Baltimore OrchKids:
An Examination of Student Outcomes

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Executive Summary

This report provides the results of a quasi-experimental analysis of the effects of OrchKids out-of-school-time (OST) program participation on student outcomes. The study included students who participated in OrchKids from 2009-10 through 2016-17. Outcomes examined included mobility out of City schools, student attendance, chronic absence, suspension from school, and performance on state assessments in English/language arts and math.

Program Description

OrchKids has been offering free, year-round music-based programming to students across Baltimore for 10 years. In SY 2017-18, its OST program was based in six schools and served over 1,000 children in pre-K through 10th grade. The primary goal of OrchKids is to expose students and their family members to music and provide students opportunities to participate in musical ensembles. In its OST program, OrchKids also provides students with meals, academic instruction and homework support, as well as adult and peer mentorship via a network of partnerships with community-based organizations. Goals of the program include increasing participants' exposure to classical music, increasing participants' confidence and accomplishment as musicians, improving academic outcomes and supporting the development of 21st century skills such as collaboration, teamwork, self-discipline, and creativity.

Findings

Participants who joined the program in pre-K through 4th grade and persisted in the program for more than one year had higher average daily attendance, lower chronic absence, and were less likely to receive a suspension from school. Participants who joined OrchKids between 5th and 8th grade also had significantly higher attendance, relative to

comparison students. Comparisons of participant and comparison students' state assessment outcomes in English/language arts and math also yielded positive findings.

Youth Served	Length of Participation	Findings
Began Participating in pre-K through 4th grade	5 to 8 years (N=86)	• Higher rates of attendance • Lower rates of chronic absence • Fewer suspensions • Less likely to leave City Schools • More likely to score proficient or advanced on MSA ELA and math • More likely to meet/exceed expectations on PARCC ELA
	2 to 4 years (N=244)	• Higher rates of attendance • Lower rates of chronic absence • Fewer suspensions • More likely to score proficient/advanced on MSA math
	1 year (N=221)	• More likely to be proficient/advanced on MSA ELA and math
Began Participating in 5th through 8th grade	2 to 3 years (N=30)	• Higher rates of attendance
	1 year (N=58)	• No differences detected

Analyses also demonstrated that relative to similar students, those who participated in OrchKids for 5 or more years were significantly less likely to depart City Schools during those years. This suggests that access to school-based arts enrichment programs may help retain families in the district.

Future research on OrchKids might examine the impact of participation on later outcomes in adulthood (e.g., college enrollment or degree completion), as well as collect qualitative data that could address ways that OrchKids promotes positive social attachment, identity formation, and family engagement in school.

OrchKids:
An Examination of Student Outcomes

Background

This report describes research to assess the impact of participation in OrchKids, an out-of-school-time (OST) program implemented in several Baltimore schools. Impacts were measured for out-of-district mobility, attendance, suspensions, and state assessment outcomes in English/language arts (ELA) and mathematics.

Prior Research

Research on out-of-school programming has shown that low-income children's participation in formal afterschool programs is significantly and positively associated with academic outcomes, peer relationships, and emotional adjustment (Posner & Vandell, 1994). Participation in OST is also positively associated with school attendance and negatively associated with high-risk youth behaviors (Moore & Hamilton, 2010).

As a music intervention, OrchKids is unique. It was inspired by Venezuela's El Sistema music program, which targets students living in under-resourced communities to promote "human opportunity and development through free classical music education" (Slevin & Slevin, 2013, p. 132). More specifically, the model aims to "systematize music education and to promote the collective practice of music through symphony orchestras and choruses in order to help children and young people achieve their full potential..." (El Sistema website, cited in Majna, 2012, p. 57). Research on music-based afterschool programming has yielded evidence of positive impacts on school outcomes for both high- and low-income students (Fitzpatrick, 2006).

OrchKids in Baltimore[1]

The primary goal of OrchKids is to expose students and their family members to music, as well as provide students with instruments, lessons, and opportunities to perform in musical ensembles. To accomplish this OrchKids offers free, year-round, music-focused programming to students across Baltimore city. In school year (SY) 2017-18, it was based in six schools and served over 1,000 children in pre-K through 10th grade.[2] As an OST program, OrchKids also provides students with meals, academic instruction and homework support, as well as adult and peer mentorship via a network of partnerships with community-based organizations. (See Appendix A for a list of selected partners.)

Program Structure. The structure of the OrchKids program has evolved over the 10 years it has operated in Baltimore. Currently, students are provided instruments at no cost, with music instruction provided by professional musicians. In more recent years, students have also received academic instruction by certified teachers from Baltimore City Schools (City Schools) in small-groups. One aim of the academic component is to ensure that students complete homework assignments, but additionally, teachers work with students on reading practice and comprehension. Efforts are also made to tie academic instruction during OST to the school-day curriculum. The ultimate goal of OrchKids is not only to help students gain cultural exposure and become confident, accomplished musicians, but to support 21st century skills such as collaboration, teamwork, self-discipline, and creativity.

Recruitment. Students who participate in the OrchKids OST program are typically recruited when their parents learn about the OST program through word-of-mouth in the community, as well as during in-school music classes. The hope is that in-school participants will enroll in the OST program where they can be connected to additional services and supports. There are no screening tests or requirements to participate, and the OST program is open to all students – including students who are not enrolled in the schools where OrchKids is based.

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[1] Nick Skinner, OrchKids Director of Operations, personal communication, May 10, 2018

[2] Schools with programs in 2017-18 include Lockerman-Bundy Elementary, Mary Ann Winterling Elementary, New Song Academy, Highlandtown Elementary/Middle (215), Booker T. Washington Middle School for the Arts, and Patterson Park Public Charter School (retrieved from http://www.bsomusic.org/education-community/young-musicians/orchkids.aspx#tab-1993)

Relationships. Students perform at least three to four times per year, with younger students rehearsing and performing alongside older, more experienced student musicians, and sometimes with the professional musicians of the Baltimore Symphony Orchestra. In this way, relationships develop and younger participants are inspired by the accomplishments of their older peers, as well as the professional musicians who teach them.

Family Engagement. Engagement with families is accomplished through regular performances in the community, parties or other events at school, and field trips outside students' neighborhoods. For example, OrchKids recently held concerts for families at an annual gala, a Dr. Martin Luther King breakfast in west Baltimore, and the Library of Congress in Washington, D.C. Upon joining, OrchKids staff meet with the parents of new participants to discuss expectations for participation, which include regular program attendance, appropriate behavior during sessions, and on-time pick-up from school. If and when these expectations are not met, staff again meet with parents to communicate the program's importance as an extension of the regular school day. Such communications are performed on an individualized basis.

The following sections provide details on the data used in the analysis, analytical methods, and findings of the study.

Data and Methods

This section includes a description of data sources used, a summary of the study's analytical methods, how the data were organized for analyses, and the research questions that guided analyses.

