al., 2010; Park et al., 2016). Middle-class parents' keen awareness of growing income inequality and increased global competition motivates them to invest in out-of-school educative activities, particularly in math, science, and foreign languages (Cooper, 2014; Park et al., 2016). Higher socioeconomic status families can facilitate their children's participation in private tutoring because they are able and willing to invest in education. Such parents tend to be more involved in their children's education in various ways, including finding a quality instructor and monitoring their child's progress with the instructor (Lareau, 2003; Park et al., 2016). On the other hand, low socioeconomic status families might be more likely to engage in subsidized after-school programs and summer schools that target socioeconomically disadvantaged students (Park et al., 2016). However, it has been reported that not all eligible students participate due to parents' lack of information on specific services available and limited transportation options (Heinrich & Burch, 2011).

There is a divide in participation patterns by community characteristics (Silova, 2010). Suburban communities have relatively easy access to private tutorial institutions, while many inner-city neighborhoods do not have such services or these services are beyond the reach of the low-income families living there (Zhou, 2012). Communities of different races and ethnicities exhibit preference to various types of academic-oriented OST education. In comparison with their white counterparts, African American, Hispanic, and Asian students are more likely to use test preparation services in general (Buchmann et al., 2010; Byun & Park, 2012). Moreover, some Asian American communities, such as Chinese and Korean, have a greater capacity to mobilize or generate resources to support education so that many low-income parents can also send their children to community-based after-school learning centers within the ethnic system of OST education (Zhou, 2012).

The Impact of OST Education

It is common to assume OST education contributes to children's holistic education effectively and academically (Stacki, 2015), otherwise the investment might be a waste of money and time for students, families, and states (Park et al., 2016). OST learning activities offer ample opportunities for children to develop skills in an informal context involving interactions with peers and facilitators (OECD, 2015). Using data from the Student Descriptive Questionnaire and SAT scores obtained from College Board, Everson and Millsap (2005) confirmed that participation in extracurricular school activities (including nonacademic contents) provided all students, including students from disadvantaged backgrounds, minorities, and those with otherwise less-than-distinguished academic achievements in high school, a measurable and meaningful gain in SAT scores. There is some state-based research on the free tutoring or supplemental educational services provided to academically struggling students. For example, in Illinois, Chicago Public Schools' evaluations reported more substantial increases in reading and math for students receiving at least 40 hours of tutoring per academic year and for students in grades 4 through 8 who were not English Language Learners and who received at least 30 hours of OST educational services tutoring (Heinrich & Burch, 2011). A San Francisco School District (Honig & McDonald, 2005) described the early outcomes of a 21st CCLC program operating in four middle schools in the district and reported that parents felt the program succeeded in helping children with their homework and improving their attitudes toward school and their behavior in school. However, in California, a Los Angeles Unified School District study found small program effects even among students with the highest levels of OST educational services attendance. Studies of Minneapolis and Milwaukee Public Schools found no statistically significant positive impact of OST educational services participation (Heinrich & Burch, 2011). Regarding private tutoring, Briggs (2001) applied the Heckman model to address selectivity and finds coaching and tutoring could boost American students' SAT and ACT scores, but by a rather small amount. Buchmann et al. (2010) found that enrollment in private test prep courses corresponded to SAT score gains of about 30-40 points, which could increase the chance of admission into the most selective colleges and universities in the U.S.

Beyond academic benefits, OST learning activities might have positive influence on soft skills, now widely known as social and emotional skills (e.g., goal-setting, perseverance, optimism, emotional control) (OECD, 2015). A meta-analysis of various after-school programs indicated that program participants demonstrated significant increases in their self-perceptions and bonding in school, positive social behaviors, and significant reductions in problem behaviors (Durlak et al., 2010). However, far less research has examined the potential effects of academic-oriented OST programs on nonacademic outcomes such as student engagement in school and attitudes toward learning (Bray, 1999; Park et al., 2016). Some literature argues that students might be less engaged in the classroom if they have already learned the topics or they know they will learn them in the OST programs (Jheng, 2015). The counterargument is that some students may become more interested in learning, achieve more in school curricula, and also develop soft skills through participating in OST activities (Bray, 2017; Schacter, 2011).

From a methodological perspective, the mixed findings could result from the heterogenous effects of OST instructions depending on the characteristics of participants. As conceptualized earlier, the participation of OST education is shaped by multilevel factors. Students who attend OST classes may differ from those who do not across multiple dimensions, such as socioeconomic or racial groups, learning levels or schoolteacher quality. Rosenbaum and Rubin (1983) defined the unbalanced nature of treatment and comparison groups as a violation of strongly ignorable treatment assignment. Undifferentiated student populations between participants and nonparticipants could undermine the evaluation of average effects of OST instructions and produce biased and inconsistent estimation of the regression coefficient (Park et al., 2016; Springer et al., 2009).

Theoretical Underpinnings

Literature in the sociology of education (Bourdieu & Passeron, 1990; Brooks-Gunn et al., 1995; Dixon-Román, 2012; Lareau, 2003) has argued that it is often the various forms of education-relevant capital (such as cultural, financial and social capital) one possesses (or are intergenerationally transmitted to one) that convert into meaningful pedagogical experiences and enable the development of high academic achievement and intellect (Dixon-Román, 2012; Gordon et al., 2012). However, the capitals and opportunities for skill development are inequitably distributed, particularly at the point when school is out of session. OST is better utilized by wealthy families as these families are more financially capable and more active in their fostering of and involvement in their children's extracurricular activities (Lareau, 2003).

In addition, this study is grounded in the theory that successes in education and life are driven by multi-dimensional skills. Beyond cognitive skills, soft skills such as perseverance, self-discipline, and self-motivation have powerful consequences for academic and life outcomes. Indicated by multiple frameworks (OECD, 2015), soft skills, or now more commonly referred as social and emotional (SE) skills, are individual capacities that are manifested in consistent patterns of thoughts, feelings, and behaviors (Chernyshenko et al., 2018). Higher levels of SE skills can aid and activate cognitive skill development and help individuals benefit more from education in health and well-being, job performance, and occupational attainment (Chernyshenko et al., 2018). OST and space is a crucial context to the development of SE skills

(Chernyshenko et al., 2018) because exposure to an unsafe neighborhood after school, receiving unstructured child care, and lacking available resources in the community or adult role models can be risk factors (CECMHC, 2019).

