UCLA | CRESST NATIONAL CENTER FOR RESEARCH ON EVALUATION, STANDARDS, AND STUDENT TESTING

LONG-TERM OUTCOME STUDY: A LONGITUDINAL STUDY OF LA'S BEST STUDENTS' PERSISTENCE AND GRADUATION RATES

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Executive Summary

The LA's BEST Afterschool Enrichment Program is housed at primary centers and elementary schools in the Los Angeles Unified School District (LAUSD). The program is free and is open to all students in the selected sites on a first-come, first-served basis. At the time of this study, LA's BEST served a student population of approximately 25,000 students at 167 school sites. Activities offered at each program site include homework help or tutoring, academic enrichment activities in core content areas and technology, and other forms of enrichment such as sports or the arts.

The primary goal of this study was to replicate and improve upon a previous study of LA's BEST participants' secondary school persistence (or dropout) in light of the program's expansion. Specifically, analyses sought to answer the following research questions:

- How do the participants and non-participants compare in regards to their demographics? Are there differences based on dosage in the LA's BEST program?
- How do the participants served in LA's BEST program sites compare to non-participants in their persistence (or dropping out) in school? Are there differences based on dosage in the LA's BEST program?
- How do participants served in LA's BEST program sites compare to non-participants in regards to their high school graduation? Are there differences based on dosage in the LA's BEST program?

Study Methodology

A quasi-experimental design including the use of coarsened exact matching was used to establish demographically similar study samples from which valid inferences could be generated. The control group was composed of students who attended LA's BEST schools from second to fifth grade, but who had no exposure to the program. Multilevel multiple membership classification (MMMC) models were used to examine student outcomes over time.

This was done to examine long-term impacts on students' secondary school persistence or dropout and high school graduation/completion. Analyses included two cohorts of students who were projected to graduate on time from high school in 2016 and 2017. The MMMC models used were necessary to account for the nested structure of the data and to take into the account student movement between schools.

Analyses were conducted at two levels. First, we conducted models to examine the overall and subgroup results for all students in the study (i.e., the pooled sample) in order to ensure sufficient sample sizes to detect intervention effects. We then examined overall and subgroup results separately for each of the two cohorts. The dosage-based subgroups used for the study were statistically determined in order to account for the overall high level of attendance among the treatment students. More specifically, students were in the control group if they did not attend LA's BEST at all during the baseline (second grade) or treatment period of the study (third to fifth grade). Students who were included in the treatment group were then classified as low (1 to 132 days per year), moderate (133 to 167 days per year), high (≥ 168 days per year), or as treatment interrupted (participated in second grade, but not during third, fourth, and/or fifth grade).

Study Results

The results of the study generally imply positive long-term impacts on secondary school persistence and graduation/completion for students who had higher average attendance in LA's BEST during third through fifth grade. The following presents more details of the findings for the study.

Demographics of the LA's BEST and Control Students

- LA's BEST participants and their statistically matched controls were primarily Hispanic and of a low socioeconomic status. More than one-half of the students were classified as English language learners. About half of each population and sample was female and students generally had lower second grade English language arts (ELA) achievement scores than the district mean.

Secondary School Persistence

- Multilevel models showed some statistically significant differences between the LA's BEST and control group students concerning secondary school persistence.
- Significant positive differences were found for the high LA's BEST attenders when compared to the control group. These significant differences were found for the analyses of the pooled samples and for the Cohort 2 samples, and approached significance for Cohort 1.

- Significant negative differences were found for the low LA's BEST attenders when compared to the control group. These significant differences were found for the analyses of the pooled samples and Cohort 2 samples only.
- Significant negative differences were found for the LA's BEST students who had interrupted enrollment during third, fourth, and/or fifth grade. These significant differences were found for Cohort 1 only, and approached significance for Cohort 2.

High School Graduation

- Multilevel models showed some statistically significant differences between the LA's BEST and control group students concerning on time high school graduation or completion.
- Significant positive differences were found for the combined LA's BEST attenders when compared to the control group. These significant differences were found for the Cohort 1 samples, and approached significance for the pooled samples.
- Significant positive differences were found for the high LA's BEST attenders when compared to the control group. These significant differences were found for the analyses of the pooled samples and Cohort 1 samples, and approached significance for Cohort 2.
- Significant negative differences were found for the LA's BEST students who had interrupted enrollment during third, fourth, and/or fifth grade. These significant differences were found for the analyses of the pooled samples and Cohort 1 samples, but not for Cohort 2.

Conclusion

This study set out to replicate and improve methodologically upon a previous study conducted of long-term persistence (or dropping out) outcomes for LA's BEST participants in comparison to a control group of non-participants in the program. The research tracked two cohorts of students from second grade to twelfth grade. Despite the differences in methodology and in the definition of dosage, the study was able to replicate and extend upon the overall finding that students with higher levels of LA's BEST attendance experienced positive benefits regarding secondary school persistence. More specifically, the current study found that higher attenders were five percent less likely to dropout and six percent more likely to complete high school on time than were the matched control students in the same elementary schools who never participated in the program. These results were found within the context of more rigorous California State University A-G aligned graduation requirements by LAUSD.

Based on the results of the study, we recommend increased funding for afterschool programs to improve attendance among less frequent participants and to increase the number

of students served. In large, economically diverse regions such as Los Angeles, even small increases in graduation rates may positively impact opportunities for thousands of students and their families.

Long-Term Outcome Study: A Longitudinal Study of LA's BEST Students' Persistence and Graduation Rates

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Introduction

Since the publication of A Nation at Risk (Gardner, 1983), which urged adding an hour to the school day and 20 to 40 more days to the school year to make the U.S. education system more globally competitive, the expansion of student learning time has been an increasingly popular policy option for educational scholars and policymakers (Kane, 1994; National Center on Education and the Economy, 2008). Recent studies have found that extended learning programs, such as afterschool programs, can have positive effects on student outcomes (Bodilly & Beckett, 2005; Checkoway et al., 2012; Pedersen, 2012), particularly those that utilize frequent assessment (Bodilly & Beckett, 2005), those that focus on high needs students (Checkoway et al., 2012), and those in which participants receive adequate dosage (Huang, Leon, & La Torre, 2017; Huang, Leon, & La Torre Matrundola, 2014).

For more than 20 years, researchers and stakeholders have viewed afterschool programs as an opportunity to improve academic outcomes (Hollister, 2003), which is an important student level factor that can impact persistence and graduation (Goldschmidt & Wang, 1999). The providing of afterschool opportunities is considered particularly important for students who attend low-income and/or low-performing schools (Afterschool Alliance, 2003; Muñoz, 2002). As such, federal and state funding programs, such as the 21st Century Community Learning Centers (21st CCLC) and the After School Education & Safety (ASES) Program, have placed greater emphasis on the need for programs to provide homework help, supports for core academic subjects, as well as other forms of enrichment such as sports or the arts.

In this study, we provide evidence for two critical issues concerning school level outcomes for participants in afterschool programs. Building on previous work conducted by the National Center for Research on Evaluation, Standards, and Student Testing (CRESST) at the University of California, Los Angeles (UCLA), we measure the long-term impact of the LA's BEST

Afterschool Enrichment Program on secondary school persistence as well as on time high school graduation or completion.

Background

In this section, we explore the literature on afterschool research and evaluation with a focus on afterschool attendance. We also present literature on secondary school persistence, dropout, and graduation in order to lay the foundation for the student and school level factors taken into account during the study. Details of the applicable studies and findings for the LA's BEST program will be provided in the following section about the study context.

Secondary School Persistence and High School Graduation

One of the newer requirements of the Elementary and Secondary Education Act of 1965, as amended by the Every Student Succeeds Act (2015) involves the calculation and reporting of high school graduation rates as a measure of school success as well as college and career readiness (see U.S. Department of Education, 2017). For the purposes of these regulations, students are expected to graduate or complete high school, if they have a significant cognitive disability, within four school years of entering ninth grade (U.S. Department of Education, 2017).

Despite the increased emphasis being made concerning this issue, and clear improvements overall and across subgroups in recent years, on time graduation or completion is still a problem in California. According to the Public Policy Institute of California (2018), overall graduation rates increased by 8% and subgroup results increased from 12% to 16% between the 2009−2010 and 2015−2016 school years. Despite this, their data also shows that the state's graduation rate stood at only 83% overall and was in the low to mid-seventies for major subgroups including Latinos, African Americans, students who are socioeconomically disadvantaged, and those classified as English learners (Public Policy Institute of California, 2018). Results provided by the California Department of Education (2018) for the 2016−2017 school year shows very similar results with an overall statewide total of 82.7%. Similarly, according to the California School Dashboard (California Department of Education, 2017), the graduation rates for Los Angeles Unified School District (LAUSD), which hosts LA's BEST, stood at 80.5% during the 2015−2016 school year and at 84.2% for the subsequent year.

While there is a dearth of research directly assessing the impact of afterschool programs on high school graduation rates, research has been conducted on multiple issues that should relate, and which were taken into account during the statistical matching process for this study. For example, there is some evidence that students who participate in elementary school-based

programs have better school attendance than those who are in a control group, whether statistically matched as in the study conducted of 21st CCLC and ASES programs funded in California (Huang & Wang, 2012a) or a recent study conducted of LA's BEST (La Torre, Leon, Wang, & Cai, 2018), or when using unmatched samples (Dynarski et al., 2003; Hartmann, Good, & Edmunds, 2011; Jensen et al., 2018). Furthermore, some studies and meta-analyses have found positive impacts of afterschool participation in one or both of the key content areas of English language arts (ELA) and mathematics (Dynarski et al., 2003; Dynarski et al., 2004; Falls, 2013; Herrera, Linden, Arbreton, & Grossman, 2011; Lauer et al., 2006; Miller, 2003; O'Donnell & Kirkner, 2014; Wilson, 2016).

While also limited in scope, some research has also been done on the relationship between participation in extracurricular activities and secondary school persistence. Fashola and Slavin (1998) reviewed the research conducted on six programs that were specifically geared towards dropout prevention or encouraging college attendance. While the authors did make broad statements about the features of programs that led to success, the methodologies used varied greatly. For example, while one study looked at whether students were gone from school for 20 or more days while another reported on changes in the percentage of graduates. Furthermore, only one of the studies used statistically matched samples—in this case of participants and non-participants in the same schools—in order to be able to make causal inferences (see Burkheimer, Levinsohn, Koo, & French, 1976; Fashola and Slavin, 1998; Burkheimer, Riccobono, & Wisenbaker, 1979). It should be noted, though, that few of the other articles reviewed concerning dropout, persistence, or graduation rates for this report noted using statistical matching and none noted the use of an experimental design.

Based on the literature, differences in graduation or persistence rates may be due to a variety of reasons. For example, gender, race or ethnicity, and socioeconomic status are all common demographic factors that are specifically examined or taken into account. Despite this, reports vary in their findings concerning race and gender with some claiming no statistical differences (see Marshall, 2017; National Center for Education Statistics, 1998; US Department of Education, 2014; Wilson & Tanner-Smith, 2013) and others finding one or more to be a significant predictor (Marshall, 2017). In contrast, poverty and socioeconomic status have been found to be consistent predictors for dropping out (Cairns, Cairns, & Neckerman, 1989; Goldschmidt & Wang, 1999; Rodríguez & Conchas, 2009) and therefore graduation. Furthermore, some research has found school level poverty or socioeconomic status to be a significant predictor, with lower school level rates relating to lower dropout (Goldschmidt & Wang, 1999; Hahn & Danzberger, 1987; Lee, Cornell, Gregory, & Fan, 2011). Based on the literature, student characteristics such as school attendance (Allensworth, Gwynne, Moore, &

de la Torre, 2014; Balfanz, Herzog, & Mac Iver, 2007; Bowers, Sprott, & Taff, 2012; Rumberger, 2011; Rumberger, 1987), behavior or disciplinary problems (Allensworth et al., 2014; Barnes, 1992; Bowers et al., 2012; Stearns & Glennie, 2006), and language proficiency (Hahn & Danzberger, 1987) can also be predictive of school persistence or dropout. Finally, being retained one or more grades has been found to be a consistently strong predictor of secondary school dropout (Eide & Showalter, 2001; Goldschmidt & Wang, 1999; Roderick, 1994; Janosz, LeBlanc, Boulerice, & Tremblay, 1997; Rumberger, 1995).