Data

This study utilized roster data provided by OrchKids listing their participants from 2009-10 through 2016-17. These records were matched using student IDs with student-level administrative data provided to BERC by City Schools' Office of Achievement and Accountability. Administrative student data for school years 2009-10 through 2016-17 included gender, race, Hispanic ethnicity, month and year of birth, service characteristics (free/reduced-price meal eligibility (FARMS),[3] special education, English language learner (ELL) services), monthly and annual attendance records, school and grade-level membership, suspensions, and state assessment scores in ELA and math on the Maryland School Assessment (MSA) and the Partnership for Assessment of Readiness for College and Careers (PARCC).

Analytical Groups

To control for length of exposure, different analytical groups of participants were identified in the roster data. The groups were identified according to both theoretical and analytical considerations. From a theoretical standpoint, students who began the program in the early grades were likely to have had unobservable characteristics and motivations different from students who began participating in middle school. Duration cut points were chosen so that the analyses could address the relationship between outcomes and both short-term and long-term participation. These decisions were also balanced against the need to maintain an adequate sample size in each group.

[3] In 2015-16 and 2016-17, FARMS data were no longer collected in City Schools, as all students received free meals via the Community Eligibility Program. Instead, low-income status is determined via 'direct certification' of family eligibility for Temporary Aid for Needy Families, Supplemental Nutrition Assistance Program, homelessness services, and foster care.

As a result, the roster data were initially organized by participation start grade. As a next step, analytical groups were defined by the length of time students persisted in the program. Groups 1, 2, and 3 began participating during pre-K through 4th grade, and participated for 5 to 8 years, 2 to 4 years, and 1 year, respectively. Groups 4 and 5 began participating in OrchKids as 5th through 8th graders and participated for 2 or 3 years, and 1 year, respectively. Table 1 is a matrix showing the grade level and starting year for all participants, as well as starting-grade totals and the number of participants in each analytical group. Each 'X' in Table 1 indicates that one or more students began participating in OrchKids in that grade and during that specific school year.

The year in which students' outcomes were identified was based on the number of years they participated in OrchKids and when their participation began. For instance, outcomes for students who began participating in 2009-10 and participated in OrchKids for 5 years were measured in 2013-14. Outcomes for students who received 1 year of OrchKids and began participation in 2015-16 were measured at the end of 2015-16. For presentation purposes, outcomes identified for each student's respective outcome year were combined into a single outcome measure for all members of the participation group and its comparison students.

The comparison groups were defined using a propensity score matching approach (Rosenbaum & Rubin, 1985). It identified similar students who did not participate in OrchKids, and also did not participate in Family League's OST programs between 2009-10 and 2016-17. This latter filter was used to ensure that comparisons had not also been exposed to OrchKids through a different program and to control for general benefits of participation in extracurricular activities via OST.

Comparison students must have been in the same grade level as participants, and they were also matched to participating students using gender, age, race, ethnicity, service characteristics (i.e., FARMS, special education status, etc.), September absence rate, and a host of school characteristics for the school in which they were enrolled at the start of their first year of OrchKids participation (i.e., percentages who were FARMS-eligible, African-American, receiving special education, ELL, and chronically absent the year prior). Additional achievement-related variables were also used to identify comparison students who began OrchKids in certain grade-years. For instance, to match 1st grade starters to comparisons, kindergarten readiness scores from the prior year were used to identify similar students. (Appendix B includes further details about the matching method, and

Appendix Tables B.1 through B.5 present baseline characteristics of OrchKids participants and comparison students for each of the 5 analytical groups).

Table 1
Starting School Years and Grade Levels of OrchKids Participants Included in Analyses (N=639)

		Started in grades pre-K-4th						Started in grades 5th-8th			
	Starting Years	Pre-K	K	1st	2nd	3rd	4th	5th	6th	7th	8th
Group 1 participated 5 to 8 years (N=86)	2009-10	X	X	X	X	X	X				
	2010-11	X	X								
	2011-12	X									
	Totals	34	10	17	16	<10	<10				
Group 2 participated 2 to 4 years (N=244)	2009-10	X	X	X	X						
	2010-11	X	X								
	2011-12	X	X			X					
	2012-13	X	X	X		X					
	2013-14	X	X	X	X	X					
	2014-15	X	X	X	X	X	X				
	2015-16	X	X	X	X	X	X				
	Totals	74	35	61	27	30	17				
Group 3 participated for 1 year (N=221)	2011-12	X	X								
	2012-13		X								
	2013-14						X				
	2014-15	X	X	X	X	X	X				
	2015-16	X	X	X	X	X	X				
	Totals	75	24	57	26	25	14				
Group 4 participated 2 to 3 years (N=30)	2014-15							X	X	X	X
	2015-16							X	X	X	X
	Totals							13	<10	<10	<10
Group 5 participated for 1 year (N=58)	2013-14							X	X		
	2014-15							X	X	X	X
	2015-16							X	X	X	X
	2016-17							X	X	X	X
	Totals							13	11	15	19

Note. A total of 676 unique students were in OrchKids roster data. Of these, 643 were matched to City Schools student records. Four students who joined OrchKids as high school students were excluded from the analysis, since there were too few to create a meaningful analytical group. Several of the excluded students were documented as home-schooled, and the remaining are presumed to have had erroneous student IDs or to have not been City Schools students.

Analytical Methods

Once suitable comparison students were identified, analyses employed descriptive and multivariate statistical methods. Tables in the results section present average outcomes for

participants and comparison students. Statistically significant differences were determined from multivariate regression estimates and standard errors of the effect of the participation on outcomes. These models also included other important control variables. Regression analyses were performed separately on each analytical group and its specific set of comparison students.

Outcomes included the likelihood of transferring out of the school district, students' average daily attendance rate (ADA), chronic absence (i.e., absent 10% or more of days on roll annually), receiving one or more suspensions in a year, and the likelihood of meeting or exceeding expectations on the PARCC assessment in English/language arts (ELA) and math. A subset of participants and comparison students whose outcomes were measured in 2010-11 through 2013-14 took the MSA instead of PARCC which was introduced in 2015-16, in which case the outcome refers to scoring proficient or advanced.

Limitations

Any study conclusions, even those based on quasi-experimental methods, are subject to unobserved bias. For the current study, procedures were used to reduce such bias; however, particular factors that the analyst cannot observe, such as family orientations toward the programming or to school in general, may lead to overestimation of program benefit. In addition, some background variables presented particular challenges in the matching procedure. This was especially the case for participants who started in pre-K through 4th grade and participated 2 to 4 years or 1 year. OrchKids participants in these two groups were especially heterogeneous, and significant differences between participants and comparisons remained after matching. Recognizing this limitation, the main comparison analysis also included all student-level matching variables to further reduce bias in estimates of effects. For the current study, it was not possible to include measures of program satisfaction, program attendance, inclinations about music, or school achievement data collected outside City Schools. As a result, such factors that positively relate to OrchKids participation may have also led to artificially positive estimates of OrchKids' effect.