In spite of the increasing prevalence of OST research and practice, little is known about the mechanisms in the OST and space that enable and nurture the comprehensive process of skill development, or the ways in which equitable and deliberate pedagogical experiences are provided (Dixon-Román & Gordon, 2012). Through the lens of academic-oriented OST math learning, this study sought to add to the research landscape by identifying the participation patterns of OST math education in the U.S. and making estimates of its associations with academic outcomes and soft skills. The study design was structured for conceptual and methodological considerations. Drawn from the ecological model, the first research question interrogated whether and how participation in OST math learning was shaped by student, family and school characteristics. Focusing on skill development, the second question evaluated the extent to which OST math learning was associated with PISA math performance and math study behaviors and attitudes. The heterogeneity found between participants and non-participants from the first research question, if any, would inform the method used to estimate the relations between OST math learning and skill development.

Method

Data

The data used in this study was retrieved from the U.S. samples of the Program for International Student Assessment (PISA) 2012. The students who participated in the study were 15 years old and attended schools in grade 7 or higher when they took the survey. There were 4,978 U.S. students who participated in PISA 2012. Female and male students were approximately equal. Over 50% of students identified themselves as White, 24% Hispanic, 13% African American , 5% Asian, and 4% multiracial. Although the proportion of students identified as English learners was not clear in the data, around 15% of surveyed students reported speaking languages other than English at home.

The principal domain of the PISA 2012 survey was math, meaning PISA has given greater emphasis to issues of teaching and learning math. There were 3,225 students who provided valid responses to the OST math learning questions in the student contextual questionnaire. Because OST math class participation was the key variable of interest, the main analyses were based on the existing samples with listwise deletion on the missingness of OST math class participation. For the missingness of other covariates (ranging from 5% to 15%), multiple imputation using chained equations was employed. Five data sets were generated, and the estimates were combined from the multiply imputed data using Stata's MI prefix. Descriptive statistics of the key variables can be found in Table 1.

Variables

Participation in OST math education was obtained by one question: *How many hours do you typically spend per week attending out-of-school lessons in math?* Of the five categories to choose from, 70.23% of the students reported no participation in any types of OST math lessons. Furthermore, 16.78% of students reported spending less than 2 hours per week on OST classes,

Table 1

Descriptive Statistics on the Variables after Imputation

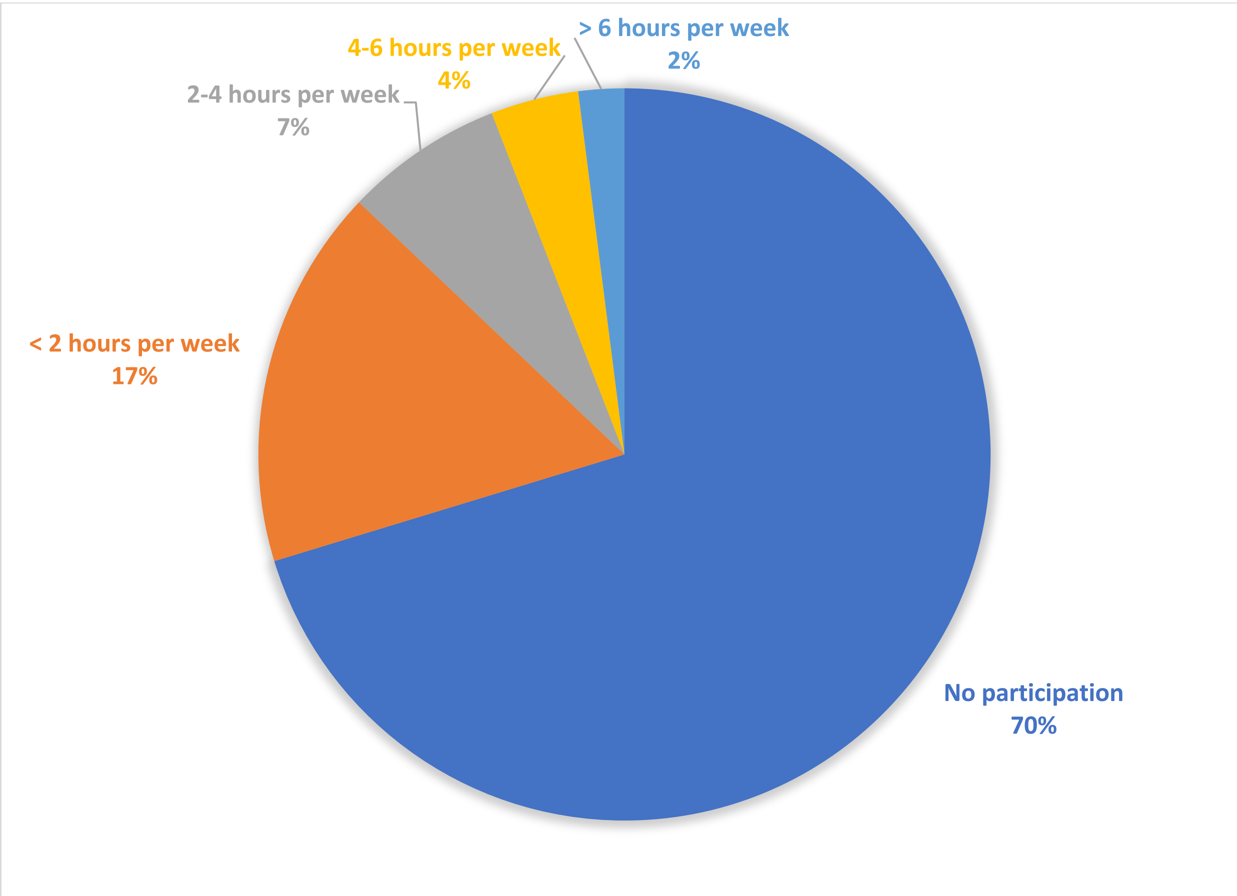
Variables	**Mean (SD)**	**Min**	**Max**
Dependent Variables			
OST math education [UK2]	1.52 (0.97)	1	5
Math performance	476.31 (87.33)	194.85	797.47
Math study behaviors	0.29 (1.00)	-3.45	3.69
Student Level – Demographics			
Gender[a]	0.51 (0.50)	0	1
Race/Ethnicity[b]	1.92 (1.36)	1	6
Sibling[c]	0.77 (0.42)	0	1
Student Level – Family Characteristics			
Economic, social & cultural status	0.18 (0.93)	-3.8	3.13
Family structure[d]	1.82 (0.43)	1	3
Student Level – Academic Standing			
Mathematics anxiety	-0.08 (0.43)	-3.67	3.66
Grade repetition[e]	0.16 (0.37)	0	1
Preschool attendance[f]	2.73 (0.49)	1	3
School Level – Math Teacher Quality			
Classroom disciplinary climate	0.07 (1.02)	-3.54	3.44
Math teacher support	0.26 (1.05)	-3.14	3.84
Formative assessment by math teacher	0.31 (1.08)	-3.56	3.82
School Level – School Characteristics			
Student-teacher ratio	116.74 (57.44)	13.87	325.50
School location[g]	2.61 (1.27)	1	5
Class size	23.34 (5.55)	11.83	43.85
Math class time per week	249.06 (130.56)	4.58	1280
Ability grouping for math class[h]	2.11 (0.60)	1	3
School type[i]	0.89 (0.32)	0	1
School selectivity[j]	2.03 (0.84)	1	3
Math extension courses offered at school	2.44 (0.64)	1	3

Note. Summary statistics were calculated based on 3225 weighted samples of one imputed file.