Level of Afterschool Attendance

The issue of opportunity to learn does not apply only to the issue of school attendance, but also to the level of exposure that students receive to homework help, tutoring, and core academic content during the afterschool hours. This issue is naturally more confounded during the afterschool hours than during the regular school day since the number of days and hours a program is offered may vary across or within programs (Vaden-Kiernan et al., 2008) depending upon the source of funding and specific circumstances of the school. For example, while 21st CCLC and ASES funded programs in California are required to offer services on all school days until 6pm, participating schools may have different operating hours causing the afterschool programs to have different start times. Furthermore, programs receiving funds through these two programs may or may not apply for funding to operate during summer intersession.

Despite the potential importance of accounting for level of attendance as a measure of opportunity to learn, few studies examine this issue and those that do vary in how it is analyzed. In some studies, such as the randomized control trial of Read 180 Enterprise versus the regular afterschool program (Kim, Capotosto, Hartry, & Fitzgerald, 2011), program attendance has been used as a continuous predictor variable. In this case, a positive relationship was found between greater program attendance and gains in reading vocabulary and comprehension when compared to control students.

Yet other studies have used various ranges of program attendance to create categorical grouping variables. These categories seem to be based on theory rather than on empirical evidence. For example, a study by Frankel and Daley (2007) of afterschool programs in LAUSD created four unequal attendance categories (1−20 days, 21−50 days, 51−100 days, and 101 or more days). In this study, the authors found an association between afterschool attendance and academic outcomes in ELA and mathematics for elementary students who attended 101 or more days per year and for middle school students who participated 51 or more days per year. Very similar thresholds were used by Huang and colleagues in their two studies looking at

attendance dosage and academic outcomes for LA's BEST (see Huang et al., 2008, 2009, 2014), which will be discussed in depth in the following section.

Huang and Wang (2012a) also took level of attendance into account during their longitudinal evaluation of the ASES and 21st CCLC program sites funded in California. While they did create attendance categories, the thresholds they set for what constituted regular attendance varied by the grade level of the schools being examined. More specifically, they set their threshold at 108 days or more per year, equivalent to three or more days per week, for elementary school students and at 72 or more days per year, or two or more days per week, for middle school students. In this study, while significant positive outcomes on ELA and mathematics achievement were not found for regular attenders as a whole for the elementary and middle school students, Huang and Wang (2012a) did find positive benefits for regular attenders who were African American, classified as special education, or were rated as far below basic on the previous year's standardized achievement test(s).

The LA'S BEST Afterschool Enrichment Program

The following section provides information about the LA's BEST context including its history, focus, student demographics, and program structure. This is followed by a discussion of the previous evaluation studies of LA's BEST that included a focus on persistence (or dropping out) and students' motivation to stay in school.

The LA's BEST Context

LA's BEST seeks to provide a safe haven for at-risk students in neighborhoods where gang violence, drugs, and other types of antisocial behaviors are common. The program is housed at selected LAUSD elementary schools and is designed for students in kindergarten through fifth or sixth grade, depending upon the school. The LA's BEST sites are chosen based on certain criteria, such as low academic performance and their location in low-income, high-crime neighborhoods. For optimal program success, and to ensure buy-in from the principals and school staff, the school principals have to write an official letter of request for the program to be placed in their school site.

LA's BEST is a free program open to all students in the selected sites on a first-come, first-served basis. Students who sign up for the program are expected to attend five days a week in order to reap the full benefits of the program. At the time of this study, LA's BEST served a student population of approximately 25,000 students at 167 school sites. Of this population, about 80% were Hispanic and about 12% were African American. Over half of

students were classified as English learners with the majority of students speaking Spanish as their primary language.

Since its inception in 1988, LA's BEST has adapted and updated their goals in response to educational policies, research, and theory. Over the years, the program has moved past its initial emphasis on providing a safe environment and educational enrichment to an emphasis on the development of the whole-child. In developmental theory, a whole-child curriculum is one that cultivates the development of students' intellectual, social, and emotional well-being so that children can achieve their full potential (Hodgkinson, 2006; Schaps, 2006).

While individual LA's BEST sites are given freedom to develop most of their own activities, all are required to follow the three and one-half beat structure. The purpose in doing so is to meet their grant requirements as well as the program's mission of providing education, enrichment, and recreation. These daily beats, or program segments, include homework help or tutoring, academic enrichment in the core content areas and technology, other forms of enrichment such as sports or the arts, and a healthy meal. While the individual sites are given the freedom to create most of their own lessons and activities, all of the schools also offer the KidzLit, KidzMath, and KidzScience curricula, which were designed specifically for use in afterschool settings (see http://www.collaborativeclassroom.org).

Prior Research and Findings on LA's BEST

In light of the expansion of the program, LA's BEST has contracted with CRESST to carry out a new study to examine secondary school persistence and high school graduation rates for two recent cohorts of LA's BEST students. To help frame these analyses, we next present details about our previous studies conducted in partnership with LA's BEST about secondary school persistence as well as student engagement and academic outcomes, both of which are thought to have a relationship with persistence.

Student engagement. As a follow-up to an earlier qualitative study, Huang and colleagues (2007) conducted an exploratory study of the relationship between staff members' and students' perceptions of social capital. For this study, surveys were administered to afterschool site staff and to students in third through fifth grade at 50 LA's BEST sites. Both staff and student surveys included scales to measure staff-student relationships. In addition, the staff survey included scales on collective staff efficacy and communication and teamwork, while the student instrument also measured student engagement, value of education, and future aspirations. When examining student perceptions of staff-student relationships, hierarchical linear modeling (HLM) analyses revealed positive relationships with both staff perceptions of staff-student relationships and collective staff efficacy. In addition, path analyses revealed a

positive direct effect of staff-student relationships on student perceptions of the value of education as well as indirect positive effects of these relationships on the students' valuing of education, perceptions of school engagement, and future aspirations, as mediated by LA's BEST student engagement.

Academic outcomes. During the mid-2000s, CRESST conducted a series of quasi-experimental design studies that used complementary methodologies to examine longitudinal academic outcomes for students as a function of their level of participation in LA's BEST. The first of these studies utilized a residual gain approach to HLM to examine differences in real versus predicted growth for students irrespective of their participation in LA's BEST followed by a mixed model approach on the pooled data with a factor to determine if the results varied by level of attendance (Huang et al., 2009, 2014). In this study, the issue of self-selection bias was addressed through the inclusion and exclusion criteria used for the control and three treatment groups as well as through the use of a propensity matching technique. More specifically, students were included in the control group if they attended LA's BEST for 20 or more days during the baseline year for the study (second grade) and then did not attend at all during the three-year follow-up period (third through fifth grade). In contrast, members of the treatment groups attended the program during the follow-up period, but not during the baseline year. Students who were included in the treatment were then classified as low (1−20 days per year), medium (21−99 days per year), or high/regular attenders (100 or more days per year) using afterschool attendance thresholds adapted from those established by Frankel and Daley (2007) in their evaluation of afterschool programs in LAUSD.

The second of these studies on academic outcomes utilized different HLM modeling techniques as well as different inclusion and exclusion criteria for the subgroup analyses (Huang et al., 2008). In this case, a value-added approach to HLM was used that included growth modeling to examine individual student trajectories as well as propensity scores to examine differences in growth for the control and three treatment groups based on level of attendance. In this case, the low attendance category was treated as a control or reference group (1−20 days per year) with treatment classified at three levels (21−50 days per year, 51−100 days per year, and 101−180 days per year).

Despite the adaptations made in methodology, these two studies of students who participated in LA's BEST during the mid-2000s showed consistent results (Huang et al., 2008, 2009, 2014). More specifically, students in the high attending groups for these two studies showed significantly better growth trajectories in their mathematics achievement outcomes on the California Standards Tests (CSTs) when compared to students who were low attenders or

who did not attend LA's BEST at all during the follow-up period. Both studies also revealed that neither participation in LA's BEST nor the level of attendance was significantly related to students' achievement growth in English language arts. Although, it should be noted that ELA achievement growth was in the positive direction for the study using the value-added models (Huang et al., 2008).

Secondary school persistence. Huang and colleagues also conducted a quasi-experimental design study to examine longitudinal outcomes for students as a function of their participation in LA's BEST (Huang, Kim, Marshall, & Pérez, 2005). This study utilized chi-square analyses and Cox regression to examine differences in secondary school persistence between four cohorts of LA's BEST participants (sixth through ninth grade in the 1998–1999 school year) and a sample of LAUSD students who did not participate in the program.

In this study, the issue of self-selection bias was partially addressed through the inclusion and exclusion criteria used for the treatment and control groups as well as through the use of a statistical matching technique. More specifically, students were eligible for inclusion in the control group if they did not participate in LA's BEST during elementary school. In contrast, students were eligible for the treatment group if they participated in LA's BEST at least 20 days in a school year. Students who were included in the treatment were then classified as having participated for one year, two years, or three or more years. Despite the broad classification of dosage used for the study, statistically lower dropout rates were found for the LA's BEST students who participated in the program for at least three years when compared to the matched control sample. In addition, a significant relationship was found between days of participation in LA's BEST and persistence in secondary school.

Evaluation Questions

The research questions for the current study are as follows: (1) How do the participants and non-participants compare in regards to their demographics? Are there differences based on dosage in the LA's BEST program? (2) How do participants in LA's BEST program sites compare to non-participants in their persistence (or dropping out) in school? Are there differences based on dosage in the LA's BEST program? (3) How do participants served in LA's BEST program sites compare to non-participants in regards to their high school graduation? Are there differences based on dosage in the LA's BEST program?

Study Methodology

The study employs a quasi-experimental design consisting of a longitudinal sample of academic, behavior, school attendance, afterschool program attendance, and secondary persistence and graduation data. The study utilizes two matched samples of LA's BEST and demographically and academically similar students who did not participate in the program who were enrolled in second grade during the 2005–2006 or 2006–2007 school years. In addition, LA's BEST students were separated into three groups based on their intensity of attendance in the program during the treatment years of third to fifth grade. Once the final samples were constructed, multilevel modeling was used to examine outcomes regarding persistence in secondary school and high school graduation.

Sample

The basis for the sample was composed of existing data gathered by LAUSD and LA's BEST for the 2005–2006 through 2016–2017 school years. The first step in building the sample involved generating a sampling frame. This was accomplished by tracking four years of elementary school data (i.e., academic, behavior, school attendance, and afterschool program attendance) and seven years of secondary school data (i.e., persistence, graduation). In order to apply appropriate statistical techniques, all students in the study were required to attend an LA's BEST school during the treatment period. Given that we were examining the relationship between program attendance and long-term school persistence and graduation, the study periods were defined as baseline (second grade), treatment (third to fifth grade), and follow-up (sixth to 12th grade). See Table 1 for further details of the years for each cohort for each study period.