Research Questions

The analyses were guided by the following research questions:

- What were the characteristics of students participating and persisting in the program, and how do they compare to other City Schools students?
- How did student mobility within and out of the district relate to OrchKids participation?
- How did OrchKids participation impact student outcomes, and did the effect of participation vary by the grade level of participants? Specifically,
    - How did participants' attendance and chronic absence rates compare to that of otherwise similar students?
    - Did participants receive fewer suspensions from school than similar students?
    - How did participants perform on English and math state assessments as compared to similar students?

Results

Characteristics of OrchKids

Compared to City Schools elementary and middle grades students, OrchKids served a greater share of female students and a slightly lower proportion of students receiving special education services. (See Table 2.) Elementary-aged students who joined OrchKids were nearly as likely to be African-American (78% vs. 81%), but were over twice as likely to identify as Latina/o and to receive ELL services. Based on their FARMS-eligibility, OrchKids participants had slightly higher levels of economic need than elementary-aged students across the district (91% vs. 89%).

Table 2
Characteristics of OrchKids Participants and City School Students

	OrchKids		City Schools*	
	Elementary	Middle	Elementary	Middle
Demographics				
% Male	45.7	43.5	51.2	51.0
% Female	54.3	56.5	48.8	49.0
% African-American	78.3	95.2	81.2	86.0
% Latina/o	17.6	6.5	8.0	4.8
% White/Asian/AmerIndian	3.0	0.0	10.2	8.7
Services				
% FARMS-eligible	91.0	90.3	89.1	88.3
% Special education	9.4	17.7	13.2	19.1
% ELL	11.6	1.6	5.6	$\leq$ 5.0
Number of students	577	62	44,786	17,062

* Figures for City Schools represent SY 2013-14, the mid-point of OrchKids programming in Baltimore. Grade span for OrchKids participants represents the grade level in which participation began. City Schools figures were obtained from MSDE (mdreportcard.org). Standard deviations for City Schools means were unavailable, so significance tests were not possible.

Participants who started OrchKids during middle school were more likely to identify as African-American and Latina/o, relative to the district average, but they were less likely to receive ELL or special education services. Participants were also slightly more likely to qualify for FARMS, relative to all middle grades students in City Schools (90% vs. 88%). Because of these differences, these student background factors were used in the process of identifying comparison students.

Program Persistence

There was a great deal of variability in the number of years that students participated in OrchKids. This variation is represented by the analytical groups identified for the study. In Table 3, the characteristics of students who persisted for 5 or more years are compared to those of students who persisted between 2 and 4 years, and those who left after 1 year of participation.

Table 3.
Characteristics of OrchKids Participants by Length of Participation

	5-8 years	2-4 years	1 year only
Demographics			
% Male	40.7	42.1	50.2
% Female	59.3	57.9	49.8
% African-American	100.0[b,c]	77.1[a]	76.1[a]
% Latina/o	1.1[b,c]	19.0[a]	19.1[a]
% White/Asian/AmerIndian	0.0[c]	3.9[a]	2.4
Services			
% FARMS-eligible	94.2	90.9	89.6
% Special education	9.3	7.0[b]	14.3[c]
% ELL	0.0[b,c]	13.5[a]	11.2[a]
Number of participants	86	274	217

[a] Significantly different from 5-8 year participants.
[b] Significantly different from 1 year participants.
[c] Significantly different from 2-4 year participants.
Note. This analysis excluded participants who joined in 2016-17, since participant roster data for 2017-18 were not yet available, and their continuation in the program was unknown.

All of the students who persisted in the program for 5 to 8 years were African-American, and 1% also identified as Latina/o. (See Table 3.) Further, 94% were FARMS-eligible, 9% received special education, and none received ELL services. Compared to the 5 to 8-year participants, those in the program for 2 to 4 years were much more likely to identify as Latina/o (19%) and 13.5% received ELL services. Compared to 1-year participants, students in the 2-to-4-year group were significantly less likely to receive special education services, but the groups were similar on race/ethnicity. There were no significant differences between any of the groups in terms of gender or FARMS-eligibility.

Student Mobility

We examined whether OrchKids participants were less likely to transfer out of City Schools than otherwise similar comparison students. The only statistically significant relationship was among students who started participating during the early grades and persisted for 5 to 8 years, relative to comparison students. (See Table 4.) On average, 55.1% of comparison students left the district at some point between 2009-10 and 2016-17. Yet, just 30.2% of OrchKids who joined as pre-K through 4th graders and participated for more than 5 years left the district. (Results of additional mobility analyses are available in Appendix C. Full regression analysis details for all outcomes can be found in Appendix D.)

Table 4
Percent of OrchKids Participants and Comparison Students Who Left City Schools

	Started OrchKids in pre-K through 4th grade			
	5-8 years	2-4 years	1 year only	Comparison students
% Left the district	30.2*	76.8	33.2	55.1

	Started OrchKids in 5th through 8th grade		
	2-4 years	1 year only	Comparison students
% Left the district	3.3	12.1	12.4

*p<.05
Statistically significant comparisons refer to differences between each participation group and relevant comparison students. Significance is based on regression estimates also controlling for student background characteristics.

Student Outcomes

Outcomes of interest were selected based on the implicit theory of change of OrchKids. In particular, the program aims to increase school engagement (measured through average attendance rates and chronic absence), promote positive school behavior (measured as number of suspensions), and support academic development (measured as performance on state assessments).

Attendance

OrchKids starting in pre-K through 4th grade. The average daily attendance (ADA) rate for students participating for five or more years was significantly higher at 95.8%, relative to 92.0% among comparisons. In addition, the percent of 5-to-8 year participants who were chronically absent was significantly lower, at 9.3% compared to 27.5% for comparison students. (See Table 5). The ADA rate for students participating in OrchKids for 2 to 4 years was 94.7%, and 14.0% were chronically absent. Relative to comparison students, these differences were also statistically significant. There were no significant differences on attendance outcomes between 1-year participants and comparison students.

Table 5
Attendance Outcomes for OrchKids and Comparison Students, by Length of Participation and Starting Grade Span

	Started in pre-K through 4th grade			
	5-8 years	2-4 years	1 year	Comparison students
Average daily attendance rate	95.8*	94.7*	92.6	92.0
% Chronically absent	9.3*	14.0**	27.6	27.5

	Started in 5th through 8th grade		
	2-3 years	1 year	Comparison students
Average daily attendance rate	94.3*	93.3	90.8
% Chronically absent	16.7	22.4	23.9

**p<.001 *p<.05 Statistically significant comparisons refer to differences between each participation group and relevant comparison students. Significance is based on regression estimates also controlling for student background characteristics.

OrchKids starting in 5th through 8th grade. The findings were similar for students who joined OrchKids in middle school. Average daily attendance was significantly higher among OrchKids students participating for 2 to 3 years (94.3% vs. 90.8%) relative to comparison students. Although the estimate of the impact of participation on chronic absence was not statistically significant for the 2-to-3-year participants, their chronic absence rate was much lower than for comparison students (16.7% vs. 23.9%). As was the case for the students starting OrchKids in the early grades, there were no significant differences in attendance outcomes between 1-year participants and comparison students.

