The Summer Learning of Exceptional Students

Seth Gershenson[♦]
School of Public Affairs
American University

Michael S. Hayes
Department of Public Policy and Administration
Rutgers University – Camden

Abstract

The summer activities and summer learning of exceptional students—students who either have an individualized education plan (IEP) or who are English language learners (ELL)—are potentially important yet understudied. We analyze nationally representative survey data to fill this gap. Exceptional students are significantly less likely to participate in organized summer activities and summer daycare, but are more likely to attend summer school and practice math with a parent, than their mainstream counterparts. Exceptional learners make significantly greater reading gains during the summer vacation than their mainstream counterparts. However, this is only true for non-poor exceptional learners. Moreover, the well documented "summer learning loss" of low-income students in reading is entirely driven by losses of low-income exceptional learners.

Keywords: summer learning loss; exceptional students; English language learners; special education

[♦] Corresponding author – Comments are welcome. Email: gershens@american.edu. Phone: 202-885-2687. Fax: 202-885-2347. American University, School of Public Affairs, 4400 Massachusetts Avenue, NW, Washington DC, 20016-8070.

Introduction

In 1999, 12% of U.S. kindergarteners spoke a language other than English at home and 7% had an Individualized Education Plan (IEP).[1] In the 2011 kindergarten cohort, these figures had risen to 16% and 9%, respectively.[2] English language learners (ELL) who speak a language other than English at home and students with disabilities who have IEPs, collectively referred to as exceptional students, face numerous potential inequities and challenges (e.g., Jones et al. 2013). Moreover, poverty potentially magnifies the challenges faced by exceptional students, as more than 30% of Hispanic primary school students are ELL (Hemphill and Vanneman 2011), there is an SES gap in the Spanish skills of Spanish-speaking students (Reese, Garnier, Gallimore, and Goldenberg 2000), and ELL, low-income, and racial minority students are overrepresented in special education programs (e.g., Artiles et al. 2005). Despite increasing attention to the challenges faced by exceptional students from policymakers and educators, and the knowledge that high-quality programs and effective teachers can improve exceptional students' educational achievement (e.g., Cann et al. 2015; Genesee et al. 2005), significant achievement gaps between exceptional and mainstream students remain (e.g., Fry 2007; Lubienski and Lubienski 2006).

Policy makers and educators must understand the determinants of academic success and the factors that contribute to such achievement gaps if the gaps are to be closed. The activities, individuals, and environments to which children are exposed during summer vacation may contribute to the persistence of gaps in achievement between exceptional and mainstream students. Indeed, Heyns (1978) put forth and tested the hypothesis that lower rates of summer learning among socioeconomically disadvantaged students might contribute to the stubborn persistence of achievement gaps between students of different demographic and socioeconomic backgrounds.[3] As a result, a sizable and interdisciplinary body of literature has emerged that documents differences by race and socioeconomic status (SES) in students' summer activities and summer learning gains (e.g., Alexander et al. 2001; Burkam et al. 2004; Chin & Phillips 2004; Cooper et al. 1996; Downey et al. 2004; Author 2013; Quinn 2014). However, this literature focuses almost entirely on racial and SES differences in summer learning, despite the fact that summer learning rates might also vary by ELL and IEP status (Verachtert et al. 2009).

The current study contributes to this gap in the summer learning literature by examining the summer activities, summer learning rates, and determinants of summer learning rates of exceptional students. We do so using nationally representative data on the 1999 U.S. kindergarten cohort from the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K). We find that exceptional students are significantly less likely to participate in organized summer activities and summer daycare programs, but are more likely to attend summer school or practice math with a parent during the summer vacation, than their mainstream classmates. Regarding summer learning, on average, we find that exceptional students experience significantly higher summer learning rates in reading than their mainstream counterparts, and that this difference is primarily driven by the summer learning of students who have an IEP. However, this premium exists only for relatively advantaged exceptional students, as exceptional students in households below the poverty line experience significantly lower summer learning rates than both more advantaged exceptional students and mainstream students. Interestingly, we find no evidence of lower summer learning rates among impoverished mainstream students, suggesting that the lower rates of summer learning among low-income students documented in the extant literature on summer learning loss are primarily attributable to low-income exceptional students.

Literature Review and Theoretical Background

Cooper et al. (1996) thoroughly reviewed the early empirical literature on summer learning loss, which includes the influential studies by Heyns (1978) and Entwisle and Alexander (1992) of Atlanta and Baltimore, respectively. A series of more recent studies of summer learning utilize the nationally representative ECLS-K (e.g., Burkam et al. 2004; Downey et al. 2004). A consistent finding in this literature is that low-income students make significantly smaller reading gains during the summer vacation than their more advantaged counterparts, while no such difference is found in math gains. However, as Verachtert et al. (2009) note, the existing literature largely ignores the potential differences in summer learning between exceptional and mainstream students.