Table 1

Definition of the Study Periods for the Two Cohorts

Study period	Grades	Cohort 1 Years	Cohort 2 Years
BASELINE			
Elementary school	Second	2005–2006	2006–2007
TREATMENT			
Elementary school	Third to fifth	2006–2007 to 2008–2009	2007–2008 to 2009–2010
FOLLOW-UP			
Middle school	Sixth to eighth	2009–2010 to 2011–2012	2010–2011 to 2012–2013
High school	Ninth to 12th	2012–2013 to 2015–2016	2013–2014 to 2016–2017

For any intervention project to demonstrate effects, students must be exposed to sufficient treatment. As such, we built on previous studies conducted by CRESST that took into account dosage or intensity of participation within LA's BEST (see Huang et al., 2008, 2009, 2017; Huang & Wang, 2012a, 2012b). Because of issues with sample size for the lower subgroups originally proposed (1–36 and 37–107 days on average per year) as well as the varying maximum dosage that students were able to attend the program depending upon whether their school offered summer school, it was decided to create a continuous variable to represent dosage for each student. Once this was done, three dosage groups of similar size were created (see Table 2). In doing so, the research team was able to obtain more fine-grained information about the amount of dosage necessary to receive positive growth trajectories in comparison to a sample of non-participants.

Table 2

Definition of Study Samples by Dosage

Sample	Definition
0. Control	Attended one or more LA's BEST schools during the baseline and three treatment years, but did not participate in the program
Treatment	
1. Treatment (low)	Participated in LA's BEST during the baseline and three treatment years (1 to 132 days per year)
2. Treatment (moderate)	Participated in LA's BEST during the baseline and three treatment years (133 to 167 days per year)
3. Treatment (high)	Participated in LA's BEST during the baseline and three treatment years (≥ 168 days per year)
Treatment interrupted	
4. Treatment (interrupted)	Participated in LA's BEST at baseline (second grade), but did not attend the program during one or more treatment years

As shown in Table 2, the control group for the study was also constructed of students who were enrolled in a school that hosted an LA's BEST site during the baseline (second grade) and treatment (third to fifth grade) periods. While this did not account for issues of self-selection bias, wherein some families and students may have elected not to participate for a variety of reasons, we believe that the use of this control group enabled us to take into account within school differences that might account for differences in persistence and graduation/completion outcomes during the follow-up period. Since random assignment was not possible for this study, coarsened exact matching was employed to control for background differences between participating and non-participating students.

Data

The study employed a longitudinal sample of existing data sources (see Appendix A for a complete list of variables). Elementary school sources included student school attendance, behavior data, academic data, and demographics from LAUSD as well as afterschool attendance data collected from LA's BEST. The academic data consisted of the CST scale scores for both English language arts and mathematics. Secondary school sources from LAUSD included graduation or completion data as well as student withdrawal/dropout data.

Analysis Strategy

The following presents an overview of the descriptive statistics and multilevel models used to answer the research questions for the study. Additional details about the outcome analysis methodology can be found in Appendix B.

Descriptive statistics. Descriptive statistics including percentages and means were employed to analyze the student background characteristics for the LA's BEST and non-LA's BEST students. This was done for the populations for each analysis as well as for the overall and dosage group samples following statistical matching. Descriptive statistics are also employed to examine students' persistence (dropout) and graduation outcomes.

Multilevel models for logistic regression. Multilevel models were used to address the second and third research questions concerning persistence (dropout) and graduation outcomes for LA's BEST students. Separate models were fit for each comparison (overall, low attendance, moderate attendance, and high attendance) as well as for each cohort to determine the probability of dropping out or graduating within the typical time-span (2015–2016 and 2016–2017, respectively). Additional models were fit to examine outcomes for students who attended LA's BEST at baseline (2005–2006, 2006–2007), but did not attend the program at all during one or more of the treatment years (third, fourth, and/or fifth grade).

To be included in the samples, students were required to attend an LA's BEST school from second through fifth grade, but were allowed to transfer between program schools. In addition, our inclusion criteria allowed students to transfer between middle schools and high schools during the follow-up periods (sixth to eighth grade, ninth to 12th grade). To allow for the inclusion of students who transferred between LA's BEST schools during the treatment period or between secondary schools during the follow-up period we employed multilevel regression models with a multiple membership multiple classification (MMMC) scheme (Browne, Goldstein, & Rasbash, 2001). MMMC models account for the nonindependence of observations within cluster by adjusting the inferences on the parameter estimates for the correlations between the responses in a cluster. This modeling approach, however, becomes computationally cumbersome using traditional frequentist estimation methods. Because of this, as recommended by Browne and colleagues (2001) we employed Bayesian methods using Markov Chain Monte Carlo (MCMC) techniques. For our analyses, we also used Benjamini-Hochberg corrections to control for false discovery (i.e., false positive or Type I errors) among the multiple tests used (see Benjamini & Hochberg, 1995).

The multilevel models used for these analyses can account for complex classification structures, such as a context in which students are nested within schools in each year, but may

potentially move between schools during elementary school and/or secondary school. MMMC has the flexibility to account for this type of complex nesting structure in which students have a one-to-many relationship with schools. In the MMMC modeling approach, each observation at the lowest level represents one student. The double arrows linking students to schools signifies the possibility of one student being exposed to multiple schools.

Figure 1 presents the MMMC structure for the regression design that was found to have the best fit. In this case, the structure takes into account movement during elementary and/or middle school, and not during high school. Appendix B provides more details about the selection of this structure for the regression models, including the model fit statistics.

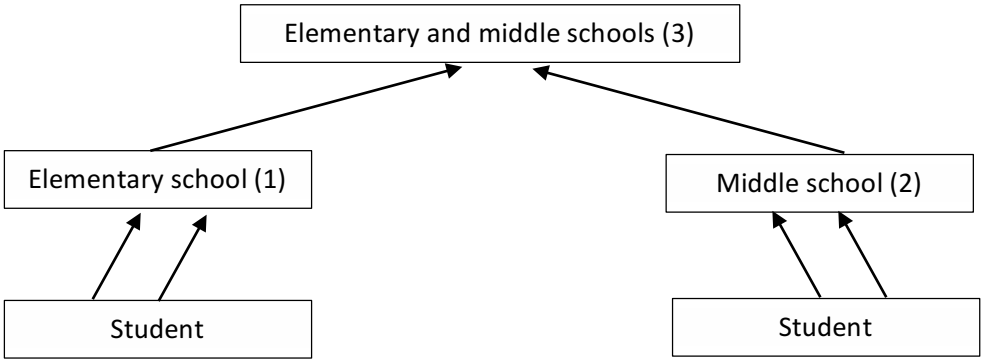

Figure 1. Multiple membership multiple classification structure

1. Each student can map to multiple elementary schools (maximum 3 for the treatment period)
2. Each student can map to multiple middle schools (maximum 3 for the follow-up period)
3. Each student can map to multiple elementary and middle schools (maximum 6 for the treatment and follow-up periods)

Sample Matching Process

Outcome analyses were conducted for the pooled sample as well as the two separate cohorts included in this study to examine secondary school persistence and high school graduation/completion. As previously noted, baseline was classified as second grade, treatment as third to fifth grade, and follow-up as sixth to 12th grade. In order to be eligible for inclusion in the study, students had to attend an LA's BEST site throughout the baseline and treatment periods, have available baseline data, attendance data for the treatment period, and dropout/withdrawal and graduation/completion data for the follow-up period. The eligible control sample included students who attended one or more schools hosting LA's BEST during

second to fifth grade, but did not participate in the program, and who had available data. Achievement and demographic data were used in the matching process.

Table 3a

LA's BEST Study Population: Mobility During the Elementary School Treatment Period

	No mobility		Some mobility		Total	
LA's BEST students	#	% within	#	% within	#	% within
COHORT 1						
LA's BEST population	1,315	95.0	69	5.0	1,384	100.0
Low attendance	367	89.5	43	10.5	410	100.0
Moderate attendance	444	96.1	18	3.9	462	100.0
High attendance	504	98.4	8	1.6	512	100.0
Interrupted attendance	1,087	89.2	131	10.8	1,218	100.0
Total	2,402	92.3	200	7.7	2,602	100.0
COHORT 2						
LA's BEST population	1,360	95.4	65	4.6	1,425	100.0
Low attendance	441	91.9	39	8.1	480	100.0
Moderate attendance	498	96.0	21	4.0	519	100.0
High attendance	421	98.8	5	1.2	426	100.0
Interrupted attendance	1,035	89.2	125	10.8	1,160	100.0
Total	2,395	92.6	190	7.4	2,585	100.0

The control samples were selected via a multistage process that eventually created matched groups for each of four separate groups of LA's BEST students. The four groups of LA's BEST students for each cohort included three groups defined by their level of attendance during the treatment period (low, moderate, or high), and a group of students who stopped attending the program during the treatment period. Table 3a and Table 3b present the eligible samples of LA's BEST and control students for the two cohorts, along with their mobility, during the treatment period (third to fifth grade) and middle school (sixth to eighth grade).

Table 3b

LA's BEST Study Population: Mobility During the Middle School Follow-Up Period

	No mobility		Some mobility		Total	
LA's BEST students	#	% within	#	% within	#	% within
COHORT 1						
LA's BEST population	1,117	80.7	267	19.3	1,384	100.0
Low attendance	319	77.8	91	22.2	410	100.0
Moderate attendance	376	81.4	86	18.6	462	100.0
High attendance	422	82.4	90	17.6	512	100.0
Interrupted attendance	971	79.7	247	20.3	1,218	100.0
Total	2,088	80.2	514	19.8	2,602	100.0
COHORT 2						
LA's BEST population	1,024	71.9	401	28.1	1,425	100.0
Low attendance	331	69.0	149	31.0	480	100.0
Moderate attendance	388	74.8	131	25.2	519	100.0
High attendance	305	71.6	121	28.4	426	100.0
Interrupted attendance	822	70.9	338	29.1	1,160	100.0
Total	1,846	71.4	739	28.6	2,585	100.0

The student-level matching technique we employed at baseline (second grade) was coarsened exact matching (CEM; Iacus, King, & Porro, 2011). CEM is a flexible matching approach with many favorable properties, and allows the researcher to specify the precise conditions under which students are matched. For categorical variables, such as race/ethnicity or poverty, this often entails exact matching, while for continuous measures, such as prior individual student achievement and aggregate class level achievement, cut-points for matching can be specified. With this approach, we were able to set precise cut-points on the most important baseline indicators to ensure that where possible every LA's BEST student was matched with a suitable comparison. Student matching variables we considered in CEM included Hispanic, Black, poverty status, female, English language proficiency (English language learner, redesignated fluent English proficient), special education status, gifted status, achievement in ELA and mathematics, behavior ratings, and prior school attendance. We also included an aggregate school level measure of the percentage of students in poverty.

In the first stage, we used CEM to align eligible LA's BEST and control students at baseline into equal sized matching strata based on our matching criteria. In this process, we were able to match exactly on English language learner, redesignated fluent English proficient, special education, and female, and were able to match closely on the continuous variables (e.g., achievement in ELA and mathematics, behavior ratings, and school attendance) within strata.

The next step paired each LA's BEST student with the closest control student within the already created strata. This was done by creating a Mahalanobis distance measure (see De Maesschalck, Jouan-Rimbaud, & Massart, 2000) on the non-exactly matched variables, sorting LA's BEST and control students on the distance measure within strata, and then matching the LA's BEST and control students within strata on the sort order of the distance measure.

Descriptive Results

Table 4a and Table 4b present the student characteristics for the overall LA's BEST and control group samples for two cohorts following statistical matching. Demographics for the low, moderate, and high attendance groups for each analytical sample can be found in Appendix C. We first discuss the samples prior to matching after which we discuss the background demographics following statistical matching.

Population Demographics

Before matching, the populations of LA's BEST and non-LA's BEST students at baseline were similar on many demographic variables. This was true for the populations for both Cohort 1 and Cohort 2, which were in second grade during the 2005−2006 and 2006−2007 school years, respectively. For example, both the LA's BEST and non-LA's BEST populations were primarily Hispanic (84.0% to 86.6%) and came from families at the poverty level (88.8% to 94.8%). Approximately half of students were female (48.4% to 54.1%), between one half and two thirds of students were classified as English language learners (51.8% to 66.4%), and just over five percent were classified as special education (5.5% to 6.0%). Furthermore, students in each group attended school close to 160 days per year (155.8 to 162.0), and had mean behavior ratings of approximately three.