[a]Female = 0, male = 1 [b]White = 1, African American = 2, Hispanic = 3, Asian = 4, Multiracial = 5, other = 6 [c]No siblings = 0, has siblings = 1 [d]Single parent = 1, two parents = 2, other = 3 [e]No grade repetition = 0, repeated a grade = 1 [f] Never attended pre-school or kindergarten = 1, attended for 1 year or less = 2, attending more than 1 year = 3 [g]Village = 1, small town = 2, town = 3, city = 4, large city = 5 [h] No ability grouping = 1, ability grouping for some classes = 2, ability grouping for all classes = 3 [i]Private school = 0, public school = 1 [j]Not selective = 1, somewhat selective = 2, very selective = 3 [k]No math extension classes = 1, either enrichment or remedial classes = 2, both enrichment and remedial classes = 3

Figure 1

Out-of-School Math Lessons Participation in the U.S.



Note. A total of 3225 participants were included in this figure.

followed by 7.10% that spent 2-4 hours per week, 3.88% spent 4-5 hours, and 2.02% spent more than 6 hours per week (Figure 1).

There were two dependent variables embedded in the second research questions: the first dependent variable was PISA math performance; the second dependent variable was study behaviors in math. PISA considered student math performance as missing data and used the imputation methodology to predict a selection of likely proficiencies, usually referred to as plausible values, inferred from the observed item responses (OECD, 2014). Using item parameters anchored at their estimated values from the international calibration, the instrument contained five plausible values of math performance, which were random draws from the marginal posterior of the latent distribution for each student (see OECD 2014). The soft skill variable, math study behaviors and attitudes, was a new construct created in the main survey of PISA 2012, which measured students' task performance in math with a survey question, *Thinking about the math you do for school: to what extent do you agree with the following statements?* Nine items were included in the scaling procedure, such as *I finish my homework in time for math class.* The response categories ranged from *Strongly Agree* to *Strongly Disagree* on a 1-5 scale. All items were reversed, so the larger number corresponded to the higher level of positive study behaviors and attitudes.

Other covariates were structured into blocks at two levels. At the student level, student demographics, math/academic standing, and family socioeconomic status were included. At the school level, measures of teacher and school quality, also known as the opportunity to learn indices (OECD, 2014), were included in the analyses. As suggested in the PISA technical report, student ratings of classroom disciplinary climate, math teacher support, and formative assessment in math were aggregated and centered on the group mean at the school level in multilevel models examining differences in student achievement (Lüdtke et al., 2008; OECD, 2014). Note that most of the covariates used in the study were latent constructs, meaning the variables contained a set of survey items and were scaled to singular scores using Item Response Theory. These latent variables were created by OECD and contained in the dataset with high degree of validity within and between countries (OECD, 2014). Details on the scaling procedures of latent variables could be found in Table 5 in the Appendix.

Analytical Approaches

Participation Pattern of OST Math Education

Analyses were accomplished in StataMP14. Ordered logistic regression modeling was employed to answer the first research question (Long, 1997). Ordered logistic regression estimated a single odds ratio that summarized the association of interests across all levels of the outcome, hours of OST math learning per week. As the student samples were clustered within schools, two-level modeling was adopted to investigate the contribution of both student and school-level indicators in explaining variance in OST math class participation. Although the between-school variation was modest (intra-class correlation=0.04), a multilevel analytical approach was necessary given the design effect (2.12) (Lai & Kwok, 2015), the sampling procedure (OECD, 2014), and the intention of the study.

A stepwise approach was used for building the multilevel models, starting from the simpler model at the student level and systematically moving towards more complex models at the school level (Raudenbush & Bryk, 2002). Because of the nonlinearity nature of the models, a Wald test was performed to test the joint significance of the coefficients of the newly added blocks of variables, so as to obtain the final models (Guo, 2005). Throughout the ordered logistic models, the school-level weight and an adjusted student-level weight that summed to the effective sample size of their corresponding second-level cluster, as suggested by Rabe-Hesketh and Skrondal (2006), were incorporated in respond to the complex survey design.

Relationships with Math Performance and Study Behaviors and Attitudes

Considering the potential differences between the participants and nonparticipants of OST math education, this study employed propensity dosage analysis (Guo & Fraser, 2015) to evaluate the relationships between (different intensities of) OST math education and cognitive and non-cognitive skills: (1) math performance and (2) math study behaviors. In the propensity score framework, treatments that take on a continuum of values are considered as having multiple doses. Modeling treatment dosage enables to determine “the effects of differential amounts of treatment on outcomes” (Guo & Fraser, 2015, p. 309). In this study, the levels of time spent on OST math learning are doses. To account for the polychotomous nature of its measurement and obtain a roughly similar number of cases for each level (dose), level 4 and level 5 of the original measurement of OST math education were combined. Four categories of the treatment variable OST education were finalized (Table 2).

Table 2

Distribution of Math Tutoring in Four Dosage Categories

Dosage Level	Frequency	Percent
0 (never attend)	2265	70.23
1 (0-2 hours)	541	16.78
2 (2-4 hours)	229	7.10
3 (>4 hours)	190	5.89
Total	3225	100

Building upon the preceding findings, variables showing significant correlations with OST math class participation were entered into a multinomial logit model as predictors (Table 6 in the Appendix[MOU3]). Generalized propensity scores (GPS) for all study students were calculated as the predicted probabilities following the estimation of the multinomial model. The inverse of the propensity score of dose category each participant actually received was the weight for outcome analysis. Data imbalance was re-diagnosed by checking whether each covariate imposed a significant impact on the assignment of each dosage, with GPS as weights. Results suggested that the propensity score model and the GPS have removed covariate imbalance satisfactorily. Next, PISA math performance and in-school math work behavior were entered as the outcome variables in the weighted ordinary least square regression, with the highest dose, "more than 4 hours of OST math education per week," being the reference group. The final student-level weight used in the OLS regression was the multiplication of adjusted student-level weights and the weights from the propensity score method, along with the school weight at the school level (Ridgeway et al., 2015).