Suspensions

OrchKids starting in pre-K through 4th grade. Students who participated in OrchKids for 5 to 8 years, as well as those participating for 2 to 4 years, were significantly less likely to be suspended from school than comparison students. (See Table 6.) Whereas 2.3% of 2-4 year and 1.6% and 1-year participants received a suspension, 3.0% of comparison students were suspended. There was no significant difference in suspensions between 1-year OrchKids participants and comparison students.

Table 6
Percent of OrchKids and Comparison Students who Received a Suspension, by Length of Participation and Starting Grade Span

	Started in pre-K through 4th grade			
	5-8 years	2-4 years	1 year only	Comparison students
% Suspended	2.3*	1.6†	2.3	3.0

	Started in 5th through 8th grade		
	2-3 years	1 year only	Comparison students
% Suspended	13.3	5.2	9.4

*p<.05 † p<.10 Statistically significant comparisons refer to differences between each participation group and relevant comparison students. Significance is based on regression estimates also controlling for student background characteristics.

OrchKids starting in 5th through 8th grade. Among participants who joined OrchKids as older students, there were no significant differences in the likelihood of suspension. (See Table 6.)

State Assessments

Unlike mobility, attendance, and suspension, which can be easily compared from one year to the next, the state assessment regime was revised over the course of the OrchKids program. Until 2014-15, Maryland students in grades 3 through 8 took the MSA in English/language arts (ELA) and math. Starting in 2014-15, students in the same grades began taking the PARCC assessment in these subjects. As a result, there are different ways to examine the relationship between participation and state assessment outcomes.

One way is to treat both state assessments as a single outcome, where 'meeting' or 'exceeding expectations' on the PARCC test is considered equivalent to scoring 'proficient' or 'advanced' on the MSA, respectively. A second way is to examine MSA and PARCC results separately, which is sensible given the increased expectations of the PARCC test benchmarks that are more closely aligned to Maryland's College and Career Readiness standards. This distinction is especially relevant for students who joined OrchKids as pre-K through 4th graders. Half of this group's assessment outcomes were measured via the MSA, whereas only a small handful of those who began participating as 5th through 8th graders had MSA scores in their outcome year. As a result, MSA and PARCC assessment outcomes were examined separately for pre-K through 4th grade starters, but among the 5th through 8th grade starters, there were too few with MSA scores for meaningful comparisons, so their MSA and PARCC outcomes are combined. The results of this analysis are provided in Table 7.

Table 7
State Assessment Outcomes for OrchKids and Comparison Students, by Years of Participation and Starting Grade Span

	Started in pre-K through 4th grade			
MSA	5-8 years	2-4 years	1 year	Comparison students
% Proficient/Advanced, ELA	65.6*	63.3	16.1†	30.8
% Proficient/Advanced, Math	43.8*	74.9*	27.4*	25.3
PARCC				
% Met/exceeded expectations, ELA	33.3†	11.8	4.4	14.1
% Met/exceeded expectations, Math	19.6	25.4	6.5	17.3

	Started in 5th through 8th grade		
PARCC and MSA Combined±	2-3 years	1 year	Comparison students
% Met/exceeded expectations/Prof/Adv, ELA	11.1	11.3	11.8
% Met/exceeded expectations/Prof/Adv, Math	3.7	11.1	6.6

*p<.05 †p<.10 ±Too few 5th-8th grade students had taken the MSA to analyze MSA and PARCC scores separately. Statistically significant comparisons refer to differences between each participation group and relevant comparison students. Significance is based on regression estimates also controlling for student background characteristics.

OrchKids starting in pre-K through 4th grade. On average, students who joined OrchKids in elementary school and who participated for 5 to 8 years were significantly more likely to meet or exceed expectations on the MSA assessment in ELA and math, relative to comparison students. OrchKids participants who persisted in the program for 2 to 4 years were more likely to score proficient or advanced on the math assessment, and

1-year participants were more likely to score proficient or advanced in both ELA and math (See Table 7.) For those assessed on the PARCC, there was one marginally significant finding relative to comparison students, where 5-to-8-year participants were more likely to meet or exceed expectations on the math assessment, relative to comparison students.

OrchKids starting in 5th through 8th grade. On average, and examining MSA and PARCC performance in combination, there were no significant differences in ELA and math state assessment outcomes between students who joined OrchKids as 5th through 8th graders and comparison students.

Summary and Conclusions

The results of this study provide evidence that OrchKids participation – particularly for multiple years – positively relates to student attendance and school behavior. Compared to students who appear similar to OrchKids participants on observable characteristics, students who participated in OrchKids for 5 or more years had higher attendance rates, and were less likely to be chronically absent from school or receive a suspension. Students who joined OrchKids at younger ages, i.e., between pre-K and 4th grade, and persisted in the program for 2 to 4 years also showed significantly higher attendance and a lower probability of being suspended from school. Significant positive relationships were also found between participation in OrchKids and the attendance rates of students who joined the program between 5th and 8th grade and persisted for at least 2 years.

The study found that participants of the program for 5 to 8 years were less likely to leave City Schools than similar students in the district who did not participate in OrchKids. In comparisons of students who remained in OrchKids for multiple years and those who participated for 1 year only, we found that fewer years of participation may have been related to factors often associated with higher than average student mobility; in particular, those who left OrchKids after 1 year were more often Hispanic and receiving ELL or special education services. Those who participated for at least 5 years were more likely to be African-American, and very few were Hispanic or received ELL services.

The results showed a significant relationship between OrchKids participation and performance on state assessments in both English/language arts and math. Relative to comparison students, those who participated in OrchKids for at least 5 years were significantly more likely than comparison students to score proficient or advanced on the MSA ELA and math assessments, as well as meet or exceed expectations on the PARCC ELA assessment. Those who began OrchKids in elementary school and participated for 2 to 4 years were significantly more likely to score proficient or advanced on the MSA math assessment. One year of OrchKids participation was significantly and positively related to ELA and math achievement on the MSA, as well. However, fewer differences were found between OrchKids participants and comparison students on PARCC assessment scores. Relative to comparison students and among those who started OrchKids as 5th through 8th graders, the research found no significant differences in state assessment outcomes, yet most were assessed under the new PARCC testing regime. As the PARCC is a relatively new assessment and its benchmarks are intended to be more challenging, fewer Baltimore

city students have met expectations, relative to the percent who were proficient on the MSA. This has led to less variation across students, making it more challenging to relate programming to PARCC scores.

Recommendations

The strongest impacts of the program on student outcomes were noted for students who participated in OrchKids for multiple years. Further, to participate for multiple years students needed to have started when they were young, i.e., by 3rd grade. As with any challenging endeavor, such as learning to play a musical instrument, more time invested towards mastery can have increasing returns on enjoyment and commitment. Overall, this suggests that engaging students in OrchKids during the early grades is beneficial for retaining students in the program by middle and high school.