Summer learning rates likely vary across students for a variety of reasons such as differences in children's summer time use and exposure to parental involvement (Author 2013) and differential rates of participation in organized summer activities (Chin & Phillips 2004). Reese et al. (2000) document the long-run benefits for English acquisition of parents providing literary activities at home in the native language. Borman et al. (2005) discuss four potentially interrelated mechanisms that may cause children in low-SES households to experience smaller achievement gains than their more advantaged counterparts during the summer vacation. First, the "faucet theory" of Entwisle et al. (2001) posits that SES differences in summer learning rates are driven by high-SES households being better able to compensate when the flow of resources from the "school tap" is shut off. Second, differences in summer learning rates may result from different parenting strategies (Entwisle, Alexander, and Olson 1997; Heyns 1978). Third, psychological models suggest that differences in parents' expectations for children's achievement and behavior may lead to differences in summer learning (Entwisle et al. 1997; Hoover-Dempsey and Sandler 1995). Finally, heterogeneity in either access or returns to participation in organized summer activities may contribute to differences in summer learning rates (Cooper et al. 2000).

Many of these potential sources of SES-gaps in summer learning suggest that there may be differences between exceptional and mainstream students' summer learning rates as well, given that ELL and racial minority students are overrepresented in special-education designations and are more likely to live in low-income households (Artiles et al. 2005; Gandara 2010; Lui et al. 2006). If so, exceptional students might lose ground relative to their mainstream counterparts during the summer vacation. Alternatively, summer may be a time for exceptional students to gain ground on their mainstream counterparts, as high-quality programs and teachers have been shown to improve ELL students' educational achievement (Cann et al. 2015; Genesee et al. 2005). The theoretical ambiguity regarding the direction of the "summer learning gap" between exceptional and mainstream students suggests that this is an empirical question, one that we address in this paper.

Previously, only three studies have formally compared the summer learning rates of exceptional and mainstream students. First, using data on kindergarten and first-grade students in Belgium, Verachtert et al. (2009) find that the summer gains made by children who speak a foreign language at home are about 5% of a math test score standard deviation (SD) lower than the summer gains made by native (Dutch) speakers, though this difference is imprecisely estimated. During first grade, however, the children who speak a foreign language at home make significantly greater gains in math achievement than their native-speaker counterparts. Second, Sandberg-Patton and Reschly (2013) examine the summer learning gains of first through fourth grade students in one Title-1 primary school in rural Georgia. The authors find no statistically significant differences between ELL and non-ELL students' summer reading gains; however, special education students were found to make smaller summer reading gains than their mainstream counterparts. Finally, Shaw (1982) examined the differences in students' summer learning using a sample of 28 schools in Stanislaus County, California and found that special education students experienced summer learning loss in math relative to their mainstream peers. We contribute to these existing studies by examining the summer achievement gains made in both math and reading using rich, nationally representative U.S. survey data that includes information on students' household characteristics, socioeconomic status, and summer activities. Additionally, we analyze the summer activities of exceptional students in the U.S. and leverage this information to investigate the potential mechanisms through which exceptional students experience differential rates of summer learning.

Given the relative lack of research on exceptional students' summer learning, it is useful to briefly review what is known about exceptional student learning during the school year to see what, if any, knowledge of exceptional student experiences might inform the current study. Achievement gaps between ELL and mainstream students are well documented; for example, ELL students are between 18 and 53 percent more likely to be below basic proficiency levels in mathematics than mainstream students (Fry, 2007, 2008). Various explanations for this achievement gap have been proposed. For example, Fry (2008) suggests that the gap results from ELL students being concentrated in disadvantaged schools, which highlights the importance of controlling for school and classroom characteristics. Artiles et al. (2005), meanwhile, argue that learning is restricted for ELL students who are inappropriately placed in special education programs. Others suggest that the placement of ELL students in English-only classrooms contributes to the achievement gap (Farver, Lonigan, and Eppe 2009; Francis, Lesaux, and August 2006; Jepsen 2010; Gordon and Hoxby 2004; Greene 1997; Pappamihiel 2002; Slavin and Cheung 2005). Compared to English-only classrooms, ELL students tend to be more successful in bilingual programs that are customized to meet their needs (Genesee et al. 2005; Gersten and Baker 2000; Thomas and Collier 2002).

Previous studies also find a significant achievement gap between IEP and mainstream students. (Levinson 2011; McDonnell et al. 2003). Several studies have offered possible explanations for this achievement gap. Mercer (1997) and Buldren and Carta (1992) suggest that students with learning disabilities are more likely to have memory problems and difficulty staying on task than mainstream students. Evidence is mixed on whether or not students with learning disabilities who receive special education services experience larger gains in math and reading achievement than similar students who did not receive special education services (Ehrhardt et al. 2013; Morgan et al. 2010; Sullivan and Field 2013; Swanson & Hoskyn 1998). Expanding on previous correlational analyses, Sullivan and Field (2013) used a propensity-score matching strategy and found that children with learning disabilities who did not receive special education services experienced moderate positive gains in both math and reading relative to observably similar children who received special education designations. Finally, some students with special needs, though not all, are exposed to enriching summer activities. For example, Clark & Nwokah (2010) showed that organized summer camps provide such students with opportunities to learn through playing in group activities.