Results

Participation Patterns

The multilevel ordered logistic regression results have been summarized in Table 3, with proportional odds ratios and standard errors reported. Individual-level variables including race and academic standings were significant predictors of OST math learning participation across four models. Specifically, the odds of participating in (more) OST math education among 15-year-old African American, Hispanic, and Asian students were approximately [UK4]1.8, 1.3, and 1.4 times greater than for their White counterparts. For individual students who were one standard deviation higher in self-reported math anxiety or who had ever repeated a grade, the odds of participating in (more) OST math education were about 1.2 and 1.5 [UK5]times greater than those who had no academic anxiety over math or who had never repeated a grade. Early childhood education was also a statistically significant predictor. Attending one year or more than two years of preschool was associated with 0.4 and 0.5 times the odds of participating in (more) OST math education per week, respectively, than those who never had a preschool or kindergarten

Table 3

Ordered Logistic Regression of Out of School Time Math Education

Variables	Model 1	Model 2	Model 3	Model 4
Student Level -- Demographics[UK6]				
Gender (ref: female)	1.21 (0.11)	1.19 (0.11)	1.20 (0.12)	1.17 (0.13)
Race (ref: White)				
African American	2.32 (0.23)***	2.18 (0.19)***	2.01 (0.16)***	1.79 (0.20)**
Hispanic	1.38 (0.17)	1.43 (0.17)*	1.42 (0.16)*	1.30 (0.17)
Asian	1.58 (0.19)**	1.58 (0.17)**	1.57 (0.18)*	1.42 (0.20)
Multiracial	0.90 (0.28)	0.84 (0.28)	0.90 (0.28)	0.89 (0.29)
Other	1.57 (0.21)*	1.40 (0.19)	1.43 (0.17)*	1.60 (0.16)**
Student Level – Family Characteristics				
Sibling (ref: none)	1.06 (0.16)	1.08 (0.17)	1.82 (0.16)	1.11 (0.17)
Economic, social & cultural status	0.91 (0.08)	0.97 (0.08)	0.94 (0.08)	0.95 (0.09)
Family Structure (Ref: single parent)				
Two parents	0.82 (0.26)	0.82 (0.25)	0.84 (0.25)	0.83 (0.26)
Other	0.88 (0.47)	0.91 (0.46)	0.97 (0.47)	1.04 (0.47)
Student Level – Academic Standing				
Math anxiety		1.19 (0.08)*	1.19 (0.08)*	1.17 (0.08)*
Grade repetition (ref: no repetition)	.	1.57 (0.19)*	1.46 (0.15)**	1.42 (0.41)*
Preschool attendance (ref: none)				
One year		0.37 (0.36)**	0.38 (0.35)**	0.40 (0.41)*
More than 2 years		0.45 (0.32)*	0.48 (0.32)*	0.48 (0.39)*
School Level – Math Teacher Quality				
Classroom disciplinary climate			1.16 (0.21)	1.09 (0.16)
Math teacher support		.	0.52 (0.24)**	0.58 (0.25)*
Formative assessment by math teacher			1.30 (0.16)	1.22 (0.18)
School Level –School Characteristics				
Location (ref: village[RA7])				
Small town				0.92 (0.17)
Town				0.76 (0.19)
City				0.88 (0.20)
Large city				1.05 (0.23)
Class size				1.01 (0.01)
Math class time per week				0.78 (0.18)
Ability group for math classes (ref: no grouping)				
For some classes				1.49 (0.20)*
For all classes				1.46 (0.23)
School type (ref: private school)				0.68 (0.24)
School selectivity (ref: high selectivity)				
Not selective				1.32 (0.14)*
Somewhat selective				1.00 (0.14)
Math extension courses offered at school (ref: none)				
Either enrichment or remedial				1.45 (0.27)
Both enrichment and remedial				1.65 (0.26)

Note. *$p<.05$. **$p<.01$. ***$p<.001$. Regression estimates of each imputed file were based on 3225 weighted samples. Standard errors were adjusted for the complex survey design. Each cell contained incidence-rate ratios (exponentiated ordered logistic regression coefficients) and standard errors (in parentheses). Ref = Reference Group.

education. No significant difference was found between male and female students.

Opportunity to learn indices at the school level, such as student ratings of math teacher support, school implementation of ability grouping, and school selectivity, were significant predictors of participation. One standard deviation increase in math teacher support was associated with twice the odds of participating in (less) OST math education. Students attending schools with ability grouping practices for some classes significantly correlated with 1.5 times the odds of participating in (more) OST math learning than those schools having no ability grouping policy. Students attending schools that implemented unselective admission processes were 1.3 times the odds of participating in (more) OST math education than those attending very selective schools. Results from multinomial regression and logistic regression of the binary outcome, whether students participated OST education or not, demonstrated similar findings.

Relationships with PISA Math Performance and Math Study Behaviors and Attitudes

A number of variables were correlated with students' math performance significantly, such as family socioeconomic status, math anxiety, disciplinary climate in the classroom, math teacher support, class size, class time per week, and math teacher-student ratio (Table 4). With generalized propensity score adjustment (using GPS as weights in the model), the associations between dosages of OST math lessons and PISA math performance were negative, though most of the relationships were not significant. For instance, students taking OST math lessons more than 4 hours per week would achieve 47.64 points lower in PISA math assessment than those with no OST math lessons and the difference was statistically significant ($p<.001$). Students attending OST math lessons 0-2 hours per week would achieve 17.4 points higher than those with more than 4 hours of tutoring. Students with 2-4 hours of OST math lessons would achieve 19.52 points higher than those with more than 4 hours of tutoring.

Furthermore, students with the highest intensity of OST math education were associated with the highest level of positive study behaviors and attitudes. Specifically, more than 4 hours of weekly OST math lessons correlated with the improvement of math study behavior scores by .24 ($p < .05$), .16, and .13 units from none, 0-2 hours, and 2-4 hours of OST math, respectively. Overall, the results illustrated a statistically significant relationship in an upward direction between doses of OST math lessons and math study behaviors: the longer a student attended OST math learning, the more positive math study behaviors and attitudes he or she would demonstrate to apply to math schoolwork. Analyses with imputation on OST math class participation were conducted as sensitivity tests. In general, the findings have been similar to previously discussed results.