Second, meaningful academic support in the context of OST requires close coordination between OST providers and regular school teachers. According to OrchKids staff, the academic component of their afterschool activities, as well as collaboration with teachers, have been growing over time. The findings from the current study suggest that maintaining the academic aspect of OrchKids is justified, in that participants seem to benefit from having extra time for homework completion and reading comprehension. OrchKids might also consider an academic focus on math, as the findings show the benefit of OrchKids thus far to be more apparent for English/language arts.

Next Steps

The current study relied exclusively on administrative data and used methods capable of identifying statistically similar comparison students to draw conclusions about the program's effect on school outcomes. Additional information about participants and comparison students that predict the likelihood of participating in a program such as OrchKids would strengthen the findings, as is typical with research using quasi-experimental methods and administrative data. Specifically, data regarding parents' engagement with school or students' social attachment to school would provide useful information that could reduce some of the potential 'unobserved' differences between OrchKids and comparison students.

Given the promising findings from this study concerning OrchKids' potentially positive impact on objective student outcomes, future research might also collect data about the effects of OrchKids participation on more qualitative outcomes, such as youth identity and social attachment. Other research has found that participation in similar, identity-forming activities, especially if connected to school, can have a positive effect on adult outcomes such as on-time high school graduation, and college enrollment or productive career pursuits (DeLuca, Clampet-Lundquist & Edin, 2016). Participation in a program that requires independent practice and embeds learning within a social community (similar to team sports and drama) almost certainly offers unique opportunities for the development of social identity that engenders a sense of meaning and attachment.

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Appendix A
Selected OrchKids Partners*

Baltimore Brass Company
Baltimore City Public Schools
Baltimore School for the Arts
Baltimore Urban Debate League
Baltimore Woodwind Repair
Breath of God Lutheran Church
City of Baltimore
Creative Alliance
Disability Rights Maryland
Grace United Methodist Church
Highlandtown Exchange Club
Johns Hopkins University School of Education
Joshua Smith
L & L Music - Wind Shop
Las Artesanas Mexicanas
Menchey Music
Mindful Me Yoga
Montgomery Philharmonic
Nova Strings
Pastor Mark Parker
Patterson Park Neighborhood Association
Peabody Preparatory
Roll Bmore Ice Cream
Rotary Club of Baltimore
Southwest Airlines
The Baltimore Symphony Associates
The Seed School
Towson State University
University of Maryland Baltimore County
William. S. Haynes Flute Company
Woodlawn Motor Coach

*Source: Nick Skinner, OrchKids Director of Operations, May 11, 2018

Appendix B
Propensity Score Matching Procedure Details

The propensity score method used for the current study was performed to identify control subjects, i.e., comparison students, who on average were as similar as possible to students who received the treatment, in this case – the treatment is OrchKids participation. Ideally, control subjects must not at any point in time have received the treatment themselves, and any characteristics used to "match" subjects should be measured prior to the start of the treatment.

To account for the first condition, any student identified as an OrchKids participant according to roster data provided was excluded from the pool of potential control subjects. In addition, any student who participated in a Family League-supported OST program for more than 30 days between 2009-10 and 2016-17 was excluded from potential controls. This latter filter was performed to ensure that comparisons had not also been exposed to OrchKids through a different program.

For the second condition, the variables used to match treatment and control subjects were captured from the school year prior to the target year, or when a student joined OrchKids. Matching variables included gender, race, Hispanic ethnicity, special education status, ELL status, FARM-eligibility status, century-month of birth, whether enrolled in City Schools prior to the target year, whether the student had been retained in grade the year prior to the target year, and relevant academic performance measures according to grade-level-specific testing regimes (e.g., kindergarten readiness scores for kindergarten and 1st grade starters, Stanford10 scores in ELA/Math for 2nd or 3rd grade starters, and MSA ELA/Math scores for 3rd-8th grade starters). Other matching variables included characteristics of the school enrolled in August of their relevant target year, including percentages who were FARMS, African-American, Hispanic, receiving ELL services, special education, and percent of students chronically absent the year prior.

The propensity score matching model was estimated separately for each analytical group and each starting-grade cohort. The R package MatchIt (Stuart, King, Imai & Ho, 2011) was used to perform the matching algorithm, which estimates a logit regression of the

probability, or "propensity" of receiving the treatment. This propensity can be expressed as equation (1):

$$(1) \quad \text{Logit}(P) = \text{Log}\,[P / (1 - P)]$$

The propensity was regressed on relevant background characteristics, and specifically, the algorithm to define "nearest neighbor" matches was estimated (i.e., each treatment case was matched to 3 or more control cases, based on post-estimation balance statistics), with "exact match" on grade level. A post-estimation propensity score, or probability of receiving the treatment, is calculated for each potential control subject. Based on an iterative estimate of the average propensity across potential control cases, suitable control subjects are identified and remaining subjects are discarded. In other words, the matching procedure determines the set of control students who, on average, are most similar to the treatment students on observed characteristics.

To check balance, the standardized mean differences between treatment and the control cases for each matching variable were examined before outcome analyses were performed. The standardized mean difference is calculated by subtracting the control group mean from the treatment group mean and dividing the difference by the standard deviation for the control group. Appendix Tables B.1 through B.5 present means comparisons of essential matching variables for OrchKids participants and matched comparisons. Tables B.1 – B.5 correspond to analytical groups 1 – 5, respectively. In some instances, important variables for best possible set of comparison cases were still significantly different from those for OrchKids participants. In the tables below, remaining significant differences are denoted with an asterisk. Because of the lack of optimal treatment-control balance, all student-level characteristics used in the matching procedure were retained in all regression analyses to further reduce bias in the estimates of the 'effect' of OrchKids participation on each outcome.

For the current analysis, the number of control students was different from the number of treatment students (i.e., there were insufficient suitable control subjects for a one-to-one match for each treatment case), so weights generated in the matching procedure were applied to all further comparison analyses, where the weight for each treatment student is equal to 1, and the weight for any control student is equal to the inverse of the calculated probability score, balanced across the control cases so that the sum of the control weights equals the sum of the number of treatment cases. This procedure allows for estimating the average effect of the treatment on the treated.

Table B.1

Baseline Characteristics of Students Who Began Participating in OrchKids as Pre-K to 4th Graders and Persisted for 5 to 8 Years, and Comparison Students

	OrchKids %	Comparison %
Student demographic characteristics		
Male	40.7	43.8
Female	59.3	56.2
African-American	100.0	100.0
Hispanic	1.6	1.2
Student service characteristics		
FARMS-eligible	94.2	93.6
Special education services	9.3	9.6
English language learner services	0.0	0.0
First school characteristics		
% FARMS-eligible	95.7	95.8
% African-American	97.6	97.8
% Special education	12.9	12.2
% Hispanic	0.3	0.3
% English learner	2.0	2.0
% Chronically Absent	27.3	27.1
N	86	249

After matching, no differences were statistically significant.