Data

Data on summer learning, household characteristics, and summer activities are taken from the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K), which was collected by the National Center for Education Statistics (NCES). The ECLS-K sampled more than 20,000 U.S. children from about 1,000 kindergarten programs (i.e., schools) and was designed to be nationally representative of the cohort that entered kindergarten in the 1998-99 academic year. All children were surveyed in the fall and spring of kindergarten and the spring of first grade. However, the analytic sample is restricted to the 30% random subsample of children who were also surveyed in fall of first grade. This facilitates the estimation of learning that occurred between the spring kindergarten assessment and the fall first grade assessment (i.e., during the summer between kindergarten and first grade).

The ECLS-K oversampled certain subsets of the population, so the primary analyses are conducted using NCES-provided sampling weights that adjust for the survey's nonrandom sampling frame and nonresponse based on observables. We further restrict the analytic sample by excluding students who repeated kindergarten, changed schools between school years, or were missing basic demographic or test score data. School changers are excluded to avoid conflating summer learning with shocks to achievement caused by the disruption associated with changing schools. However, the main findings are robust to including students who either repeated kindergarten or changed schools.

These data are well suited for the current analysis of exceptional students' summer learning for three reasons. First, the ECLS-K is the only nationally representative survey of U.S. students that contains both fall and spring test scores spanning the summer vacation. Second, the ECLS-K contains information regarding students' summer activities, which facilitates analyses of the behaviors and activities that contribute to summer learning and of underlying differences between exceptional and mainstream students' summer activities. Third, the age-appropriate reading and mathematics assessments used to calculate summer achievement covered the same content and had the same (low) stakes, so teachers had no incentive to strategically divert resources or instructional time towards a specific test. See NCES (2002) and Fitzpatrick et al. (2011) for further discussion of the ECLS-K assessments. Test scores are standardized by subject and testing period to have mean zero and SD one, using all available test scores. However, in an online appendix we show that all of our main findings are robust to instead using unstandardized IRT scale scores.

Importantly, in both fall and spring semesters, ECLS-K assessments were administered to different students on different days. Fitzpatrick et al. (2011) show that ECLS-K test dates vary randomly between schools, between classrooms within schools, and even between students within the same classroom. The authors exploited this exogenous variation in time between tests to estimate the causal effect of instructional days on academic achievement. In the current context, to avoid conflating summer- and school-year learning, the econometric model must acknowledge that assessments were administered on neither the first nor last days of the academic year. For the summer between academic years t and t+1, there are four relevant dates:

A. Spring t Assessment Date

B. Academic year t End Date

C. Academic year t+1 Start Date

D. Fall t+1 Assessment Date

The number of days between dates A, B, C, and D, as well as achievement gains during the kindergarten, first-grade, and intervening summer, are summarized in table 1. The estimated SD of unadjusted summer and school-year learning are sizeable and similar in all three time periods, indicating that there are nontrivial amounts of variation in both school-year and summer learning. However, simple comparisons of these "unadjusted" summer learning estimates are misleading, as nearly half of the days between the spring-kindergarten and fall-first grade tests were actually school days. The average summer vacation in the ECLS-K was about 80 days. Of the 70 school days that transpired between tests, about 55% were at the start of first grade before the fall first-grade test and about 45% were at the end of kindergarten after the spring kindergarten test. Importantly, the average summer vacation and average number of school days before (after) the fall (spring) test was similar for both exceptional and mainstream students.

Table 2 summarizes the demographic composition and summer activities of the analytic samples of both exceptional and mainstream students. Students with either an Individualized Education Plan (IEP) or who did not speak English at home (N = 100) constitute about 7.4% of the full analytic sample (N = 1,350). Of these exceptional students, 59% are only IEP, 40% are only ELL, and only 1% are both IEP and ELL. The analytic sample of exceptional students is approximately 56% non-Hispanic white, 3% non-Hispanic black, and 31% Hispanic. The remaining 10% is classified as "other race," which includes Asians, Pacific Islanders, Native Americans, and students of mixed race. The analytic sample of mainstream students contains a significantly higher percent of non-Hispanic white and non-Hispanic black students, while containing a significantly lower percentage of Hispanic and "other race" students. About 38% of exceptional students are female, while males and females are equally represented in the mainstream subsample.