Discussion

Findings about the participation patterns shed some light on the nature of OST math learning and key differences between participants and nonparticipants in the U.S. context. At the individual level, academically disadvantaged students (who have more math anxiety, grade repetition, or fewer years of preschool education) were more likely to attend math lessons during their out-of-school time. Subsequent regression analyses with propensity score weights identified the connections between lower dosages of OST math lessons and higher PISA math scores. Thus, the main nature of OST math learning in the U.S. might be remedial, used predominantly

Table 4

Regression Analyses of the Associations between Dosage of Out of School Time Math Education on Math Performance and Study Behaviors

Covariate	Estimated Regression Coefficient (Robust SE)	
	PISA Math Performance	Study Behaviors
Student Level – Demographics[UK8]		
Gender	1.71 (5.80)	-0.20 (0.08)**
Race/Ethnicity	2.30 (1.96)	-0.02 (0.04)
Student Level – Family Characteristics		
Economic, social & cultural status	18.85 (4.00)***	0.09 (0.05)*
Family structure	4.02 (8.03)	4.02 (8.03)
Student Level – Academic Standings		
Grade repetition	-31.22 (12.09)*	-0.02 (0.17)
Math anxiety	-12.83 (3.95)**	-0.20 (0.07)*
School Level – Math Teacher Behavior		
Classroom disciplinary climate	46.18 (9.19)***	0.05 (0.06)
Math teacher support	3.53 (13.10)*	0.15 (0.06)*
Formative assessment by math teacher	-25.68 (11.27)*	0.20 (0.05)**
School Level –School Characteristics		
School location	-6.35 (3.28)*	--
Class size	1.56 (0.75)*	--
Math class time per week	59.69 (14.27)***	--
Ability grouping for math classes	11.17 (5.02) *	--
Student-teacher ratio	-0.11 (0.05)*	--
Math extension courses offered at school	-0.56 (5.90)	--
Dosage of OST Math Class Participation (ref. more than 4 [UK9]hours of math class participation per week)		
Never	47.64 (13.31)***	-0.24 (0.11)*
0-2 hours per week	17.40 (11.82)	-0.16 (0.12)
2-4 hours per week	19.52 (12.04)	-0.13 (0.14)
Constant	76.72 (89.12)	0.68 (0.18)***
Random Effects		
Random Intercept Variance	25.74 (2.67)	0.37 (0.07)

Note. $*p<.05$. $**p<.01$. $***p<.001$[RA10][MOU11]. Regression estimates of each imputed file were based on 3225 weighted samples. Standard errors were adjusted for the complex survey design.

by low-performing students to catch up. In addition, the study found socioeconomic status was a nonsignificant predictor, implying variation of the participation was not explained by family resources. However, there were some individual variations in the participation of OST math learning. Racial or ethnic minority students, particularly African American students, were more likely to attend OST math learning. Considering minority students are disproportionately underserved in the U.S. public schools, this finding is also aligned with the remedial nature of OST math learning.

On a broader level, the interplay between opportunity-to-learn characteristics of formal schooling and OST education is crucially revealed. A higher degree of support offered by math teachers, which equals to a better chance of understanding class contents within schools, is associated with the decreased likelihood of participating in OST math learning. Regarding certain school practices, students from the schools that implement ability grouping practices or unselective admission processes were more likely to attend OST math learning. Though further investigation is needed, ability grouping might contribute to heightened learning pressure on students and unequal inputs from teachers in that experienced teachers are usually assigned to more advanced classes (Betts & Shkolnik, 2000). Left with less-experienced and less-qualified teachers at schools, lower-track students might be more likely to participate in OST math education to fully understand class content and acquire the requisite skills. In a similar vein, students in unselective schools might need more academic help or attention, thus more likely to seek for OST instructional aids.

Regarding skill development, OST math class participation was connected to the growth of certain soft skill that would benefit academic outcomes. Building upon student self-reported information, participation of OST math education was associated with higher levels of positive math study behaviors and attitudes, including being attentive in math class, well-prepared for exams, and punctual with homework. The relationships were in an upward direction, indicating higher dosages of OST math instructions were related to greater development of positive study behaviors and attitudes in math. According to the literature on social and emotional learning, soft skills are tightly connected with learning development because children with these skills will do their homework diligently and seek out further opportunities for growth (OECD, 2015). In conjunction with the identified participation patterns, OST math education might particularly facilitate the development of academically-relevant soft skills for the students who were underperforming or attended low-quality schools. The finding also aligns with Bridglall and Gordon's (2005) argument that the importance of OST education was carried by the development and cultivation of soft skills. Particularly, engaging in structured and supervised educative activities during OST could limit the influence of neighborhood or family-level risk factors while develop positive network with instructors and other hard-working peers. Positive network could offer greater opportunities for gaining the capitals beneficial to academic and life successes. Although the cross-sectional data only captured a snapshot of the relationship, it is reasonable to expect the development of these soft skills might further translate into academic growth. As seen in Viadero's (2007) report on the Promising Afterschool Programs, disadvantaged students who regularly attended well-designed after-school curricular programs for two years ended up academically far ahead of peers who spent more out-of-school time in unsupervised activities.

The reciprocal relationship between formal schooling and OST education found in the study is unique and instructive to the field of OST education. Characteristics of formal schooling (e.g., teacher quality and school practices) and institutional functions of schools (e.g., credentialing and stratifying) play a significant role in the decision-making process of participation of OST curricular learning. Reciprocally, OST education enables the development of positive study habits and attitudes that apply to schoolwork. The multi-layered interconnection between formal schooling and OST education has implications on policy and practice. For example, improving the quality of formal schools could be effective to regulate the OST sector. It is also crucial to include time and space beyond schooling in the discourse of educational excellence and disparities. Efforts that intend to shape students' soft skills could consider the interventions taking place outside of schools, such as at families, neighborhoods, and communities.

Conclusion

As the worldwide school closures in early 2020 disrupted formal class learning, out-of-school time and space is more important than ever. Existing research suggests that remote education would lead to learning losses among all students, but the losses would be deeper for disadvantages students (Hanushek & Woessmann, 2020). Although literature has suggested that the out-of-school socio-ecological contexts are important to educational opportunities and outcomes, less is known about the ways in which OST experiences shape patterns of educational stratification due to the variety of OST programs and the hidden decision-making process of participation. In this particular time, students whose families are less able to support out-of-school learning will face larger learning losses than their more advantaged peers, which in turn will translate into wider achievement gaps and deeper losses of lifetime earnings.