Matched Sample Demographics

For each analytical match, the LA's BEST and control samples matched very closely. Using CEM, we were able to achieve exact matches for female, and classifications as an English language learner, redesignated fluent English proficient, or special education. The baseline

characteristics presented in Table 4a and Table 4b display the desired baseline equivalence we sought to obtain with our matching approach and lend the resulting data samples amenable to further analytic methods to examine the LA's BEST program effects.

Table 4a

Demographics of the Cohort 1 LA's BEST and Control Group Students: Before and After Matching

	Before matching		After matching	
Student characteristics	LA's BEST (*N* = 1,620)	Control (*N* = 4,478)	LA's BEST (*n* = 1,384)	Control (*n* = 1,384)
Race/Ethnicity				
Hispanic (%)	84.0	86.6	84.8	86.7
Black (%)	8.4	5.0	7.5	5.9
Asian (%)	3.0	3.2	3.2	2.7
White (%)	3.0	3.0	2.8	2.9
Other (%)	1.6	2.2	1.6	1.8
Special programs status				
Poverty (%)	93.8	94.8	93.8	95.7
English language learner (%)	60.6	66.4	62.7	62.7
Redesignated fluent English proficient (%)	0.5	0.6	0.4	0.4
Special education (%)	6.0	5.9	4.7	4.7
Gifted (%)	2.0	2.1	2.0	2.0
Student achievement				
Mean second grade ELA score	-0.107	-0.048	-0.073	-0.080
Mean second grade mathematics score	-0.024	0.014	0.002	-0.006
Other characteristics				
Female (%)	52.2	49.4	51.4	51.4
Average school attendance	155.8	156.8	157.5	156.8
Mean behavior rating (1-4)	3.0	3.1	3.1	3.1
School: Poverty (%)	91.5	91.7	91.7	91.8

Table 4b

Demographics of the Cohort 2 LA's BEST and Control Group Students: Before and After Matching

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 1,605)	Control (*N* = 4,110)	LA's BEST (*n* = 1,425)	Control (*n* = 1,425)
Race/Ethnicity				
Hispanic (%)	85.0	86.4	85.7	85.8
Black (%)	7.8	5.0	7.2	5.9
Asian (%)	3.2	3.4	3.4	2.7
White (%)	1.9	3.2	1.8	3.6
Other (%)	2.2	2.0	1.9	2.0
Special programs status				
Poverty (%)	88.8	90.7	88.9	91.2
English language learner (%)	51.8	59.6	54.3	54.3
Redesignated fluent English proficient (%)	6.2	6.4	5.9	5.9
Special education (%)	6.0	5.5	3.8	3.8
Gifted (%)	2.3	2.5	2.5	3.1
Student achievement				
Mean second grade ELA score	-0.066	-0.038	-0.033	-0.023
Mean second grade mathematics score	-0.015	0.062	0.024	0.029
Other characteristics				
Female (%)	54.1	48.4	53.7	53.7
Average school attendance	161.6	162.0	163.2	162.5
Mean behavior rating (1-4)	3.0	3.1	3.1	3.1
School: Poverty (%)	86.2	87.5	86.2	87.3

After matching at baseline (2005–2006 and 2006–2007), the two overall LA's BEST student samples were composed largely of students who were Hispanic (84.8%, 85.7%) and of low socioeconomic status (93.8%, 88.9%). Regarding special program status, over half of the students in each cohort were classified as English language learners (62.7%, 54.3%), with less than 10% of students being classified as redesignated fluent English proficient (0.4%, 5.9%), or special education (4.7%, 3.8%). In addition, 3.1% or fewer of the LA's BEST and control students were classified as special education. The CST scale scores were standardized relative to district

grade-level performance, based on the district mean and standard deviation. Mean performance at baseline for the matched samples was similar to the district-wide performance in both ELA and mathematics. When comparing students based on their level of attendance in the LA's BEST program, students with low attendance had lower mean performance on the CSTs at baseline, lower school attendance at baseline, and were less likely to be female (see Appendix C). Students in the group that had stopped attending LA's BEST for one or more years during the treatment period (third to fifth grade) had baseline characteristics that more closely resembled those of students in the low attendance group than students in the higher LA's BEST dosage groups.

Secondary School Persistence Outcomes

We examined school persistence (dropout) outcomes for the LA's BEST participants in comparison to the control students who attended schools hosting the program during the baseline and treatment periods (second grade, third to fifth grade). First, we present descriptive statistics for the overall and dosage group samples. After which we present the model results of MMMC analyses for the overall and dosage group samples. Results for both sets of analyses are presented for the pooled samples as well as for each cohort (2005–2006 and 2006–2007).

Descriptive Statistics for the Matched Samples

We used the high school withdrawal/dropout records from LAUSD as primary measures for the outcome analyses for both cohorts. For this analysis, a student was defined as dropping out if they enrolled in LAUSD in ninth grade and subsequently received a leave code that did not indicate that they left either the district or the state of California for another school.

As can be seen in Table 5, there are clear differences in dropout rates across the LA's BEST samples. First, the dropout rates for LA's BEST students with high attendance are consistently lower than the rates for the LA's BEST students in the low attendance group or the interrupted group. This result was found for both cohorts as well as for the pooled sample. Second, while the dropout rate for the moderate attendance group was greater than the rate for the high attendance group and lower than the rate for the low attendance group, this result was only found for Cohort 2 and the pooled sample. With Cohort 1, the moderate attendance group had the lowest dropout rate at 12.3%.

Differences in dropout rates can also be found when comparing the individual LA's BEST samples to the matched comparison samples. For example, students in the high LA's BEST dosage group showed consistently lower dropout rates than did their matched controls. Similar

results were found for the matched moderate attendance groups, although in this case the LA's BEST samples only had lower dropout rates for the pooled and Cohort 1 samples, and not for the Cohort 2 sample. Finally, as would be expected, the LA's BEST students in the low attendance group and in the interrupted group tended to have higher dropout rates than their matched samples. This was true for all analyses except Cohort 2, with the interrupted students still having a lower dropout rate than their controls (17.3% to 19.2%).

Table 5

Secondary School Dropout Descriptive Statistics

	LA's BEST		Control	
Samples	*n*	%	*n*	%
POOLED OUTCOMES				
LA's BEST vs. combined control (any dosage)	2,809	16.9	2,809	17.4
Low attendance group	890	21.8	890	17.0
Moderate attendance group	981	16.7	981	17.5
High attendance group	938	12.4	938	17.7
Interruption in attendance (third to fifth grade)	2,378	20.5	2,378	18.9
COHORT 1 OUTCOMES				
LA's BEST vs combined control (any dosage)	1,384	15.1	1,384	17.3
Low attendance group	410	20.5	410	17.3
Moderate attendance group	462	12.3	462	16.7
High attendance group	512	13.3	512	18.0
Interruption in attendance (third to fifth grade)	1,218	23.6	1,218	18.6
COHORT 2 OUTCOMES				
LA's BEST vs combined control (any dosage)	1,425	18.6	1,425	17.5
Low attendance group	480	22.9	480	16.7
Moderate attendance group	519	20.6	519	18.3
High attendance group	426	11.3	426	17.4
Interruption in attendance (third to fifth grade)	1,160	17.3	1,160	19.2

Note. Lower percentages represent less dropout and greater persistence for the sample.

Outcome Analysis

To examine the relationship between afterschool attendance and secondary school persistence, we employed an MMMC design. In doing so, we were able to estimate the impact

of LA's BEST attendance on student persistence (or dropout) in high school. This was done for two cohorts of students who were projected to complete 12th grade during the 2015−2016 and 2016−2017 school years. Analyses are also presented for the overall treatment and control groups as well as the matched samples by LA's BEST attendance level during the treatment years of third to fifth grade. For these analyses, we followed the recommendations of the What Works Clearinghouse. First, we present the Cox index as an effect size for the dichotomous outcome (dropped out or persisted in school) and odds-ratios as tests of statistical significance. Second, we used Benjamini-Hochberg corrections for multiple comparisons (see Benjamini & Hochberg, 1995) for these analyses pooled with the analyses of persistence (or dropout) that will be presented in the following section (see Appendix B for more information).

Table 6

Secondary School Dropout MMMC Models

Samples	Effect (Cox index)	Odds ratio	$\mathcal{X}^2$ (1 DF)	*p* value
POOLED OUTCOMES				
LA's BEST vs combined control (any dosage)	-0.019	0.969	0.169	0.681
Low attendance group	0.181	1.349	5.758	0.016*
Moderate attendance group	-0.034	0.946	0.201	0.654
High attendance group	-0.248	0.664	8.868	0.003**
Interruption in attendance (third to fifth grade)	0.035	1.059	0.584	0.445
COHORT 1 OUTCOMES				
LA's BEST vs combined control (any dosage)	-0.089	0.863	1.932	0.165
Low attendance group	0.140	1.260	1.543	0.214
Moderate attendance group	-0.205	0.713	2.933	0.087
High attendance group	-0.210	0.708	3.663	0.056
Interruption in attendance (third to fifth grade)	0.161	1.305	6.690	0.010*
COHORT 2 OUTCOMES				
LA's BEST vs combined control (any dosage)	0.042	1.073	0.483	0.487
Low attendance group	0.246	1.501	5.587	0.018*
Moderate attendance group	0.079	1.139	0.622	0.430
High attendance group	-0.313	0.596	6.222	0.013*
Interruption in attendance (third to fifth grade)	-0.127	0.811	3.425	0.064

*$p \leq .05$. ** $p \leq .01$.

Results for the MMMC analyses of high school dropout are presented in Table 6. For these analyses, negative effect sizes and odds ratios of less than one indicate lower dropout in comparison to the control group, while positive effect sizes and odds ratios exceeding one indicate greater dropout. As can be seen, results for the pooled samples indicate a statistically significant finding for students in the high attendance group with the LA's BEST students being less likely than their matched controls to drop out of high school ($\chi^2(1) = 8.868$, $p = .003$).[1] In addition, a statistically significant effect was found for the low attendance group with the LA's BEST students being more likely to dropout than the students in the control group (χ^2 (1) = 5.758, $p = .016$).

Results for the cohort level outcomes are also presented in Table 6. In this case, findings for Cohort 2 mirrored those found for the overall pooled sample. More specifically, statistically significant findings were found with students in the high attendance LA's BEST sample being less likely to dropout (χ^2 (1) = 6.622, $p = .013$) and the low attendance LA's BEST students being more likely to dropout (χ^2 (1) = 5.587, $p = .018$) than were students in their respective control samples. While the effect sizes were also in the expected directions for the Cohort 1 high and low attendance groups, they did not reach statistical significance. For the Cohort 1 analyses, the only statistically significant result was for students in the interrupted group, with LA's BEST students who did not attend the program in third, fourth, and/or fifth grade being more likely to dropout than their matched controls (χ^2 (1) = 6.690, $p = .010$). Model coefficients for the MMMC analyses of secondary school persistence/dropout can be found in Appendix D.

High School Graduation Outcomes

We examined high school graduation/completion outcomes for the LA's BEST participants in comparison to the control students who attended schools hosting the program during the baseline and treatment periods (second grade, third to fifth grade). First, we present descriptive statistics for the overall and dosage group samples. After which we present the model results of the MMMC analyses for the overall and dosage group samples. Results for both sets of analyses are presented for the pooled samples as well as for each cohort (2005–2006 and 2006–2007).

Descriptive Statistics for the Matched Samples

We used the high school graduation/completion records from LAUSD as primary measures for the outcome analyses for both cohorts. As can be seen in Table 7, there are clear

[1] The MMMC model results for the pooled high attendance group equate to a predicted probability of dropping out of 12.2% for the LA's BEST group and of 17.1% for the matched control group.

trends in the graduation/completion rates amongst the different LA's BEST samples. In general, the graduation/completion rates increased as students were assigned to a higher LA's BEST dosage group. This result was found for the pooled sample as well as the two separate cohorts. The only trend that differed among the LA's BEST samples involved Cohort 1, with the graduation rate being equal at 76.6% for both the moderate and high attendance groups.