As documented in previous research, these are also significant differences in SES between exceptional and mainstream students. For example, about one fifth of exceptional students reside in households below the poverty line, a poverty rate that is eight percentage points higher than among mainstream students. There are similar, statistically significant gaps in maternal education and the likelihood of having a computer in the home between the two groups. Finally, table 2 documents some significant differences between the summer experiences of exceptional and mainstream students. In particular, relative to mainstream students, exceptional students are 20 percentage points less likely to have participated in an organized summer activity but more than twice as likely to have attended summer school.

Table 3 provides a more thorough descriptive analysis of differences between exceptional and mainstream students' participation in eight summer activities. Specifically, four regression specifications are estimated for each summer activity: models that do and do not control for student socioeconomic and demographic characteristics, and models that do and do not disaggregate the exceptional indicator into separate ELL and IEP indicators. The first five summer activities considered in table 3 are binary "participation indicators," so estimates of logit model average partial effects (APE) are reported. As suggested by table 2, there are significant differences by students' exceptionality status in three of these outcomes: participation in organized activities, summer school, and summer day care.

Table 3 shows that these differences are robust to conditioning on student-level control variables, indicating that observed differences between exceptional and mainstream students' summer activities are not entirely driven by higher rates of exceptional designations among racial minority and low-income students. It is also interesting that, for the most part, differential rates of participation in summer activities by exceptionality are equally driven by ELL and IEP students. Indeed, for no outcome are the ELL and IEP effects significantly different from one another at traditional confidence levels, though exceptionality's effect on participation in organized activities appears to be mostly driven by IEP students rather than by ELL students. That IEP students are less likely to participate in organized summer activities could be partly explained by the fact that IEP students are also about 7 percentage points more likely to be enrolled in summer school, though this only explains about half of IEP's negative effect on the likelihood of participating in an organized summer activity. Another possible explanation is that organized summer activities designed for students with learning disabilities are both less common and more expensive than mainstream summer activities (Williams 2010).

Column 6 of table 3 shows no evidence of significant differences by IEP or ELL status in the number of summer trips to bookstores and libraries, even after controlling for demographic and socioeconomic background. There are significant differences, however, in parental involvement: the positive and significant ordered logit coefficients reported in column 7 of table 3 suggest that the parents of exceptional students practice math with their children more frequently during the summer vacation than do the parents of mainstream students. No such differences are observed in the frequency with which parents read to children. However, the ordered logit coefficients cannot be directly interpreted, so APE on each categorical indicator (never, sometimes, and frequently) are reported in table 4 (Wooldridge 2010, 656). The APE reported in table 4 show that after conditioning on observed student characteristics, exceptional students are about seven percentage points more likely to practice math with a parent every day, and about eleven percentage points less likely to never practice math with a parent, during the summer vacation than their mainstream counterparts. These effects are larger among ELL than IEP students, though once again the differences are not statistically significant. Together, tables 3 and 4 show that significant differences in the summer activities of exceptional and mainstream students exist, are roughly similar for both IEP and ELL students, and are robust to conditioning on students' socioeconomic and demographic backgrounds. These findings further motivate our analysis of exceptional students' summer learning.

Econometric Model and Estimation

Let y^j represent achievement at date j for $j \in \{A, B, C, D\}$. Only y^D and y^A are observed, so we rewrite the difference between observed test scores as

$$y^D - y^A = (y^D - y^C) + (y^C - y^B) + (y^B - y^A), \quad (1)$$

where the middle term on the RHS of equation (1) constitutes summer learning. We then approximate the RHS of (1) using a piecewise-linear function of days between dates

$$y^D - y^A = \alpha(d^D - d^C) + \beta(d^C - d^B) + \gamma(d^B - d^A) + \varepsilon, \quad (2)$$

where ε is an error term. Student (i), school (s), and year (t) subscripts on the y^j, d^j, and ε in equation (2) are suppressed for notational convenience.[4] β, which represents the average daily rate of summer learning, can be given a causal interpretation if vacation length is not endoegenous; that is, if vacation length is orthogonal to elements of ε that predict achievement (e.g., school quality, parental involvement). Authors (2015) show that vacation length is not correlated with observable student, household, or school characteristics and argue that it is therefore plausible that vacation length is similarly uncorrelated with unobserved measures of student and school quality. However, even if β is not given a causal interpretation, it is a descriptive parameter of interest that informs our understanding of the role that summers play in the education production function and of potential differences between exceptional and mainstream students in summer learning.

Recall that the primary objective of the current study is to test for differences in summer learning between exceptional and mainstream students. One way to do this is by estimating equation (2) separately for different types of students. Alternatively, equation (2) can be augmented to condition on observed student and school characteristics (X) and interactions between X and ($d^C - d^B$):

$$y^D - y^A = \alpha(d^D - d^C) + \beta(d^C - d^B) + \gamma(d^B - d^A) + \delta X + \lambda(d^C - d^B)\times X + \varepsilon, \qquad (3)$$

where X could include lagged achievement (y^A).[5] When the vector X includes y^A, the model becomes a familiar lag-score value-added model (e.g., Sass et al. 2014).[6] Summer learning might depend on past achievement for at least two reasons. First, there might be "Matthew Effects" through which high-achieving students continue to learn at higher rates than their lower-achieving peers.[7] Second, convergence in test scores might occur if low-achieving students "catch up" by learning at relatively faster rates. We empirically investigate which, if either, of these scenarios occur in the next section. Finally, to examine whether the determinants of summer learning rates (e.g., household characteristics, summer activities) vary by exceptionality status, we will estimate equation (3) separately mainstream and exceptional students.