Utilizing strategic analyses on the U.S. samples from PISA 2012, this study investigated the participation patterns of OST math learning and the relevance to academic and non-academic skill development (math performance and the soft skills of study behaviors and attitudes) among 15-year-old students in the U.S. The study found that African American students, low-performing students, and students attending schools with suboptimal teaching and institutional characteristics were more likely to participate in (more) OST math education. Given these relationships, this study reasoned that OST math education might be primarily used as a remedial intervention, provided to academically struggling students. In addition to focusing on academic performance, this study revealed that participation of OST math education was significantly associated with the development of positive study behaviors and attitudes, such as persistence, motivation, and responsibility.

Nevertheless, the study opens up more questions to be resolved. Due to the complexity of student learning, PISA 2012 did not probe into the purposes and motivations of OST instruction by subject. The present study interpreted OST math education in the U.S. as largely remedial on the basis of the direction and statistical significance of the relationship between students' prior performance and OST math participation. It should be noted that this interpretation is limited in its capacity to reveal the specific cultural meanings that students and parents attach to OST education (Bray & Kobakhidze, 2014; Park et al., 2016). Although a robust international dataset, PISA 2012 did not have a precise definition of OST education, nor did they account for the broad range of modes of OST education (Bray & Kobakhidze, 2014). Future research should consider using the instruments that have clear and well-targeted questions and collect information on the motivations of students and definitions of services (modes, locations, resources and forms). If more data regarding the characteristics and programs of OST curricular learning can be collected, researchers would be able to interrogate whether and how specific classes or activities are effective for diverse student populations. Evidence on the components making up meaningful and effective OST programs will be of greater relevance to practice. To understand performance growth, longitudinal data is also important and desired.

In spite of these limitations, the survey questions about OST math education in PISA 2012 capture well all possible curriculum-oriented math learning that takes place when school is out of session. The high degree of coverage in OST math learning sufficiently served the goals of this study. Therefore, this study makes unique contributions in revealing the interconnections between OST education and formal schooling from both conceptual and empirical perspectives. On the one hand, the institutional quality of formal schooling, as demonstrated in the teaching force and school practices, is connected with participation in OST education. On the other hand, OST education is related to the soft skills that are important to academic and life outcomes. The evidence that OST education might empower students and families with academically relevant capitals and skills is particularly profound in that it enriches the conceptualization of contemporary education and educational justice. Time and space beyond schooling is a critical component of education and should be leveraged to develop multi-dimensional skills as well as to overcome the continuing pressure of disadvantaged conditions of certain student groups.

Educational policies that rest on a distributive model of justice should consider making educational resources available and accessible within and beyond school walls.

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References

Alexander, K. L., Entwisle, D. R., & Olson, L. S. (2007). Lasting consequences of the summer learning gap. *American Sociological Review, 72*(2), 167-180. https://doi.org/10.1177/000312240707200202

Baker, D. P. & LeTendre, G. K. (2005). *National differences, global similarities: World culture and the future of schooling*. Stanford University Press.

Betts, J. R., & Shkolnik, J. L. (2000). The effects of ability grouping on student achievement and resource allocation in secondary schools. *Economics of Education Review*, *19*(1), 1–15. https://doi.org/10.1016/S0272-7757(98)00044-2

Bissell, J., Dugan, C., Ford-Johnson, A., & Jones, P. (2002). *Evaluation of the YS –CARE after school program for California work opportunity and responsibility to kids (Cal-WORKS).* Department of Education, University of California, Irvine & Research Support Services. https://archive.globalfrp.org/out-of-school-time/ost-database-bibliography/database/ys-care/evaluation-1999-2001

Bourdieu, P., & Passeron, J. C. (1990). *Reproduction in education, society and culture*. Sage.

Bray, M. (1999). *The shadow education system: Private tutoring and its implications for planners*. UNESCO International Institute for Educational Planning.

Bray, M. (2017). Schooling and its supplements: Changing global patterns and implications for comparative education. *Comparative Education Review, 61*(3). https://doi.org/10.1086/692709

Bray, M., & Kobakhidze, M. N. (2014). Measurement issues in research on shadow education: Challenges and pitfalls encountered in TIMSS and PISA. *Comparative Education Review*, *58*(4), 590–620. http://dx.doi.org/10.1086/677907

Bray, M., & Kwo, O. (2014). *Regulating private tutoring for public good: Policy options for supplementary education in Asia*. Comparative Education Research Centre, The University of Hong Kong; UNESCO.

Briggs, D. C. (2001). The effect of admission test preparation: Evidence from NELS-88. *Chance, 14*(1), 10-18. http://dx.doi.org/10.1080/09332480.2001.10542245

Brooks-Gunn, J., Klebanov, P., Liaw, F. R., & Duncan, G. J. (1995). Toward an understanding of the effects of poverty upon children. In H. E. Fitzgerald, B. M. Lester, & B. S. Zuckerman (Eds.), *Reference books on family issues, Vol. 23 and Garland reference library of social science, Vol. 968. Children of poverty: Research, health, and policy issues* (pp. 3-41). Garland Publishing.

Buchmann, C., Condron, D. J., & Roscigno, V. J. (2010). Shadow education, American style: Test preparation, the SAT and college enrollment. *Social Forces, 89*(2), 435–461. https://doi.org/10.1353/sof.2010.0105

Byun, S. Y., & Park, H. (2012). The academic success of East Asian American youth: The role of shadow education. *Sociology of Education*, *85*(1), 40–60. https://dx.doi.org/10.1177%2F0038040711417009

Center for Early Childhood Mental Health Consultation (CECMHC). (2019). *Factors that influence children's social and emotional development.* Georgetown University Center for Child and Human Development. https://www.ecmhc.org/tutorials/social-emotional/mod1_2.html

Chernyshenko, O., Kankaraš, M., & Drasgow, F. (2018). *Social and emotional skills for student success and wellbeing: Conceptual framework for the OECD study on social and emotional skills* (Working Paper No. 173). OECD Publishing. https://doi.org/10.1787/db1d8e59-en

Cooper, M. (2014). *Cut adrift: Families in insecure times* (1st ed.). University of California Press.