Table B.2

Baseline Characteristics of Students Who Began Participating in OrchKids as Pre-K to 4th Graders and Persisted for 2 to 4 Years, and Comparison Students

	OrchKids %	Comparison %
Student demographic characteristics		
Male	43.4	38.7
Female	56.6	61.3
African-American	76.2*	83.8
Hispanic	19.3*	13.2
Student service characteristics		
FARMS-eligible	91.0	91.8
Special education services	4.5	4.5
English language learner services	15.6*	10.0
First school characteristics		
% FARMS-eligible	91.8	92.5
% African-American	77.7*	83.7
% Special education	12.3*	13.0
% Hispanic	18.6*	13.0
% English learner	10.0*	7.2
% Chronically Absent	21.3	21.3
N	244	757

*p<.05

Table B.3
Baseline Characteristics of Students Who Began Participating in OrchKids as Pre-K to 4th Graders and Persisted for 1 Year, and Comparison Students

	OrchKids %	Comparison %
Student demographic characteristics		
Male	51.8	48.5
Female	48.2	51.5
African-American	71.5	72.2
Hispanic	22.3	21.8
Student service characteristics		
FARMS-eligible	90.2	90.2
Special education services	14.5	14.5
English language learner services	13.5	13.2
First school characteristics		
% FARMS-eligible	89.7*	84.2
% African-American	70.3	69.7
% Special education	15.8	15.9
% Hispanic	17.5	16.7
% English learner	10.3	9.2
% Chronically Absent	23.7*	28.7
N	221	681

*p<.05

Table B.4
Baseline Characteristics of Students Who Began Participating in OrchKids as 5th to 8th Graders and Persisted for 2 to 3 Years, and Comparison Students

	OrchKids %	Comparison %
Student demographic characteristics		
Male	33.3	36.0
Female	66.7	64.0
African-American	83.3	87.0
Hispanic	16.7	13.0
Student service characteristics		
FARMS-eligible	90.0	93.0
Special education services	23.3	24.0
English language learner services	0.0	0.0
First school characteristics		
% FARMS-eligible	93.7	91.8
% African-American	78.6	82.6
% Special education	20.6	21.0
% Hispanic	18.3	14.6
% English learner	9.2	7.5
% Chronically Absent	34.3	33.3
N	30	100

After matching, no differences were statistically significant

Table B.5

Baseline Characteristics of Students Who Began Participating in OrchKids as 5th to 8th Graders and Persisted for 1 Year, and Comparison Students

	OrchKids %	Comparison %
Student demographic characteristics		
Male	44.8	44.6
Female	55.2	55.4
African-American	91.4	92.4
Hispanic	8.6	8.2
Student service characteristics		
FARMS-eligible	87.9	87.0
Special education services	13.8	13.6
English language learner services	3.4	2.7
First school characteristics		
% FARMS-eligible	89.6	88.8
% African-American	90.1	90.1
% Special education	23.9	24.0
% Hispanic	8.5	8.4
% English learner	4.7	4.7
% Chronically Absent	39.9	38.5
N	58	184

After matching, no differences were statistically significant.

Appendix C
Mobility Analysis

Although the analysis cannot conclude whether a change in school or transfer out of City Schools explains why a student left the OrchKids program, examining these factors may provide some insight into potential reasons for program exit. For instance, none of the students who remained in the program for 5 to 8 years but subsequently stopped attending OrchKids had moved to a different Baltimore city school prior to leaving. (See Table C.1.) All program leavers, or 62.8% of the 5-8 year group, were found to have transferred out of the district the year they stopped participating.

Table C.1
Percent of Students Leaving the OrchKids Program who Changed Schools or Left the District, by Length of Participation

	No change in school		Changed schools		Left the district		Persisting in OrchKids		
Length of Participation	N	%	N	%	N	%	N	%	N
5-8 years	0	-	0	-	54	62.8	32	37.2	86
2-4 years	100	36.5	25	9.1	10	3.6	139	50.7	274
1 year	147	52.7	45	16.1	25	8.9	62	22.2	279
Total	247	38.7	70	11.0	89	13.9	233	36.5	639

Among students participating in OrchKids for 2 to 4 years, 50.7% still appeared to be in the program at the end of 2016-17. Among those who stopped participating, 3.6% had left the district, 9.1% had changed schools, and 36.5% had not changed schools and had not left the district, suggesting a decline in interest or some other scheduling complication. Finally, among those participating for one year only, 52.7% had not changed schools, 16.1% *did* change schools, and 8.9% had left the district the year after they stopped participating in OrchKids. Another 22.2% were still participants at the end of 2016-17.

We also examined whether program departure was more likely in particular grade levels. For context, Table C.2 provides the number and percent of students in each grade as they began participating in OrchKids, alongside the number and percent of program exiters in each grade. The most common grade in which students joined OrchKids over the 8 school

years examined was pre-K, followed by 1st, kindergarten and 2nd grade. The most common grade after which participants exited the program was pre-K, followed by 2nd grade and 1st grade.

Table C.2
Frequencies and Percent of Grade Levels for OrchKids Participation Start and Program Exit

Grade level	N Starting grade	% Participants by starting grade	N Exit grade	% Participants by exit grade
Pre-K	183	28.6	77	19.0
K	69	10.8	39	9.6
1st	135	21.1	57	14.0
2nd	69	10.8	61	15.0
3rd	63	9.9	40	9.9
4th	32	5.0	32	7.9
5th	26	4.1	34	8.4
6th	18	2.8	21	5.2
7th	21	3.3	< 20	< 5.0
8th	23	3.6	26	6.4
9th	-	-	< 10	< 1.0
Total	639		406	

Appendix D
Regression Analysis Details

Appendix D contains the full results of the multivariate regression analyses of the outcomes featured in the Results section, including transferring out of the district (Tables D.1 and D.2) average daily attendance (Tables D.3 and D.4), chronic absence (Tables D.5 and D.6), suspension (Tables D.7 and D.8), and state assessment outcomes in English/language arts (Tables D.9, D.10, D11) and mathematics (Tables D.12, D13, D14). For state assessment analyses, MSA and PARCC performance was examine separately for students who joined OrchKids as pre-K through 4th graders, but for students starting OrchKids in 5th through 8th grade, MSA and PARCC scores were combined into a single outcome.

The tables present estimates and standard errors for all variables included in the models. For dichotomous outcomes, logistic regression was used. In those cases odds ratios are presented along with their standard errors. When an estimate is replaced by '-' this indicates that there was no variation in the outcome on that variable for that particular analytical group.