Results

Exceptional Students' Summer Learning

Table 5 presents estimates of both gain-score and lag-score variants of equation (3) that allow the effect of summer learning to vary by students' exceptionality status. Columns 1-4 do so for math achievement. The gain-score model estimated in column 1 restricts the difference in summer learning between exceptional and mainstream students to be homogeneous among all exceptional students, regardless of the reason for their classification. The point estimate of the interaction term is positive and fairly large in magnitude, suggesting that exceptional students experienced higher rates of summer learning than their mainstream peers, but is imprecisely estimated. The specification estimated in column (2) allows for ELL and IEP students to experience different summer learning rates, and once again these interaction terms are positive but statistically indistinguishable from zero. Qualitatively similar patterns are observed in the estimates of analogous lag-score models presented in columns (3) and (4). In sum, columns 1-4 of table 5 provide no evidence that exceptional students' summer math learning rates are different from those of their mainstream peers.

Columns 5-8 of table 5 report corresponding estimates for summer reading gains. The gain-score estimates in column (5) show that exceptional students experience larger summer reading gains than their mainstream counterparts, and that this difference is statistically significant at the 5% confidence level. Moreover, this difference is relatively large, as an additional ten days of summer vacation would translate to a gain equal to 15% of a test score SD. Column (6) allows summer learning rates to vary by the type of exceptionality, and these estimates show that the higher rate of exceptional student summer learning documented in column (5) was almost entirely driven by the summer reading gains made by IEP students. Indeed, the summer learning premium for IEP students reported in column (6) is nearly twice as large as the average premium for all exceptional students estimated in column (5) and is statistically significant at the 1% confidence level. Once again, analogous lag-score estimates reported in columns (7) and (8) paint a similar picture: exceptional students make reading achievement gains relative to their mainstream peers during the summer vacation, and those gains are almost entirely driven by IEP students' summer learning. One possible explanation of this perhaps counterintuitive result is that, as shown in table 3, IEP students enroll in summer school at higher rates than both their ELL and mainstream peers. We further investigate this and other potential explanations in the next section.

Heterogeneity in the Determinants of Exceptional Students' Summer Learning

Table 6 reports estimates of the specification shown in equation (3) for reading achievement separately by students' exceptionality status.[8] The vector *X* in these specifications includes key student characteristics and summer activity indicators, which are allowed to affect exceptional and mainstream students' summer learning rates differently. Both gain-score and lag-score models are reported for reading achievement, as reading is the only subject in which differences between exceptional and mainstream students' summer learning rates were observed in table 5.[9] The first thing to note in table 6 is that for both gain-score and lag-score specifications, the estimated summer learning rate of exceptional students is about 0.02 SD larger than that of mainstream students. This magnitude is consistent with the exceptional student interaction terms reported in columns (5) and (7) of table 5 and confirms that these differences are robust to allowing summer learning rates to simultaneously vary with students' exceptionality status, SES, and participation in summer activities.

Otherwise, a scan of table 6 finds that poverty is the only observable student characteristic by which there are large, consistently statistically significant differences in exceptional students' summer learning rates. This "poverty penalty" in exceptional students' summer learning is more than twice as large as the overall premium experienced by exceptional students during the summer vacation, and suggests that the results discussed above and in table 5 were driven by non-poor exceptional students. Particularly interesting with regards to the general literature on summer learning loss, however, is that there are no statistically significant differences by poverty status in mainstream students' reading summer learning rates. That low-income students experience significantly lower summer reading gains than their more advantaged counterparts is generally considered to be on the most robust, consistent findings in the summer learning loss literature (Burkam et al. 2004; Cooper et al. 1996; Downey et al. 2004). The results presented in table 6 suggest that the disproportionate summer learning loss experienced by low-income students is almost entirely driven by low-income exceptional students—an important caveat that has not be recognized in the extant literature—and leads to dramatically different policy implications. Moreover, that this result holds in both the gain-score and lag-score models suggests that this is true across the achievement distribution.

Conclusion

This study contributes to the broad literature on summer learning loss by examining the summer activities and summer learning of exceptional student learners who either have an IEP or who speak a language other than English at home. The extant summer learning literature has yet to consider how exceptional students fare during the summer vacation, despite the presence of achievement gaps between exceptional and mainstream learners and the fact that exceptional learners are significantly more likely to be from low-income or racial/ethnic minority backgrounds. We contribute to this gap in the literature using nationally representative survey data from the 1999 Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K).