Table 7

High School Graduation/Completion Descriptive Statistics

	LA's BEST		Control	
Samples	*n*	%	*n*	%
POOLED OUTCOMES				
LA's BEST vs combined control (any dosage)	2,809	71.9	2,809	70.0
Low attendance group	890	64.7	890	67.5
Moderate attendance group	981	73.3	981	70.6
High attendance group	938	77.4	938	71.5
Interruption in attendance (third to fifth grade)	2,378	63.8	2,378	67.4
COHORT 1 OUTCOMES				
LA's BEST vs combined control (any dosage)	1,384	73.3	1,384	69.5
Low attendance group	410	65.4	410	65.4
Moderate attendance group	462	76.6	462	72.7
High attendance group	512	76.6	512	69.9
Interruption in attendance (third to fifth grade)	1,218	60.9	1,218	67.1
COHORT 2 OUTCOMES				
LA's BEST vs combined control (any dosage)	1,425	70.7	1,425	70.4
Low attendance group	480	64.2	480	69.4
Moderate attendance group	519	70.3	519	68.7
High attendance group	426	78.4	426	73.5
Interruption in attendance (third to fifth grade)	1,160	66.7	1,160	67.8

Differences in high school graduation/completion rates were also found when comparing the individual LA's BEST samples to the matched comparison samples. First, students in the overall, moderate attendance, and high attendance groups consistently had higher graduation/completion rates than did their matched controls. This was true for the pooled

sample as well as for each cohort. Second, LA's BEST students who had interrupted participation in the program during third, fourth, and/or fifth grade had lower graduation/completion rates than their matched samples for each analysis. Finally, the LA's BEST students in the low attendance group had the same or lower graduation/completion rates than did the matched control students.

Outcome Analysis

To examine the relationship between afterschool attendance and secondary school graduation/completion, we employed an MMMC design. In doing so, we were able to estimate the impact of LA's BEST attendance on high school graduation/completion. This was done for two cohorts of students who were projected to complete 12th grade during the 2015−2016 and 2016−2017 school years. Analyses are also presented for the overall treatment and control groups as well as the matched samples by LA's BEST attendance level during the treatment years of third to fifth grade. For these analyses, we followed the recommendations of the What Works Clearinghouse. First, we present the Cox index as an effect size for the dichotomous outcome (graduated/completed or failed to graduate/complete on time) and odds-ratios as tests of statistical significance. Second, we used Benjamini-Hochberg corrections for multiple comparisons (see Benjamini & Hochberg, 1995) for these analyses pooled with the analyses of graduation/completion that will be presented in the following section (see Appendix B for more information).

Results for the MMMC analyses of high school graduation/completion are presented in Table 8. For these analyses, positive effect sizes and odds ratios of greater than one indicate greater likelihood to graduate/complete high school on time in comparison to the control group, while negative effect sizes and odds ratios of less than one indicate less likelihood to graduate/complete on time. As can be seen, results for the pooled sample indicate a positive and statistically significant finding for students in the high attendance group with the LA's BEST students being more likely to graduate/complete high school on time ($\chi^2(1) = 8.470$, $p = .003$) than their matched controls.[2] LA's BEST students in the overall pooled sample were also somewhat more likely to graduate/complete on time, although this result did not reach statistical significance ($p = .071$). Finally, LA's BEST students in the pooled sample who had interrupted participation in the program during third, fourth, and/or fifth grade had statistically

[2] The MMMC model results for the pooled high attendance group equate to a predicted probability of graduating/completing high school on time of 78.4% for the LA's BEST group and of 72.5% for the matched control group.

lower graduation/completion rates than did the matched control students ($\chi^2(1) = 4.799$, $p = .028$).

Table 8

High School Graduation/Completion MMMC Models

Samples	Effect (Cox index)	Odds ratio	$\mathcal{X}^2$ (1 DF)	*p* value
POOLED OUTCOMES				
LA's BEST vs combined control (any dosage)	0.070	1.123	3.268	0.071
Low attendance group	-0.070	0.891	1.114	0.291
Moderate attendance group	0.088	1.156	1.799	0.180
High attendance group	0.203	1.398	8.470	0.003**
Interruption in attendance (third to fifth grade)	-0.088	0.865	4.799	0.028*
COHORT 1 OUTCOMES				
LA's BEST vs combined control (any dosage)	0.120	1.219	5.014	0.025*
Low attendance group	-0.000	1.000	0.000	0.992
Moderate attendance group	0.121	1.221	1.515	0.218
High attendance group	0.230	1.462	6.048	0.014*
Interruption in attendance (third to fifth grade)	-0.151	0.780	7.640	0.006**
COHORT 2 OUTCOMES				
LA's BEST vs combined control (any dosage)	0.024	1.040	0.186	0.666
Low attendance group	-0.155	0.775	2.856	0.091
Moderate attendance group	0.079	1.140	0.766	0.381
High attendance group	0.194	1.377	3.248	0.072
Interruption in attendance (third to fifth grade)	0.007	1.012	0.015	0.903

*$p \leq .05$. ** $p \leq .01$.

Cohort level results are also presented in Table 8. In this case, findings for Cohort 1 mirrored those found for the overall pooled sample. More specifically, statistically significant positive results were found for the LA's BEST students in the overall sample ($\chi^2(1) = 5.014$, $p = .025$) and in the high attendance group ($\chi^2(1) = 6.048$, $p = .014$). In each case, the LA's BEST students were more likely to graduate/complete on time than were the matched control students. In addition, as with the pooled sample, the LA's BEST students with interrupted attendance in the program during third, fourth, and/or fifth grade were statistically less likely to graduate on time than were the matched control students ($\chi^2(1) = 7.640$, $p = .006$). Finally,

while no statistically significant results were found for Cohort 2, the results for the low attendance and high attendance groups were in the expected directions. Model coefficients for the MMMC analyses of graduation/completion can be found in Appendix D.

Discussion and Conclusion

The retrospective data did not allow us to assign students randomly to treatment and control conditions. However, a quasi-experimental design including the use of coarsened exact matching was used to establish demographically similar study samples from which valid inferences could be generated. The control group of students is composed of students in the program schools who had no exposure to LA's BEST during second through fifth grade. However, it is possible that control students did attend other afterschool activities in the community or at the program schools such as tutoring or the Youth Services After School Program, a drop-in program that provides homework help and playground activities at over 600 elementary and secondary schools in LAUSD (see LAUSD Beyond the Bell Branch, 2018). As such, the treatment effects represent lower bound estimates of program effects for LA's BEST.

Multiple membership multiple classification models were used to examine the likelihood of persisting (or dropping out) as well as graduating/completing high school on time (i.e., within four years of entering ninth grade). This was done to examine both cohorts of students (2005–2006 and 2006–2007) followed for the study. The models used were necessary to account for the nested structure of the data, and to take into account the movement of students between schools during elementary and secondary school. It should be noted, though, that students were allowed to move between LA's BEST schools during the baseline (second grade) and treatment periods (third to fifth grade), but were not allowed to attend other elementary schools that did not host the program. In addition, since the methodology required larger sample sizes in order to find significant findings, we were not able to disentangle potential differences in effects of the individual LA's BEST program sites.

The results of the study generally imply positive long-term effects on secondary school persistence and graduation/completion for students who participated in LA's BEST from second through fifth grade. Despite this, statistically significant results were more likely to be found for the pooled samples of students who were in second grade during the 2005–2006 and 2006–2007, than for the separate cohorts. The following discusses the findings for each of the research questions in greater depth.

Demographics of the LA's BEST and Control Students

Prior to matching, students in the LA's BEST and control populations showed some demographic differences. More specifically, control students were somewhat more likely to be Hispanic and somewhat less likely to be Black than were the students who attended LA's BEST during the treatment period. Students in the control population were also more likely to be classified as English language learners during second grade than were the LA's BEST population. In addition, the LA's BEST population was somewhat more likely to be female than were the control population.

Following coarsened exact matching, we were able to create samples that were demographically very similar. More specifically, we were able to match our samples exactly for female, English language learner, redesignated fluent English proficient, and special education. When examining the two overall cohort samples, the control students were slightly less likely to be Black, had slightly lower average school attendance, and were slightly more likely to be in poverty than were the matched LA's BEST students. It should be noted, though, that some differences in the trends for these three variables were found for the dosage level samples.

Long-Term Impacts on Secondary School

Long-term impacts on secondary school persistence (dropout) and high school graduation were examined separately. To isolate treatment effects more readily, the multilevel analyses focused first on the pooled outcomes and then on the individual outcomes for two cohorts of students who were projected to finish high school in LAUSD during the 2015−2016 and 2016−2017 school years. It should be noted that the cohorts were pooled for the primary analyses in order to improve the overall sample size and to ensure adequate samples for the additional models conducted to examine the impact of attendance on the outcomes.

The results of the pooled samples for both sets of analyses underline the importance of greater exposure to the LA's BEST program on long-term secondary school outcomes. The multilevel models we utilized found significant positive effects for the high attendance groups in regards to both secondary school persistence and on time graduation or completion of high school. More specifically, students who attended the program an average of 168 or more days per year during third through fifth grade were 4.9% less likely to drop out and were 5.9% more likely to complete high school on time than were the matched control students, who also attended schools hosting LA's BEST during elementary school. In addition, the models revealed that the positive impacts disappeared with lower attendance in the program. More specifically, LA's BEST students in the pooled sample who had lower program attendance of one to 132 days per year were statistically more likely to drop out of secondary school than were the non-LA's

BEST students. Likewise, students in the pooled sample who had an interruption in enrollment in LA's BEST during third, fourth, and/or fifth grade were significantly less likely to graduate on time than were their matched controls.

While the results were less stable, most likely due to the much smaller sample sizes, the cohort level models did provide some additional evidence concerning the importance of afterschool attendance dosage. That is, the Cohort 2 outcomes for the models measuring secondary school persistence were consistent with the pooled results for the low and high attendance groups. Likewise, the Cohort 1 results for on time graduation were consistent with the pooled results for the high and interrupted LA's BEST attenders. It is also interesting to note that the model that examined the overall sample of Cohort 1 students found that LA's BEST students were significantly more likely to graduate on time when compared to their overall Cohort 1 control group.

Conclusion

This study set out to replicate and improve methodologically upon a previous study conducted of long-term secondary school persistence for LA's BEST participants in comparison to a control group of non-participants in the program. The research tracked two cohorts of students from second grade (2005–2006 and 2006–2007) to 12th grade (2015–2016 and 2016–2017). While all students were required to attend a school hosting the LA's BEST program during second through fifth grade, the models used were able to account for movement between LA's BEST school during this time as well as any movement between middle schools that occurred. Unfortunately, due to issues of sample size and model fit, as well as the large number of untraditional high schools in the district, including alternative schools that are specifically focused on helping students who are highly at-risk for dropping out, we were not able to account for movement between schools following eighth grade. Furthermore, due to the scope of the study and issues of data access we were not able to account for any additional afterschool exposure that the students in either the treatment or control groups might have received during their attendance in LAUSD. Nor were we able to conduct analyses at the school level in order to determine whether the program had differential effects.

Despite the stated limitations, the study did find evidence concerning the importance of maintaining higher attendance in the LA's BEST program. More specifically, students who attended an average of 168 or more days per year during upper elementary (third to fifth grade) were 4.9% less likely to drop out of high school and were 5.9% more likely to graduate in four years than were non-participants. Likewise, students with lower attendance seemed to lose the benefits of the program with null results for the moderate attendance groups, and null

or significantly negative results for LA's BEST students who had attendance of 132 days or less over three years or who had an interruption in enrollment for one to three years. As such, it seems important for the program to find ways to motivate lower or moderate attending students to stay in the program or increase their level of participation.