Dang, H. A., & Rogers, F. H. (2008). The growing phenomenon of private tutoring: Does it deepen human capital, widen inequalities, or waste resources? *The World Bank Research Observer,* 23(2), 161-200. https://doi.org/10.1093/wbro/lkn004

Dixon-Roman, E. (2012). Introduction: social space and the political economy of comprehensively conceived education. In E. Dixon-Roman & E. W. Gordon (Eds.), *Thinking comprehensively about education: Spaces of educative possibility and their implications for public policy* (pp. 14-42). Routledge. https://doi.org/10.4324/9780203120019

Durlak, J. A., Weissberg, R. P., & Pachan, M. (2010). A meta-analysis of after-school programs that seek to promote personal and social skills in children and adolescents. *American Journal of Community Psychology, 45*(3–4), 294–309. https://doi.org/10.1007/s10464-010-9300-6

Everson, H. T., & Millsap, R. (2005). The impact of extracurricular activities on standardized test scores. In E. W. Gordon, B. L. Bridglall, & A. M. Meroe (Eds.), *Supplementary education: The hidden curriculum of high academic achievement* (pp. 111-124). Rowman & Littlefield Publishers, Inc.

Bridglall, B. L., & Gordon, E. W (2005). The institutionalization of supplementary education. In E.W. Gordon, B.L. Bridglall, & A.M. Meroe (Eds.). *Supplementary education: The hidden curriculum of high academic achievement* (pp. 275-294). Rowman & Littlefield Publishers, Inc.

Gordon E. W., Heincke, P. C., & Pajagopalan. K. (2012) Toward a reconceptualization of education. In E. Dixon-Roman & E. W. Gordon (Eds.), *Thinking comprehensively about education: Spaces of educative possibility and their implications for public policy* (pp. 14-42). [RA13]Routledge. https://doi.org/10.4324/9780203120019

Guo, S. (2005). Analyzing grouped data with hierarchical linear modeling. *Children and Youth Services Review*, *27*(6), 637–652. https://doi.org/10.1016/j.childyouth.2004.11.017

Guo, S., & Fraser, M. W. (2015). *Propensity score analysis: Statistical methods and applications* (2nd Ed.). SAGE Publications.

Hanushek, E. & Woessmann, L. (2020). *The economic impacts of learning losses* (Working Paper No. 225). OECD Publishing. https://doi.org/10.1787/21908d74-en.

Heinrich, C. J., & Burch, P. (2011). *The implementation and effectiveness of supplemental educational services: A review and recommendations for program improvement.* Center for American Progress; American Enterprise Institute for Public Policy Research. https://www.aei.org/research-products/working-paper/the-implementation-and-effectiveness-of-supplemental-educational-services/

Honig, M. I., & McDonald, M. A. (2005). From promise to participation: after-school programs through the lens of socio-cultural learning theory. *Afterschool Matters Journal, Fall #5,* 1-26. http://www.niost.org/pdf/afterschoolmatters/asm_2005_op5_fall/asm_2005_op5_fall-1.pdf

Jheng, Y. J. (2015). The influence of private tutoring on middle-class students' use of in-class time in formal schools in Taiwan. *International Journal of Educational Development. 40*, 1–8. https://doi.org/10.1016/j.ijedudev.2014.11.019

Karakolidis, A., Pitsia, V., & Emvalotis, A. (2016). Examining students' achievement in mathematics: A multilevel analysis of the programme for international student assessment (PISA) 2012 data for Greece. *International Journal of Educational Research, 79*(1)*,* 106–115. https://doi.org/10.1016/j.ijer.2016.05.013

Kugler, M. R. (2001). After-school programs are making a difference. *NASSP Bulletin, 85*(626), 3-11. https://doi.org/10.1177/019263650108562601

Lai, M. H. C., & Kwok, O. (2015). Examining the rule of thumb of not using multilevel modeling: The "design effect smaller than two" rule. *The Journal of Experimental Education*, *83*(3), 423–438. https://doi.org/10.1080/00220973.2014.907229

Lareau, A. (2003). *Unequal childhoods: Class, race, and family life* (1st ed.). University of California Press.

Lee, J., & Stankov, L. (2013). Higher-order structure of noncognitive constructs and prediction of PISA 2003 mathematics achievement. *Learning and Individual Differences, 26*, 119–130. https://doi.org/10.1016/j.lindif.2013.05.004

Leos-Urbel, J., & Aber L. J. (2012). The challenges of developing a robust knowledge based on complementary education: Toward a policy-relevant research agenda. In E. Dixon-Roman & E. W. Gordon (Eds.), *Thinking comprehensively about education: Spaces of educative possibility and their implications for public policy* (pp. 213-228). Routledge. https://doi.org/10.4324/9780203120019

Long, J. S. (1997). *Regression models for categorical dependent variables*. SAGE Publications.

Lüdtke, O., Marsh, H. W., Robitzsch, A., Trautwein, U., Asparouhov, T. & Muthén, B. (2008). The multilevel latent covariate model: A new, more reliable approach to group-level effects in contextual studies. *Psychological Methods*, *13*(3), 203-229. https://doi.org/10.1037/a0012869

Mahoney, J. L., Lord, H., & Carryl, E. (2005). An ecological analysis of after-school program participation and the development of academic performance and motivational attributes for disadvantaged children. *Child Development*, *76*(4), 811–825. https://doi.org/10.1111/j.1467-8624.2005.00879.x

OECD. (2014). *PISA 2012 technical report.* OECD Publishing. http://www.oecd.org/pisa/pisaproducts/pisa-2012-technical-report-final.pdf

OECD. (2015). *Skills for social progress: The power of social and emotional skills.* OECD Publishing. https://doi.org/10.1787/9789264226159-en

Park, H., Buchmann, C., Choi, J., & Merry, J. J. (2016). Learning beyond the school walls: Trends and implications. *Annual Review of Sociology*, 42, 231-252. https://doi.org/10.1146/annurev-soc-081715-074341

Rabe-Hesketh, S., & Skrondal, A. (2006). Multilevel modelling of complex survey data. *Journal of the Royal Statistical Society: Series A, 169*(4), 805–827. https://doi.org/10.1111/j.1467-985X.2006.00426.x

Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models* (2nd ed.). SAGE Publications Inc.