Our analysis yields four main results. First, there exist significant differences between how exceptional and mainstream students spend their summer vacations: exceptional students are significantly less likely to participate in organized summer activities and summer daycare programs, but are more likely to attend summer school or practice math with a parent, than their mainstream counterparts. Second, we find that exceptional students experience significantly higher summer learning rates in reading than their mainstream counterparts. Interestingly, this difference is primarily driven by the summer learning of students who have an IEP. Third, reading summer learning rates of exceptional students in low-income households are significantly lower than those of non-poor exceptional students. Finally, we find no evidence of heterogeneity in reading summer learning rates by poverty status among mainstream students. Importantly, this result suggests that the lower rates of summer learning among low-income students documented in the extant summer learning loss literature are primarily attributable to low-income exceptional students, a caveat that this literature has not yet acknowledged.

These findings raise several issues that merit further inquiry and have implications for education policy. Regarding the former, it is unclear why, and through what mechanisms, exceptional students experience higher rates of summer learning in reading. The results presented in table 6 find no evidence that any of the summer activities recorded in the ECLS-K are associated with higher rates of summer learning, though this may be due to the relatively crude nature of many of the ECLS-K's summer activity survey instruments. Future research utilizing data with richer descriptions of the types and quality of students' summer activities, as well as the selection mechanisms through which students engage in such activities, would contribute greatly to our understanding of exceptional students' summer learning. Similarly, because the finding that the "poverty penalty" in summer reading gains in the ECLS-K is almost entirely due to the summer learning rates of low-income exceptional learners adds an important caveat to a long-standing, accepted result in the summer learning loss literature, it is important that future research investigates the robustness of this finding in other contexts and datasets.

That low-income exceptional learners experience significantly lower summer learning rates in reading than either mainstream students or more-advantaged exceptional students highlights the potential for well designed, well implemented, targeted summer programs. For example, multisite randomized control trials of the K-3 Plus program in New Mexico find significant impacts on ELL and bilingual students' reading gains during the summer vacation in high-poverty schools (Cann et al. 2015). As evidence on the efficacy of similar programs mounts, these targeted programs have the potential to improve the educational outcomes of exceptional learners who face the compounding challenge of economic disadvantage.

Notes

[1] Source: Authors' calculations of the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K). The IEP requires teachers, parents, administrators, and related personnel to work together to put together a plan to improve educational results for a public school student who receives special education services. See the U.S. Department of Education website for more information, http://www2.ed.gov/parents/needs/speced/iepguide/index.html#introduction.

[2] Source: Authors' calculations of the ECLS-K: 2011.

[3] Heterogeneous summer learning rates have been referred to as summer learning loss, summer setback, and summer slide.

[4] Authors (2015) consider higher-order polynomials and conduct RESET specification tests, which confirm that the RHS of equation (2) is approximately linear.

[5] Interacting X with the other terms in equation (2) does not appreciably change the estimates of the parameters of interest (the estimated coefficients on vacation length and its interactions).

[6] For example, if $y^D - y^A = \beta y^A$ and $y^D = \alpha y^A$, then $\alpha = \beta + 1$. Quinn (2014) notes that in the context of summer learning, gain-score and lag-score specifications are typically not equivalent, as the former estimates "unconditional" summer learning rates, while the latter estimates summer learning rates conditional on achievement in the previous spring.

[7] The “Matthew effect” occurs when early gains in reading skills lead to future gains in reading skills and gains in other subjects (Stanovich 1986).

[8] Unfortunately, with only 100 exceptional students in the analytic sample, we are unable to estimate these models separately by IEP and ELL status.

[9] More generally, reading is the only subject in which the extant literature on summer learning loss routinely finds evidence of heterogeneity by observable student characteristics in summer learning rates (e.g., Burkam et al. 2004; Downey et al. 2004; Entwisle and Alexander 1992). Appendix Table A1 reports the same exercise for math, where once again no significant differences are observed.

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Table 1: Achievement and Academic Calendar Descriptive Statistics

	Exceptional Students		Mainstream Students	
	Mean	SD	Mean	SD
Reading Achievement				
Unadjusted summer 1 gain ($y^D - y^A$)	0.02	0.44	-0.06	0.45
Unadjusted K school-year gain	0.01	0.63	0.08	0.64
Unadjusted 1st grade school-year gain	0.07	0.57	0.08	0.58
Math Achievement				
Unadjusted summer 1 gain ($y^D - y^A$)	0.05	0.65	-0.03	0.56
Unadjusted K school-year gain	-0.07	0.64	0.07	0.66
Unadjusted 1st grade school-year gain	0.10	0.67	0.04	0.57
Calendar Days Between Important Dates				
Spring K test and fall 1st test ($d^D - d^A$)	149.89	21.91	151.69	20.32
End of K and start of 1st ($d^C - d^B$)	81.32	5.41	80.73	5.24
Start of 1st and fall 1st Test ($d^D - d^C$)	37.99	13.78	40.80	14.65
Spring K test and end of K ($d^B - d^A$)	30.58	15.69	30.17	14.32
Days between kindergarten tests	188.06	19.49	186.99	21.18
Days between first-grade tests	210.98	18.83	209.31	20.94
N (Students)	100		1250	
N (Schools)	50		100	

Notes: Means and standard deviations (SD) are weighted by NCES provided sampling weights to account for unequal probabilities of sample selection. *** p<0.01, ** p<0.05, and * p<0.1 indicate the statistical significance of the mean difference between exceptional and mainstream students.