Recommendations for Follow-Up

While rigorous methods were used for the current study, we believe that further research of longitudinal outcomes for LA's BEST participants would benefit both the program and the afterschool field at large, in addition to some more specific studies of LA's BEST in response to the program interest. The following presents our suggestions for studies of contextual factors that might play a role in high school persistence and graduation as well as studies of past participants college and career trajectories. These suggestions include immediate to long-term options ranging from the analysis of existing data to multi-year research and/or development projects.

Chronic absenteeism and school attendance. According to the most recent WWC practice guide for dropout prevention, school attendance and behavior variables such as suspensions are reliable predictors of students' secondary school persistence (Allensworth et al., 2014; Bowers et al., 2012; Rumberger et al., 2017). For example, Allensworth and colleagues (2012) report that middle school attendance is a strong predictor of high school graduation. While previous research conducted by CRESST of LA's BEST (La Torre, Leon, Wang, & Cai, 2018) has found a relationship between program attendance and day school attendance, no causal work has been completed on the issue. Thus, we propose to use hierarchical models to examine longitudinal impacts of LA's BEST participation on secondary school attendance and behavior. Data used for the study would include LA's BEST and school attendance data, behavior data, and demographic information.

Subgroup analyses regarding persistence and graduation. As previously mentioned, graduation rates tend to vary by major subgroups. For example, the California School Dashboard (California Department of Education, 2017), shows that while the overall graduation rate for LAUSD stood at 84.2% in 2017, only 58.3% of students with disabilities graduated or completed high school within four years. As such, we believe that it would be valuable to examine the descriptive data for the subgroups to see how they compare with the two sample cohorts included in the current study of secondary school persistence and graduation. The results could help the program to target their intervention and improve the overall program success.

Social and emotional learning outcomes. One of the student supports recommended by the WWC to help prevent secondary school dropout involves the providing of social and emotional learning (SEL) and skills training (What Works Clearinghouse, 2017). As such, we recommend an examination of climate survey results collected by LAUSD since the 2010–2011 school year. One potential extension to this work involves an examination of the literature on affordances and barriers for the development of these skills and mindsets (e.g., self-management, self-efficacy, and growth) with an emphasis on afterschool settings followed by a panel meeting of afterschool stakeholders to contextualize the findings. In addition, the work could be extended through the conducting of case studies at LA's BEST sites that report high levels of social emotional skills and mindsets. We also advocate the conducting of longer-term research relating SEL development within the afterschool setting to student achievement outcomes.

School and community based social capital. From 2004 to 2006, CRESST conducted a series of multi method studies looking at the social capital within LA's BEST. This included qualitative case studies at six program sites as well as survey research with students and site staff at an additional 50 sites. We propose building on this work through the conducting of one or more case studies at LA's BEST sites to examine the influences of the program on participants, the school at large, and/or the local community at two or three of the most successful program sites. Some of the potential questions that might be explored include the promoting of key outcomes of interest by the program (e.g., social emotional outcomes, school attendance, and academics), participants experiences with the program, and influential experiences and practices developed by stakeholders that could affect participant outcomes. Results of this work could help LA's BEST to identify and develop their own logic model, share their successes with the afterschool field, and contribute to the best practices for afterschool programs.

College and career trajectories of past participants. As noted in the 2008 WWC practice guide for dropout prevention, it is important to provide students with the learning and "skills needed to graduate and to serve them after they leave school" (Dynarski et al., 2008, pg. 11). In this frame, we suggest further longitudinal research to examine college attendance and the types of careers pursued by past participants in LA's BEST.

During 2017, scholars at the Luskin School of Public Affairs at UCLA completed a study looking at college attendance and persistence for graduates of LAUSD (see Foulsham, 2017). In light of this, we suggest a study to examine college attendance, the types of schools attended (e.g., two-year, four-year institutions), persistence, and/or completions for prior attendees of LA's BEST. As with the current study, we propose to take dosage of participation with LA's BEST

into account to lend statistical weight to our analyses. Existing sources that might be used for this study include data from the National Student Clearinghouse; LAUSD data on students' high school performance, students' climate survey responses regarding college readiness and future orientation, and students' demographic and background data; and LA's BEST attendance data.

In light of the afterschool field's current focus on providing both academic and other forms of enrichment, we believe it would also be valuable to examine the career choices of past participants. Options for carrying out this work involve the systematic collection of data about college majors and careers from public web sites such as LinkedIn and/or the online surveying of past participants. Once gathered, a coding scheme would be developed using a subset of the data, and then content analyses would be conducted to provide both qualitative information and frequencies.

College and career trajectories of site staff. Based on a recent annual report, LA's BEST (2017) currently employs over 2000 program staff to work with students. Based on the earlier work of Huang and colleagues (2007), we know that LA's BEST staff members often develop strong mentoring relationships with students. This is reiterated in one of the quotes highlighted in the current annual report, "I thought I was just going to work with kids, but I realize I entered a community and found a career" (LA's BEST, 2017). As with the student study, we suggest gathering data using the systematic collection of data from public web sites such as LinkedIn and/or the online surveying of current and former staff members. For this work, we also suggest the disaggregation of results by job type (e.g., program workers versus leadership positions) as well as previous participation in the program during elementary school.

Staff training and program development. In recent years, funding agencies, such as the Institute of Education Sciences (IES) at the U.S. Department of Education, have recognized the potential role of social and behavioral contexts for academic learning. As such, we recommend the seeking of grant funds for research and development that can build on the already existing systems within LA's BEST. For example, grant funds could be used to train site staff, conduct a small-scale intervention study, and then develop a logic model for how to integrate the intervention across the program.

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Appendix A: Data Sources

Table A1a

Data Sources for the Elementary School Baseline and Treatment Periods

Elementary school variables	Cohort 1	Cohort 2
Academic		
CST ELA: Scale scores	2005–2006 to 2008–2009	2006–2007 to 2009–2010
CST mathematics: Scale scores	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Attendance		
LA's BEST daily attendance	2005–2006 to 2008–2009	2006–2007 to 2009–2010
LAUSD daily attendance	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Behavior		
LAUSD behavior ratings	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Demographics	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Race/Ethnicity	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Demographics		
English proficiency status	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Female	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Gifted	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Grade level	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Parent some college education	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Poverty	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Special education	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Linking variables		
School IDs	2005–2006 to 2008–2009	2006–2007 to 2009–2010
Student researcher IDs (de-identified)	2005–2006 to 2008–2009	2006–2007 to 2009–2010

Table A1b

Data Sources for the Secondary School Follow-Up Period

Secondary school variables	Cohort 1	Cohort 2
Graduation/Completer		
Completer codes	2009–2010 to 2015–2016	2010–2011 to 2016–2017
Completer reasons	2009–2010 to 2015–2016	2010–2011 to 2016–2017
Withdrawal/Dropout		
Withdrawal codes	2009–2010 to 2015–2016	2010–2011 to 2016–2017
Withdrawal reasons	2009–2010 to 2015–2016	2010–2011 to 2016–2017
Dropout codes	2009–2010 to 2015–2016	2010–2011 to 2016–2017
Dropout reasons	2009–2010 to 2015–2016	2010–2011 to 2016–2017
Linking variables		
School IDs	2009–2010 to 2015–2016	2010–2011 to 2016–2017
Student researcher IDs (de-identified)	2009–2010 to 2015–2016	2010–2011 to 2016–2017

Appendix B: Outcome Analysis Methodology

Regression Model Specification

To be included in the samples, students were required to attend an LA's BEST school at baseline (second grade) and for all three treatment years (third to fifth grade), but were allowed to transfer between program schools. In addition, our inclusion criteria allowed students to transfer between middle schools and high schools within LAUSD during the follow-up periods (sixth to eight grade, ninth to twelfth grade). Because of this complex clustering of students within schools, we tested the goodness of fit of different models. It should be noted that we chose not to include high schools in any of the models because of the large number of untraditional "option" schools in the district including 41 continuation high schools, which are specifically designed to serve students who are at risk of not graduating/completing (see Los Angeles Unified School District, n.d.).

We assessed the fit of six different models to account for the clustering of students within schools across the elementary and middle school settings. The first set of models address mobility at the elementary school level (see Equation 1), the second set at the middle school level (see Equation 2), and the third set at both the elementary and middle school levels (see Equation 3). A basic two-level multiple membership multiple classification (MMMC) model was used to estimate the impacts of the LA's BEST intervention on students' secondary school persistence and then on their high school graduation. Each of the equations represents an extension for dichotomous outcomes of the general specification for the MMMC model used for continuous outcomes proposed by Browne and colleagues (2001, equation 6) and applied in Tranmer and colleagues (2014, equation 3).

$$\eta_i = logit(\pi_i) = x_i'\beta + \sum_{j \in ElemSchool(i)} w_{i,j} u_j^{(2)} + e_i$$

$$\text{School(i)} \subset (1, \ldots, \text{J})$$

$$, \qquad u_j^{(2)} \sim \text{N}\left(0, \sigma^2_{u(2)}\right), \qquad e_i \sim \text{N}(0, \sigma_e^2) \qquad (1)$$

$$\eta_i = logit(\pi_i) = x_i'\beta + \sum_{j \in MiddSchool(i)} w_{i,j} u_j^{(2)} + e_i$$

$$\text{School(i)} \subset (1, \ldots, \text{J})$$

$$, \qquad u_j^{(2)} \sim \mathrm{N}\left(0, \sigma_{u(2)}^2\right), \qquad e_i \sim \mathrm{N}(0, \sigma_e^2) \qquad (2)$$

$$\eta_i = logit(\pi_i) = x_i'\beta + \sum_{j \in ElemSchool(i)} w_{i,j}^{(2)} u_{0j}^{(2)} + \sum_{j \in MiddSchool(i)} w_{i,j}^{(3)} u_{0j}^{(3)} + e_i$$

$$\mathrm{ElemSchool}(i) \subset (1, \ldots, \mathrm{J}), \qquad u_j^{(2)} \sim \mathrm{N}\left(0, \sigma_{u(2)}^2\right), \qquad e_i \sim \mathrm{N}(0, \sigma_e^2)$$

$$\mathrm{MiddSchool}(i) \subset (1, \ldots, \mathrm{J}), \qquad u_j^{(3)} \sim \mathrm{N}\left(0, \sigma_{u(2)}^2\right), \qquad e_i \sim \mathrm{N}(0, \sigma_e^2) \qquad (3)$$

In each of the models (aligned with one of the three equations), η_i is the log-odds for the outcome of interest (student persistence or graduation/completion), *Xi* is a vector of the fixed covariates, and β is the vector of the corresponding fixed effects.

Within the term $\sum_{j \in ElemSchool(i)} w_{i,j} u_j^{(2)}$, $u_j^{(2)}$ is the set of *j* random effects for the elementary schools included in the selected data set, and $w_{i,j}$ is the weight that sums to 1 for each student applied in proportion to the time assigned with each school.

Within the term $\sum_{j \in MiddSchool(i)} w_{i,j} u_j^{(2)}$, $u_j^{(2)}$ is the set of *j* random effects for the middle schools included in the selected data set, and $w_{i,j}$ is the weight that sums to 1 for each student applied in proportion to the time assigned with each school.

The two models that address only elementary school clustering (Model 1, Model 2) are shown in Equation 1. Similarly, the two models that address only middle school clustering (Model 3, Model 4) are shown in Equation 2, and the models that address both elementary and middle school clustering (Model 5, Model 6) are shown in Equation 3. We simplify Model 1, Model 3, and Model 5 by only selecting the first elementary and or middle school rather than accounting for student mobility. As a result, the $w_{i,j}$ term becomes a constant of 1 in these three models. Model 1 and Model 3 each become basic two-level models, while Model 5 becomes a basic cross-classified model.