Mobility out of City Schools

Table D.1
Logistic Regression Estimates of Leaving City Schools on OrchKids Participation and Student Background Factors, Pre-K through 4th Grade Starters

	5-8 years		2-4 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	0.54**	0.10	0.63	0.30	1.01	0.16
Male	0.85	0.17	0.82	0.82	0.99	0.17
African-American[a]	-	-	0.09*	0.05	1.95*	0.52
Hispanic	2.93	3.09	0.48	0.27	0.94	0.30
FARMS-eligible	1.16	0.56	0.66	0.24	0.72	0.18
Special Education	0.61	0.30	0.34	0.31	0.80	0.24
ELL	-	-	0.89	0.63	1.65	0.55
In City Schools[b]	1.80	0.70	6.04**	2.96	1.29	0.33
Retention in grade[b]	0.70	0.34	1.89	1.75	1.52	0.98
Age in months[b]	1.03*	0.01	1.10**	0.01	0.97**	0.01
N	335		954		793	
Pseudo r-square	0.06		0.34		0.04	

**p<.01 *p<.05 † p<.10, robust standard errors
[a] Reference group is white or Asian
[b] Measured year prior to OrchKids participation start

Table D.2
Logistic Regression Estimates of Leaving City Schools on OrchKids Participation and Student Background Factors, 5th through 8th Grade Starters

	2-3 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	0.20	0.22	0.96	0.54
Male	1.54	1.67	1.36	0.53
African-American[a]	0.01*	0.00	6.01*	5.16
Hispanic	0.01*	0.00	4.55	5.78
FARMS-eligible	0.14*	0.10	0.31*	0.17
Special Education	0.23	0.27	1.02	0.80
ELL	-	-	-	-
In City Schools[b]	-	-	0.22*	0.11
Retention in grade[b]	5.29	5.31	9.69*	7.47
Age in months[b]	1.01	0.01	1.00	0.01
N	130		242	
Pseudo r-square	0.19		0.10	

*p<.05 †p<.10, robust standard errors
[a] Reference group is white or Asian
[b] Measured year prior to OrchKids participation start

Attendance Outcomes

Table D.3
Linear Regression Estimates of Average Daily Attendance Rate on OrchKids Participation and Student Background Factors, Pre-K through 4th Grade Starters

	5-8 years		2-4 years		1 year	
	Coef	S.E.	Coef	S.E.	Coef	S.E.
Intercept	97.37	39.79	132.25	20.70	78.27	38.42
OrchKids participation	4.33*	1.78	2.25*	1.06	0.84	0.78
Male	-2.23†	1.10	-0.76	0.69	-0.50	0.87
African-American[a]	-	-	-0.93	0.64	-1.42	1.29
Hispanic	3.47*	1.34	2.92*	0.97	-1.80	1.54
FARMS-eligible	-3.64*	0.95	-1.12	1.37	2.87	2.35
Special Education	-0.33	2.59	1.27	0.86	-0.73	1.20
ELL	-	-	0.44	0.63	3.80	2.46
In City Schools[b]	-1.70	1.98	-0.08	1.07	1.42	0.97
Retention in grade[b]	-3.22	2.25	-1.01	1.10	-8.96	4.39
Age in months[b]	-0.03	0.03	-0.03†	0.02	0.01	0.03
N	291		900		793	
R-square	0.08		0.04		0.05	

*p<.05 † p<.10, robust standard errors
[a] Reference group is white or Asian
[b] Measured year prior to OrchKids participation start

Table D.4
Linear Regression Estimates of Average Daily Attendance on OrchKids Participation and Student Background Factors, 5th through 8th Grade Starters

	2-3 years		1 year	
	Coef	S.E.	Coef	S.E.
Intercept	228.60	114.60	99.57	64.37
OrchKids participation	2.11*	0.81	2.90	1.92
Male	-3.95	2.34	-0.31	2.15
African-American[a]	1.09	1.34	-1.16	4.22
Hispanic	4.61*	1.97	4.05	3.63
FARMS-eligible	-2.07	1.77	-0.25	5.79
Special Education	-1.91	2.15	-0.67	1.55
ELL	-	-	-0.72	3.06
In City Schools[b]	-	-	5.58	3.42
Retention in grade[b]	1.65	2.90	-12.69	10.19
Age in months[b]	-0.11	0.09	-0.01	0.05
N	122		242	
R-square	0.10		0.03	

*p<.05, robust standard errors

[a] Reference group is white or Asian

[b] Measured year prior to OrchKids participation start

Table D.5
Logistic Regression Estimates of Chronic Absence on OrchKids Participation and Student Background Factors, Pre-K through 4th Grade Starters

	5-8 years		2-4 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	0.20*	0.10	-0.47**	0.09	-0.03	0.15
Male	1.89*	0.55	1.13	0.20	0.10	0.18
African-American[a]	-	-	0.85	0.18	0.50	0.30
Hispanic	-	-	1.77	0.72	-0.11	0.34
FARMS-eligible	2.86	2.14	1.77	0.72	0.12	0.31
Special Education	0.90	0.48	1.36	0.47	0.37	0.25
ELL	-	-	0.79	0.23	-0.41	0.61
In City Schools[b]	1.07	0.56	1.08	0.20	-0.11	0.16
Retention in grade[b]	4.60*	3.02	1.24	0.90	0.93	0.39
Age in months[b]	1.00	0.10	1.01*	0.01	0.01	0.01
N	291		900		793	
Pseudo r-square	0.10		0.04		0.03	

**p<.01 *p<.05, robust standard errors

[a] Reference group is white or Asian

[b] Measured year prior to OrchKids participation start

Table D.6
Logistic Regression Estimates of Chronic Absence on OrchKids Participation and Student Background Factors, 5th through 8th Grade Starters

	2-3 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	0.68	0.26	0.84	0.37
Male	1.89	1.08	0.92	0.30
African-American[a]	1.41	0.97	1.03	1.19
Hispanic	0.73	0.76	0.17	0.23
FARMS-eligible	1.86	2.29	1.48	1.02
Special Education	1.07	0.46	1.19	0.47
ELL	-	-	4.51	4.19
In City Schools[b]	-	-	0.13*	0.08
Retention in grade[b]	-	-	1.13	0.92
Age in months[b]	1.01	0.02	1.00	0.01
N	122		242	
Pseudo r-square	0.03		0.05	

*p<.05, robust standard errors

[a] Reference group is white or Asian

[b] Measured year prior to OrchKids participation start

Suspension

Table D.7
Logistic Regression Estimates of Suspension on OrchKids Participation and Student Background Factors, Pre-K through 4th Grade Starters

	5-8 years		2-4 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	0.32*	0.13	0.37†	0.20	2.17	1.60
Male	1.53	0.79	4.37*	1.95	8.66*	7.34
African-American[a]	-	-	1.84	1.69	3.37	3.14
Hispanic	-	-	0.18†	0.16	0.25*	0.08
FARMS-eligible	-	-	2.28	2.43	-	-
Special Education	0.99	0.76	0.95	0.57	7.11*	4.31
ELL	-	-	1.68	0.64	9.83*	8.22
In City Schools[b]	0.89	0.59	3.58*	1.76	4.65	5.20
Retention in grade[b]	3.70	3.01	2.24	1.26	7.19*	4.40
Age in months[b]	0.97	0.02	0.99	0.01	0.95*	0.02
N	335		954		793	
Pseudo r-square	0.08		0.13		0.35	

*p<.05 †p<.10, robust standard errors
[a] Reference group is white or Asian
[b] Measured year prior to OrchKids participation start

Table D.8
Logistic Regression Estimates of Suspension on OrchKids Participation and Student Background Factors, 5th through 8th Grade Starters