Table 2: Student Descriptive Statistics

Student Characteristics	Exceptional Students	Mainstream Students
Exceptional (ELL or IEP)	100%	0.0%
Does not speak English at home	39.9%	0.0%
Individualized Education Plan (IEP)	58.9%	0.0%
Both ELL and IEP	1.2%	0.0%
White	55.5%***	76.0%
Black	2.9%***	11.6%
Hispanic	31.2%***	7.5%
Other race/ethnicity	10.3%*	4.9%
Female	38.7%**	51.9%
Poverty	20.3%**	12.2%
Kindergarten Redshirt	8.6%	6.9%
Mom did not graduate high school	14.4%**	5.9%
Mom has high school diploma	43.4%	33.6%
Mom attended some college	22.6%*	32.0%
Mom has bachelor's degree+	19.6%*	28.4%
Computer at Home	47.8%***	64.1%
Number of Books at Home	100.0	114.14
Summer Activities		
Organized Summer Activities	36.4%***	56.3%
Attended Summer School	18.6%***	7.6%
# of Trips to Library/Bookstore	6.7	6.9
Never Practice Math	9.3%***	19.5%
Sometimes Practices Math	77.4%*	70.1%
Practices Math Everyday	13.4%	10.4%
Never Reads to Child	1.2%	2.6%
Sometimes Reads to Child	52.2%	51.9%
Reads to Child Everyday	46.7%	45.5%
Attended Summer Camp	19.8%	25.2%
Attended Summer Tutoring	2.8%	2.3%
Attended Summer Daycare	3.2%***	10.8%
N Children	100	1250
N Schools	50	100

Notes: Means are weighted by NCES provided sampling weights to account for unequal probabilities of sample selection. *** $p<0.01$, ** $p<0.05$, and * $p<0.1$ indicate the statistical significance of the mean difference between exceptional and mainstream students.

Table 3: Gaps by Exceptionality in Summer Activities

Model:	Binary Logit (APE reported)					Poisson	Ordered Logit	
Activity:	Organized Activities	Summer School	Summer Camp	Tutoring	Day Care	Bookstore/ Library Trips	Practices Math w/ child	Reads to child
Coefficient	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Exceptional (No Controls)	-0.199***	0.079***	-0.058	0.005	-0.119**	-0.036	0.536**	0.073
	(0.054)	(0.024)	(0.044)	(0.015)	(0.048)	(0.150)	(0.216)	(0.229)
Exceptional (Controls)	-0.119**	0.082***	0.033	0.005	-0.112**	0.060	0.751***	0.276
	(0.047)	(0.025)	(0.044)	(0.017)	(0.054)	(0.111)	(0.222)	(0.224)
ELL (No Controls)	-0.117	0.072**	-0.074	-0.014	-0.155*	0.041	0.737**	0.138
	(0.079)	(0.036)	(0.070)	(0.024)	(0.087)	(0.231)	(0.356)	(0.314)
IEP (No Controls)	-0.236***	0.077**	-0.050	0.012	-0.099*	-0.101	0.306	-0.012
	(0.074)	(0.031)	(0.062)	(0.017)	(0.057)	(0.171)	(0.270)	(0.304)
p value (ELL = IEP)	0.25	0.91	0.82	0.36	0.58	0.61	0.29	0.73
ELL (Controls)	-0.025	0.062	0.068	-0.021	-0.150	0.249	0.809***	0.385
	(0.063)	(0.041)	(0.052)	(0.027)	(0.093)	(0.182)	(0.312)	(0.333)
IEP (Controls)	-0.158**	0.085***	0.012	0.018	-0.092	-0.065	0.602*	0.148
	(0.070)	(0.031)	(0.066)	(0.017)	(0.059)	(0.132)	(0.318)	(0.313)
p value (ELL = IEP)	0.16	0.66	0.53	0.19	0.58	0.17	0.61	0.62