In addition to the LA's BEST treatment indicators, the fixed effects included student characteristics to identify the matched control sample of students, such as baseline achievement, socioeconomic status, demographics, language proficiency, and participation in special education. For each of our outcome analyses, we used a threshold of $p \leq .05$ to determine whether there was a statistically significant impact of LA's BEST. We included dummy variables to identify each comparison that we tested (e.g., the low LA's BEST group and their matched controls).

The following presents an example of the full model for the graduation/completion specification from our best fitting model. This is an MMMC model, which accounts for student mobility in both the elementary and middle school settings (Model 6).

$$
\begin{aligned}
log-odds\ completion_i &= \beta_0 + SchPoverty_i * \beta_1 + priorELA_i * \beta_2 + priorMath_i * \beta_3 \\
&+ Behavior_i * \beta_4 + DayAttend_i * \beta_5 + Female_i * \beta_6 + LEP_i * \beta_7 \\
&+ RFEP_i * \beta_8 + Black_i * \beta_9 + Hispanic_i * \beta_{10} + SPED_i * \beta_{11} \\
&+ Gifted_i * \beta_{12} + Poverty_i * \beta_{13} + LowLA'sBEST * \beta_{14} \\
&+ LowComp * \beta_{15} + ModLA'sBEST * \beta_{16} + ModComp * \beta_{17} \\
&+ HiLA'sBEST * \beta_{18} + HiComp * \beta_{19} + InterruptedLA'sBEST \\
&* \beta_{20} + \sum_{j \in ElemSchool(i)} w_{i,j}^{(2)} u_{0j}^{(2)} + \sum_{j \in MiddSchool(i)} w_{i,j}^{(3)} u_{0j}^{(3)} + e_i
\end{aligned}
$$

$$
\text{ElemSchool}(i) \subset (1, \dots, \text{J}), \qquad u_j^{(2)} \sim \text{N}\left(0, \sigma_{u(2)}^2\right), \qquad e_i \sim \text{N}(0, \sigma_e^2)
$$

$$
\text{MiddSchool}(i) \subset (1, \dots, \text{J}), \qquad u_j^{(3)} \sim \text{N}\left(0, \sigma_{u(2)}^2\right), \qquad e_i \sim \text{N}(0, \sigma_e^2)
$$

In this model, $log-odds\ completion_i$ is the log-odds of graduation/completion for student *i*;

The dummy coded effect indicators—$LowLA'sBEST_i$, $ModLA'sBEST_i$, and $HiLA'sBEST_i$ –are coded as 1 for students receiving the indicated level of LA's BEST attendance dosage and 0 otherwise. The dummy coded control group indicators—$LowComp_i$, $ModComp_i$, and $HiComp_i$—are coded as 1 for control students paired with LA's BEST students receiving the indicated level of LA's BEST attendance dosage and 0 otherwise. The $InterruptedLA'sBEST_i$ indicator represents students who attended LA's BEST at baseline (second grade), but who stopped attending during one or more of the treatment years (third, fourth, and/or fifth grade). The paired control students for $InteruptedLA'sBEST_i$ comprise the reference group in the regression model.

$Female_i, LEP_i, RFEP_i, Black_i, Hispanic_{i,}, SPED_i, Gifted_i, and\ Poverty_i$ are student demographic indicators coded 1 if the status is present and 0 if absent;

$SchPoverty_i$ is the aggregate school level percentage of students who received free/reduced school lunch for student *i*;

$priorELA_i$, and $priorMath_i$ are standardized student CST scores from the baseline year (second grade);

$Behavior_i$ is the aggregated composite mean of five behavior ratings from the baseline year (second grade) for student *i*;

$DayAttend_i$ is the number of days of regular school attendance in the baseline (second grade) year for student *i*;

β_1 is the effect of school level poverty;

β_2 & β_3 are the effects of the prior score covariates;

β_4 is the effect of the behavior covariate;

β_5 is the effect of the school attendance covariate;

β_6 … β_{13} are the effects of the demographic covariates;

We construct our comparison tests from β_{14} … β_{20} as follows:

The effect of Low dosage LA's BEST attendance is a test of whether $\beta_{14} = \beta_{15}$

The effect of Moderate dosage LA's BEST attendance is a test of whether $\beta_{16} = \beta_{17}$

The effect of High dosage LA's BEST attendance is a test of whether $\beta_{18} = \beta_{19}$

β_{20} is the effect for students who attended LA's BEST;

It should be noted that in order to test the effect of the combined LA's BEST dosage group we ran a separate model in which $LowLA'sBEST_i$, $ModLA'sBEST_{i,}$ and $HiLA'sBEST_i$ were dropped and combined into a single LA's BEST treatment variable ($LA'sBESTd_{i,}$), and similarly $LowComp_i$, $ModComp_{i,}$ and $HiComp_i$ were dropped and combined into a single variable of paired control students ($Compd_{i,}$). In that model we again tested whether the groups were equal ($\beta_{14} = \beta_{15}$).

$u_j^{(2)}, u_j^{(3)}, e_i$ are the error components at the elementary school, middle school, and student-levels, respectively, with all assumed to have a mean of 0 and a variance, $\sigma^2_{u(2)}, \sigma^2_{u(3)}, and\ \sigma^2_e$ respectively.

Implementing MCMC Estimation

Within MCMC estimation, there are various options available to produce the most appropriate process, to address the quality of estimates, and to select the best fitting model. One option is a reparameterization method known as using orthogonal fixed effect vectors. This

method is considered most useful for non-normal response models, as is the case in the models used for this study (Browne et al., 2001).

When we evaluated the quality of the mixing in MCMC using the Effective Sample Size (ESS) of the fixed and random effects it was clear that estimation was improved when using orthogonal fixed effect vectors for the outcomes. In addition, we also evaluated the accuracy using diagnostics (see Brooks & Draper, 2007; Raftery & Lewis, 1992), and determined it was necessary to set the monitoring chain length to 15,000 iterations. We tested the fit for each of the six models and compared the results using the Bayesian Deviance Information Criterion (DIC). In each case, the goal was to determine if the MMMC approach provided a better fit than a less complex model that selected a single school per student ignoring student mobility. We also evaluated an estimation of the random variance at the school level for each model in order to ensure that the model would converge and have sufficient sample at the school level.

Table B1

LA's BEST: Logit Model Fit Assessment – Pooled Cohorts Graduation/Completion

			Random error variance (%)	
Grade band	Model	DIC	Elementary	Middle
Elementary only	First school (1)	11747	0.16 (5%)	na
	MMMC (2)	11739	0.17 (5%)	na
Middle only	First school (3)	11693	na	0.17 (5%)
	MMMC (4)	11664	na	0.15 (4%)
Elementary and middle	First school (5)	11677	0.05 (2%)	0.15 (4%)
	MMMC (6)	11652	0.05 (1%)	0.19 (5%)

Note. Random error variance percentages are estimated using the equation: (ICC=var(u_{0j})/(var(u_{0j})+(π2 / 3)).

The DIC takes into account the complexity of the model, and for both outcome measures it was determined that Model 6, which used the MMMC approach at both elementary and middle school levels produced a better fit. In addition, our evaluation of the random error variance at the school level, the ESS for the important independent variables, and the accuracy diagnostics suggested no reasons to reject this model. As a result, Model 6 was used to address the research questions. Table B1 displays the model assessment results for each of six models we considered for the analysis of graduation/completion.

A Benjamini-Hochberg (1995) approach was also used to control for false discovery on all primary analyses, which examined persistence (dropout) and graduation/completion for the pooled samples. Table B2 presents the corrections for the eight primary analyses.

Table B2

LA's BEST: Benjamini-Hochberg Correction for the Primary Analyses of Pooled Outcomes

Samples	Clustering corrected *p*-value (p_x)	*p*-value rank (x)	New critical *p*-value ($p_x' = 0.05x/8$)	Finding p-value ≤ new critical p-value? ($p_x \leq p_x'$)	Statistical significance after BH correction
Dropout: High attendance group	0.003	1	0.006	Yes	Yes
Graduation/Completion: High attendance group	0.003	2	0.013	Yes	Yes
Dropout: Low attendance group	0.016	3	0.019	Yes	Yes
Graduation/Completion: LA's BEST combined (any dosage)	0.071	4	0.025	No	No
Graduation/Completion: Moderate attendance group	0.180	5	0.031	No	No
Graduation/Completion: Low attendance group	0.291	6	0.038	No	No
Dropout: Moderate attendance group	0.654	7	0.044	No	No
Dropout: LA's BEST combined (any dosage)	0.691	8	0.050	No	No

Appendix C: Sample Demographics by Dosage Group

Table C1

Demographics of the Cohort 1 LA's BEST and Control Group Students: Before and After Matching (Low Attendance)

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 487)	Control (*N* = 4,478)	LA's BEST (*n* = 410)	Control (*n* = 410)
Race/Ethnicity				
Hispanic (%)	83.2	86.6	84.4	87.8
Black (%)	11.7	5.0	10.0	7.1
Asian (%)	1.2	3.2	1.5	1.7
White (%)	2.7	3.0	2.7	2.2
Other (%)	1.2	2.2	1.4	1.2
Special programs status				
Poverty (%)	95.3	94.8	95.1	95.1
English language learner (%)	59.1	66.4	62.0	62.0
Redesignated fluent English proficient (%)	0.6	0.6	0.5	0.5
Special education (%)	6.6	5.9	5.4	5.4
Gifted (%)	2.1	2.1	2.0	1.7
Student achievement				
Mean second grade ELA score	-0.199	-0.048	-0.185	-0.187
Mean second grade mathematics score	-0.160	0.014	-0.148	-0.136
Other characteristics				
Female (%)	50.3	49.4	48.7	48.7
Average school attendance	151.5	156.8	153.7	154.0
Mean behavior rating (1-4)	2.9	3.1	3.0	3.0
School: Poverty (%)	92.1	91.7	92.3	92.0

Table C2

Demographics of the Cohort 1 LA's BEST and Control Group Students: Before and After Matching (Moderate Attendance)

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 553)	Control (N = 4,478)	LA's BEST (*n* = 462)	Control (*n* = 462)
Race/Ethnicity				
Hispanic (%)	83.5	86.6	84.6	85.1
Black (%)	9.0	5.0	8.2	5.6
Asian (%)	2.0	3.2	1.7	2.2
White (%)	2.7	3.0	2.8	4.5
Other (%)	2.8	2.2	2.7	2.6
Special programs status				
Poverty (%)	92.2	94.8	92.4	94.8
English language learner (%)	58.0	66.4	60.0	60.0
Redesignated fluent English proficient (%)	0.5	0.6	0.2	0.2
Special education (%)	6.1	5.9	4.8	4.8
Gifted (%)	1.8	2.1	1.7	1.7
Student achievement				
Mean second grade ELA score	-0.095	-0.048	-0.049	-0.056
Mean second grade mathematics score	0.005	0.014	0.045	0.024
Other characteristics				
Female (%)	51.2	49.4	50.4	50.4
Average school attendance	156.0	156.8	157.5	156.4
Mean behavior rating (1-4)	3.0	3.1	3.1	3.1
School: Poverty (%)	91.4	91.7	91.8	91.8

Table C3

Demographics of the Cohort 1 LA's BEST and Control Group Students: Before and After Matching (High Attendance)

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 580)	Control (*N* = 4,478)	LA's BEST (*n* = 512)	Control (*n* = 512)
Race/Ethnicity				
Hispanic (%)	85.0	86.6	85.2	87.3
Black (%)	5.0	5.0	4.9	5.3
Asian (%)	5.5	3.2	5.9	3.9
White (%)	3.4	3.0	2.9	2.0
Other (%)	1.1	2.2	1.1	1.5
Special programs status				
Poverty (%)	94.0	94.8	93.9	96.9
English language learner (%)	64.1	66.4	65.8	65.8
Redesignated fluent English proficient (%)	0.3	0.6	0.4	0.4
Special education (%)	5.3	5.9	4.1	4.1
Gifted (%)	2.1	2.1	2.3	2.5
Student achievement				
Mean second grade ELA score	-0.042	-0.048	-0.005	-0.018
Mean second grade mathematics score	0.062	0.014	0.085	0.071
Other characteristics				
Female (%)	54.7	49.4	54.3	54.3
Average school attendance	159.2	156.8	160.5	159.5
Mean behavior rating (1-4)	3.1	3.1	3.1	3.1
School: Poverty (%)	91.2	91.7	91.2	91.6