	2-3 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	0.69	0.35	1.04	0.99
Male	3.37*	1.61	1.13	0.73
African-American[a]	0.37	0.27	-	-
Hispanic	2.34	1.98	-	-
FARMS-eligible	1.36	1.10	1.24	0.97
Special Education	4.10*	1.06	3.32	2.58
ELL	-	-	-	-
In City Schools[b]	-	-	0.57	0.29
Retention in grade[b]	0.53	0.45	-	-
Age in months[b]	0.95*	0.01	1.00	0.01
N	130		242	
Pseudo r-square	0.17		0.04	

*p<.05, robust standard errors
[a] Reference group is white or Asian
[b] Measured year prior to OrchKids participation start

State Assessment Outcomes

Table D.9
Logistic Regression Estimates of Maryland State Assessment (MSA) Outcomes in English/Language Arts on OrchKids Participation and Student Background Factors, Pre-K through 4th Grade Starters

	5-8 years		2-4 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	2.62*	0.90	4.43	4.87	2.52†	1.26
Male	0.99	0.35	0.88	1.19	0.39	0.21
African-American[a]	-	-	1.18	2.01	0.20*	0.13
Hispanic	-	-	1.16	2.15	0.64	0.48
FARMS-eligible	0.17	0.22	-	-	0.20	0.24
Special Education	0.12*	0.07	0.40	0.75	-0.01*	0.00
ELL	-	-	-	-	1.54	2.00
In City Schools[b]	1.52	0.91	5.26	11.80	6.12e5	1.16e6
Retention in grade[b]	0.58	0.35	-	-	-	-
Age in months[b]	0.99	0.02	0.98	0.05	0.87*	0.05
N	187		36		237	
Pseudo r-square	0.09		0.09		0.36	

*p<.05, robust standard errors

[a] Reference group is white or Asian

[b] Measured year prior to OrchKids participation start

Table D.10
Logistic Regression Estimates of PARCC Assessment Outcomes in English/Language Arts on OrchKids Participation and Student Background Factors, Pre-K through 4th Grade Starters

	5-8 years		2-4 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	2.12	1.06	0.71	0.30	0.44	0.14
Male	0.71	0.30	1.25	0.74	0.33	0.20
African-American[a]	-	-	0.72	0.89	0.07*	0.04
Hispanic	0.62	0.87	0.23	0.24	0.07*	0.04
FARMS-eligible	0.80	0.58	0.16	0.19	0.12*	0.09
Special Education	-	-	0.37*	0.16	1.07	0.70
ELL	-	-	-	-	-	-
In City Schools[b]	2.01	1.76	0.02*	0.04	-	-
Retention in grade[b]	-	-	6.73	13.18	-	-
Age in months[b]	1.03	0.02	1.03	0.05	1.02	0.03
N	85		163		211	
Pseudo r-square	0.03		0.17		0.24	

*p<.05, robust standard errors

[a] Reference group is white or Asian

[b] Measured year prior to OrchKids participation start

Table D.11
Logistic Regression Estimates of English/Language Arts State Assessment Outcomes (MSA and PARCC) on OrchKids Participation and Student Background Factors, 5th through 8th Grade Starters

	2-3 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	1.23	0.64	0.97	0.39
Male	0.30	0.31	0.86	0.37
African-American[a]	-	-	0.79	1.30
Hispanic	0.82	0.52	1.43	2.22
FARMS-eligible	0.60	0.57	0.57	0.25
Special Education	-	-	0.67	0.54
ELL	-	-	-	-
In City Schools[b]	-	-	-	-
Retention in grade[b]	-	-	-	-
Age in months[b]	1.04†	0.03	1.01	0.02
N	108		217	
Pseudo r-square	.07		0.02	

*p<.05 †p<.10, robust standard errors

[a] Reference group is white or Asian

[b] Measured year prior to OrchKids participation start

Table D.12
Logistic Regression Estimates of Maryland State Assessment (MSA) Outcomes in Mathematics on OrchKids Participation and Student Background Factors, Pre-K through 4th Grade Starters

	5-8 years		2-4 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	2.49*	0.92	1.06e3*	1.67e3	2.08*	0.67
Male	0.66	0.30	4.41e2	2.03e3	0.65	0.21
African-American[a]	-	-	0.42	0.83	0.32	0.36
Hispanic	-	-	0.51	2.55	0.39	0.21
FARMS-eligible	0.11	0.14	-	-	0.18*	0.13
Special Education	-	-	0.01	0.01	0.87	1.05
ELL	-	-	-	-	2.23	2.75
In City Schools[b]	0.47	0.25	1.30e3	3.28e3	8.41	23.83
Retention in grade[b]	0.16*	0.14	-	-	-	-
Age in months[b]	0.99	0.01	1.01	0.08	0.98	0.05
N	187		32		235	
Pseudo r-square	0.08		0.51		0.16	

*p<.05, robust standard errors

[a] Reference group is white or Asian

[b] Measured year prior to OrchKids participation start

Table D.13
Logistic Regression Estimates of PARCC Assessment Outcomes in Mathematics on OrchKids Participation and Student Background Factors, Pre-K through 4th Grade Starters

	5-8 years		2-4 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	3.58†	2.39	1.06	0.80	0.40	0.17
Male	1.80	0.68	1.49	0.47	0.57	0.23
African-American[a]	-	-	1.55	1.25	0.10*	0.08
Hispanic	2.11	3.11	3.17*	1.78	0.25	0.25
FARMS-eligible	0.46	0.34	0.07*	0.04	0.54	0.20
Special Education	-	-	0.25	0.21	0.40	0.26
ELL	-	-	0.09*	0.05	0.32*	0.18
In City Schools[b]	1.64	1.91	0.03*	0.05	0.14*	0.06
Retention in grade[b]	-	-	-	-	-	-
Age in months[b]	1.04	0.03	1.07*	0.02	1.08*	0.02
N	85		163		210	
Pseudo r-square	0.07		0.22		0.17	

*p<.05,†p<.10 robust standard errors
[a] Reference group is white or Asian
[b] Measured year prior to OrchKids participation start

Table D.14
Logistic Regression Estimates of Mathematics State Assessment Outcomes (MSA and PARCC) on OrchKids Participation and Student Background Factors, 5th through 8th Grade Starters

	2-3 years		1 year	
	Odds Ratio	S.E.	Odds Ratio	S.E.
OrchKids participation	1.48	1.62	1.99	0.94
Male	-	-	2.15	1.17
African-American[a]	-	-	0.01*	0.01
Hispanic	-	-	0.01*	0.01
FARMS-eligible	-	-	0.32*	0.17
Special Education	-	-	-	-
ELL	-	-	-	-
In City Schools[b]	-	-	-	-
Retention in grade[b]	-	-	-	-
Age in months[b]	1.04	0.03	1.04†	0.02
N	107		217	
Pseudo r-square	0.03		0.19	

*p<.05 †p<.10, robust standard errors
[a] Reference group is white or Asian
[b] Measured year prior to OrchKids participation start