Ridgeway, G., Kovalchik, S. A., Griffin, B. A., & Kabeto, M. U. (2015). Propensity score analysis with survey weighted data. *Journal of Causal Inference*, *3*(2), 237-249. https://doi.org/10.1515/jci-2014-0039

Rosenbaum, P. R. & Rubin, D. B. (1983). The central role of the propensity score in observational studies for causal effects. *Biometrika, 70*(1)*,* 41-55. https://doi.org/10.1093/biomet/70.1.41

Rothstein, R. (2004). *Class and schools: Using social, economic, and educational reform to close the black-white achievement gap.* Teachers College Press.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology, 25,* 54–67. https://doi.org/10.1006/ceps.1999.1020

Schacter, J. (2001). Reducing social inequality in elementary school reading achievement: Establishing summer literacy day camps for disadvantaged children. *Milken Family Foundation.*

Silova, I. (2010). Private tutoring in Eastern Europe and Central Asia: Policy choices and implications. *Compare: A Journal of Comparative and International Education, 40*(3), 327-344. https://doi.org/10.1080/03057920903361926

Springer, M., Pepper, M., & Ghosh-Dastidar, B. (2014). Supplemental educational services and student test score gains: evidence from a large, urban school district. *Journal of Education Finance, 39*(4), 370-403. http://www.jstor.org/stable/24459268

Stacki, S. L. (2015). After school programs. In V. A. Anfara Jr., P. G. Andrews, & S. B. Mertens (Eds), *The encyclopedia of middle grades* [RA14]*education* (2nd ed.)*.* Information Age Publishing.

Starkman, R. (2013, September 21). *Private college admissions consultants: Does your child need one?* Huffington Post. https://www.huffpost.com/entry/private-college-admissions-consulting_b_3625632

Stevenson, D. L., & Baker, D. P. (1992). Shadow education and allocation in formal schooling: Transition to university in Japan. *The American Journal of Sociology*, *97*(6), 1639-1657. https://doi.org/10.1086/229942

Steinberg, M. P. (2011). Educational choice and student participation: The case of the supplemental educational services provision in Chicago public schools. *Educational Evaluation and Policy Analysis, 3*3(2), 159-182. https://doi.org/10.3102/0162373711402991

U.S. Department of Education. (2018). *21st Century Community Learning Centers (21st CCLC) analytic support for evaluation and program monitoring: An overview of the 21st CCLC performance data: 2016–17*. U.S. Department of Education, Office of Elementary and Secondary Education. https://www2.ed.gov/programs/21stcclc/1617perrpt.docx

Viadero, D. (2007). High-quality after-school programs tied to test-score gains. *Education Week.* https://www.edweek.org/ew/articles/2007/11/28/13afterschool.h27.html

Zhou, M. (2012). The ethnic system of supplementary education: Lessons from Chinatown and Koreatown, Los Angeles. In E. Dixon-Roman & E. W. Gordon (Eds.), *Thinking comprehensively about education: Spaces of educative possibility and their implications for public policy* (pp. 65-81). Routledge. https://doi.org/10.4324/9780203120019

Appendix

Table 5

Scaling Procedures for Latent Constructs in PISA2012

Latent Constructs	**Brief Description**
Index of economic social and cultural status	Family socioeconomic status including home possessions, highest parental occupation, and highest parental education expressed in years of schooling.
Family structure	Indicates the people you are living with: (1) single parents, (2) two parents
Mathematics anxiety*	Includes four items: I worry because it is difficult; I get tense with homework; I get nervous doing math; I feel helpless doing math; I worry of poor grades in math.
Classroom disciplinary climate*	Includes five items: Students do not listen to math teachers; Noise and disorder; Long time to quiet down; Students cannot work well; Long time to start working in math class.
Mathematics teacher's support in classroom*	Includes four items: Tells us to work hard; Provides extra help when needed; Helps with learning; My teacher gives students the opportunity to express opinions.
Teacher behavior: formative assessment*	Includes four items: Tells me how well I am doing in mathematics class; Gives me feedback on my strengths and weaknesses in mathematics; Tells us what is expected of us for a test, quiz or assignment; Tells me how to become better in mathematics
Ability grouping for mathematics classes	School principals were asked to report on the extent to which their mathematics instruction catered for students with different abilities: the occurrence of ability grouping into different classes with different difficulty levels in similar content or with different content; ability grouping within classes; and application of different pedagogies within a class rather than ability grouping.
School selectivity	An index computed by assigning schools to categories (from 1= no selectivity, to 3 = high selectivity) based on their admittance policies, including placement tests and recommendation by feeder schools.
Math extension courses offered at school	An index of assigning schools to categories based on the mathematics extension course types offered at school, including (1) additional math courses without differentiation based on prior achievement; (2) either enrichment math only or remedial math classes only; and (3) both enrichment and remedial mathematics classes.
Math work behaviors at school	Includes nine items: Finish homework in time for math class, work hard on math homework, prepared for math exams, study hard for math quizzes, keep studying until understand, pay attention in math class, listen in math class, avoid distractions when studying math, keep math work well organized"

Note. *=Items were reversely recoded as (4=0), (3=1), (2=2), (1=3), such that a high score indicated high levels of measurement. Total score was calculated as a ratio of the sum of all questions over maximum score of valid responses (OECD, 2014).

Table 6

Multinomial Logit Model Predicting Generalized Propensity Scores

	Dosage 1: never		Dosage 2: 0-2 hours		Dosage 3: 2-4 hours	
Covariate	*B*	*SE*	*B*	*SE*	*B*	*SE*
Race (ref: White)						
African American	-0.42	0.34	0.39	0.47	0.73	0.42
Hispanic	-0.13	0.29	0.50	0.30	0.23	0.52
Asian	-0.13	0.36	0.72	0.46	0.31	0.46
Multiracial	0.48	0.81	0.68	0.84	0.10	0.92
Other	0.88	1.10	1.56	1.19	2.04	1.64
Math anxiety	-0.07	0.18	-0.06	0.17	-.01	0.16
Grade repetition (ref: no repetition)	-0.78***	0.20	-.25	0.29	-0.62	0.46
Preschool education (ref: no)						
One year	1.42*	0.60	0.17	0.76	0.15	0.92
More than 2 years	1.13*	0.58	0.14	0.69	0.09	0.77
Math teacher's support	0.22	0.37	0.07	0.38	-1.05*	0.50
Ability group (ref: no grouping)						
For some classes	0.77**	0.31	1.84	1.01	1.03*	0.43
For all classes	0.37	0.35	1.45	1.01	0.45	0.50
Constant	0.82	0.61	-1.03	1.13	-0.57	0.87

Note. *p<.05. **p<.01. ***p<.001. The multinomial logit model employed. Dose Category 4 "More than 4 hours" as a reference (omitted) category.