Table C4

Demographics of the Cohort 1 LA's BEST and Control Group Students: Before and After Matching (Interrupted Treatment)

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 1,440)	Control (*N* = 4,478)	LA's BEST (*n* = 1,218)	Control (*n* = 1,218)
Race/Ethnicity				
Hispanic (%)	86.8	86.6	87.9	88.1
Black (%)	7.6	5.0	6.8	5.0
Asian (%)	2.1	3.2	2.1	2.3
White (%)	2.2	3.0	1.8	2.6
Other (%)	1.3	2.2	1.4	2.0
Special programs status				
Poverty (%)	95.6	94.8	96.0	94.8
English language learner (%)	62.7	66.4	66.0	66.0
Redesignated fluent English proficient (%)	0.6	0.6	0.3	0.3
Special education (%)	4.9	5.9	3.0	3.0
Gifted (%)	1.3	2.1	1.4	1.5
Student achievement				
Mean second grade ELA score	-0.197	-0.048	-0.167	-0.157
Mean second grade mathematics score	-0.135	0.014	-0.122	-0.105
Other characteristics				
Female (%)	50.4	49.4	50.1	50.1
Average school attendance	156.2	156.8	156.9	156.4
Mean behavior rating (1-4)	3.0	3.1	3.0	3.1
School: Poverty (%)	92.0	91.7	92.3	91.9

Table C5

Demographics of the Cohort 2 LA's BEST and Control Group Students: Before and After Matching (Low Attendance)

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 539)	Control (*N* = 4,110)	LA's BEST (*n* = 480)	Control (*n* = 480)
Race/Ethnicity				
Hispanic (%)	87.9	86.4	89.6	88.1
Black (%)	7.4	5.0	6.5	4.4
Asian (%)	1.9	3.4	2.1	1.9
White (%)	0.6	3.2	0.4	3.8
Other (%)	2.2	2.0	1.4	1.8
Special programs status				
Poverty (%)	89.4	90.7	89.4	92.3
English language learner (%)	56.8	59.6	59.2	59.2
Redesignated fluent English proficient (%)	5.6	6.4	4.6	4.6
Special education (%)	6.7	5.5	4.6	4.6
Gifted (%)	2.2	2.5	2.5	2.5
Student achievement				
Mean second grade ELA score	-0.172	-0.038	-0.145	-0.140
Mean second grade mathematics score	-0.084	0.062	-0.038	-0.028
Other characteristics				
Female (%)	53.1	48.4	53.5	53.5
Average school attendance	157.6	162.0	159.2	160.1
Mean behavior rating (1-4)	3.0	3.1	3.1	3.1
School: Poverty (%)	86.8	87.5	86.7	87.4

Table C6

Demographics of the Cohort 2 LA's BEST and Control Group Students: Before and After Matching (Moderate Attendance)

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 580)	Control (*N* = 4,110)	LA's BEST (*n* = 519)	Control (*n* = 519)
Race/Ethnicity				
Hispanic (%)	84.5	86.4	85.0	85.4
Black (%)	8.1	5.0	7.3	6.9
Asian (%)	2.9	3.4	3.1	1.7
White (%)	3.1	3.2	3.3	4.2
Other (%)	1.4	2.0	1.3	1.8
Special programs status				
Poverty (%)	88.6	90.7	88.6	90.6
English language learner (%)	50.0	59.6	51.6	51.6
Redesignated fluent English proficient (%)	5.3	6.4	5.6	5.6
Special education (%)	6.2	5.5	3.7	3.7
Gifted (%)	1.7	2.5	1.9	3.1
Student achievement				
Mean second grade ELA score	-0.073	-0.038	-0.031	-0.013
Mean second grade mathematics score	-0.052	0.062	-0.012	-0.005
Other characteristics				
Female (%)	53.6	48.4	52.8	52.8
Average school attendance	160.7	162.0	162.3	161.7
Mean behavior rating (1-4)	3.1	3.1	3.1	3.1
School: Poverty (%)	85.9	87.5	86.0	87.1

Table C7

Demographics of the Cohort 2 LA's BEST and Control Group Students: Before and After Matching (High Attendance)

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 486)	Control (*N* = 4,110)	LA's BEST (*n* = 426)	Control (*n* = 426)
Race/Ethnicity				
Hispanic (%)	82.5	86.4	82.2	83.8
Black (%)	7.8	5.0	7.7	6.3
Asian (%)	4.9	3.4	5.4	4.7
White (%)	2.1	3.2	1.6	2.8
Other (%)	0.0	2.0	0.0	0.0
Special programs status				
Poverty (%)	88.3	90.7	88.7	90.6
English language learner (%)	48.6	59.6	52.1	52.1
Redesignated fluent English proficient (%)	7.8	6.4	7.7	7.7
Special education (%)	4.9	5.5	3.1	3.1
Gifted (%)	3.1	2.5	3.1	3.8
Student achievement				
Mean second grade ELA score	0.060	-0.038	0.090	0.099
Mean second grade mathematics score	0.106	0.062	0.139	0.133
Other characteristics				
Female (%)	55.8	48.4	54.9	54.9
Average school attendance	167.2	162.0	168.7	166.3
Mean behavior rating (1-4)	3.1	3.1	3.2	3.2
School: Poverty (%)	85.8	87.5	86.0	87.5

Table C8

Demographics of the Cohort 2 LA's BEST and Control Group Students: Before and After Matching (Interrupted Treatment)

Student characteristics	Before matching		After matching	
	LA's BEST (*N* = 1,313)	Control (*N* = 4,110)	LA's BEST (*n* = 1,160)	Control (*n* = 1,160)
Race/Ethnicity				
Hispanic (%)	85.6	86.4	86.6	86.8
Black (%)	8.1	5.0	6.7	5.0
Asian (%)	2.7	3.4	2.9	3.3
White (%)	1.7	3.2	1.6	3.1
Other (%)	1.9	2.0	2.2	1.8
Special programs status				
Poverty (%)	91.6	90.7	91.6	91.0
English language learner (%)	59.5	59.6	62.2	62.2
Redesignated fluent English proficient (%)	4.9	6.4	4.3	4.3
Special education (%)	6.3	5.5	4.7	4.7
Gifted (%)	1.9	2.5	2.2	1.4
Student achievement				
Mean second grade ELA score	-0.211	-0.038	-0.201	-0.188
Mean second grade mathematics score	-0.066	0.062	-0.037	-0.051
Other characteristics				
Female (%)	45.8	48.4	45.5	45.5
Average school attendance	159.8	162.0	161.4	161.6
Mean behavior rating (1-4)	2.9	3.1	3.0	3.0
School: Poverty (%)	87.2	87.5	87.2	87.9

Appendix D: Model Coefficients

Table D1

Secondary School Dropout Model Coefficients

Variables	Model coefficients (*SD*)		
	Pooled	Cohort 1	Cohort 2
LA's BEST & control group dummy codes			
Low attendance: Control	-0.149 (0.106)	-0.161 (0.156)	-0.176 (0.151)
Low attendance: LA's BEST	0.150 (0.098)	0.070 (0.149)	0.230 (0.141)
Moderate attendance: Control	-0.044 (0.103)	-0.110 (0.150)	0.005 (0.143)
Moderate attendance: LA's BEST	-0.099 (0.103)	-0.448 (0.167)*	0.135 (0.142)
High attendance: Control	0.014 (0.105)	0.017 (0.142)	0.004 (0.155)
High attendance: LA's BEST	-0.395 (0.118)*	-0.329 (0.155)*	-0.513 (0.178)*
Stopped attending: LA's BEST	0.057 (0.075)	0.266 (0.103)*	-0.209 (0.113)
Race/Ethnicity			
Hispanic	0.356 (0.131)*	0.460 (0.194)*	0.382 (0.183)*
Black	0.790 (0.169)*	0.781 (0.242)*	1.058 (0.232)*
Special programs status			
English language learner	0.003 (0.065)	-0.042 (0.094)	0.059 (0.092)
Redesignated fluent English proficient	0.449 (0.223)*	0.727 (0.600)	-0.584 (0.250)
Special education	-0.281 (0.138)*	-0.108 (0.190)	-0.476 (0.205)
Gifted	-0.054 (0.239)	-0.474 (0.428)	0.174 (0.306)
Student achievement			
Mean second grade ELA score	-0.110 (0.050)*	-0.137 (0.073)	-0.100 (0.070)
Mean second grade mathematics score	0.070 (0.048)	-0.127 (0.069)	0.006 (0.067)
Other characteristics			
Female	-0.181 (0.057)*	-0.224 (0.078)*	-0.135 (0.082)
Second grade school attendance	-0.002 (0.001)*	-0.002 (0.001)	-0.002 (0.001)
Poverty	0.159 (0.116)	0.098 (0.184)	0.193 (0.149)
Mean behavior rating (1-4)	-0.309 (0.050)*	-0.222 (0.070)*	-0.417 (0.072)*
School: Poverty	-0.001 (0.003)	-0.007 (0.008)	0.000 (0.004)

*$p \leq .05$.

Table D2

High School Graduation/Completion Model Coefficients

Variables	Model coefficients (*SD*)		
	Pooled	Cohort 1	Cohort 2
LA's BEST & control group dummy codes			
Low attendance: Control	0.001 (0.090)	-0.009 (0.131)	0.051 (0.126)
Low attendance: LA's BEST	-0.114 (0.090)	-0.009 (0.130)	-0.203 (0.127)
Moderate attendance: Control	0.055 (0.089)	0.226 (0.130)	-0.090 (0.126)
Moderate attendance: LA's BEST	0.200 (0.091)*	0.426 (0.136)*	0.041 (0.127)
High attendance: Control	0.011 (0.091)	0.005 (0.125)	0.029 (0.138)
High attendance: LA's BEST	0.346 (0.098)*	0.384 (0.130)*	0.349 (0.147)*
Stopped attending: LA's BEST	-0.143 (0.067)*	-0.249 (0.090)*	0.012 (0.098)
Race/Ethnicity			
Hispanic	-0.414 (0.116)*	-0.447 (0.164)*	-0.505 (0.158)*
Black	-0.634 (0.155)*	-0.712 (0.213)*	-0.745 (0.213)*
Special programs status			
English language learner	-0.043 (0.055)	-0.016 (0.079)	-0.062 (0.077)
Redesignated fluent English proficient	0.444 (0.193)*	-0.449 (0.604)	0.532 (0.211)*
Special education	0.416 (0.115)*	0.182 (0.158)	0.650 (0.168)*
Gifted	-0.212 (0.204)	0.037 (0.331)	-0.349 (0.267)
Student achievement			
Mean second grade ELA score	0.214 (0.044)*	0.236 (0.063)*	0.221 (0.061)*
Mean second grade mathematics score	0.248 (0.041)*	0.276 (0.060)*	0.191 (0.059)*
Other characteristics			
Female	0.310 (0.048)*	0.307 (0.069)*	0.314 (0.073)*
Second grade school attendance	0.003 (0.001)*	0.003 (0.001)*	0.003 (0.001)*
Poverty	-0.248 (0.101)*	-0.217 (0.163)	-0.270 (0.129)*
Mean behavior rating (1-4)	0.560 (0.044)*	0.504 (0.061)*	0.632 (0.064)*
School: Poverty	0.001 (0.003)	0.005 (0.007)	0.001 (0.003)

*$p \leq .05$.

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