Notes: N = 1,350. Standard errors are clustered at the school level. The four horizontal bars separate estimates from four distinct specifications. The first two include an aggregate binary indicator of exceptionality, with and without other student-level controls, respectively. The exceptionality indicator equals one if the student either spoke a language other than English at home (ELL) or had an Individualized Education Program (IEP). The next two specifications disaggregate the exceptional indicator into separate ELL and IEP indicators, with and without other student controls, respectively. The vector of controls includes race, poverty status, mother's educational attainment, summer activities, and school characteristics. APE = Average Partial Effect. APE for the ordered logit models described in columns 7 and 8 of this table are provided in table 4. The dependent variables in the ordered logit models are coded as follows: 1 = Never, 2 = Some days of the week, and 3 = Every day. Regressions are weighted by NCES provided sampling weights to account for unequal probabilities of sample selection. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: Ordered Logit Average Partial Effects (APE)

Frequency:	Never	Sometimes	Everyday
	(1)	(2)	(3)
A. Practices Math with Parent			
Exceptional, No Controls	-0.081**	0.030**	0.051**
	(0.032)	(0.013)	(0.021)
Exceptional, Controls	-0.110***	0.040***	0.070***
	(0.032)	(0.013)	(0.021)
ELL, No Controls	-0.112**	0.041*	0.070**
	(0.053)	(0.021)	(0.034)
IEP, No Controls	-0.046	0.017	0.029
	(0.040)	(0.015)	(0.026)
ELL, Controls	-0.119***	0.043**	0.076**
	(0.045)	(0.018)	(0.030)
IEP, Controls	-0.088*	0.032*	0.056*
	(0.046)	(0.017)	(0.030)
B. Reads with Parent			
Exceptional, No Controls	-0.002	-0.016	0.018
	(0.005)	(0.051)	(0.057)
Exceptional, Controls	-0.006	-0.058	0.065
	(0.005)	(0.047)	(0.053)
ELL, No Controls	-0.003	-0.031	0.034
	(0.008)	(0.071)	(0.078)
IEP, No Controls	0.000	0.003	-0.003
	(0.007)	(0.068)	(0.075)
ELL, Controls	-0.009	-0.081	0.090
	(0.008)	(0.070)	(0.078)
IEP, Controls	-0.003	-0.031	0.035
	(0.007)	(0.066)	(0.073)

Notes: N = 1,350. Standard errors are clustered at the school level.The APE in panels A and B of this table correspond to the ordered logit models presented and discussed in columns 7 and 8 of table 3, respectively, that model the frequency with which parents practice math with children and read with children during the summer vacation. The four horizontal bars in each panel separate estimates from four distinct specifications. The first two include an aggregate binary indicator of exceptionality, with and without other student-level controls, respectively. The exceptionality indicator equals one if the student either spoke a language other than English at home (ELL) or had an Individualized Education Program (IEP). The next two specifications disaggregate the exceptional indicator into separate ELL and IEP indicators, with and without other student controls, respectively. The vector of controls includes race, poverty status, mother's educational attainment, summer activities, and school characteristics.
*** p<0.01, ** p<0.05, * p<0.1.

Table 5: Exceptional Students' Summer Learning

	Math				Reading			
	Gain-Score		Lag-Score		Gain-Score		Lag-Score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$(d^D - d^C)$	0.007***	0.007***	0.008***	0.008***	0.004***	0.004***	0.005***	0.005***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
$(d^C - d^B)$ summer vacation	0.001	0.001	-0.001	-0.001	0.007***	0.007***	0.005**	0.005*
	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)
$(d^B - d^A)$	0.003***	0.003***	0.001	0.001	0.002**	0.002**	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Exceptional	-1.169		-0.679		-1.158*		-0.946	
	(1.185)		(0.985)		(0.598)		(0.575)	
ELL		-2.354		-1.905		-0.585		-0.539
		(1.735)		(1.469)		(0.908)		(0.938)
IEP		-0.589		-0.054		-2.147***		-1.877***
		(1.633)		(1.368)		(0.772)		(0.693)
Exceptional×$(d^C - d^B)$	0.016		0.008		0.015**		0.012*	
	(0.015)		(0.012)		(0.007)		(0.007)	
ELL×$(d^C - d^B)$		0.031		0.024		0.009		0.008
		(0.022)		(0.018)		(0.011)		(0.012)
IEP×$(d^C - d^B)$		0.008		-0.000		0.027***		0.023***
		(0.019)		(0.016)		(0.009)		(0.008)
Adjusted R^2	0.0418	0.0414	0.700	0.700	0.0420	0.0424	0.808	0.808
Tests of Equality (*p* values)								
(*ELL*) = (*IEP*)		0.40		0.32		0.22		0.29
ELL×$(d^C - d^B)$ = IEP×$(d^C - d^B)$		0.36		0.27		0.25		0.34

Notes: N = 1,350. Standard errors are clustered at the school level. All models include student-level controls: race, poverty status, mother's educational attainment, summer activities, and school characteristics. The exceptionality indicator equals one if the student either spoke a language other than English at home (ELL) or had an Individualized Education Program (IEP). All regressions are weighted by NCES sampling weights to account for unequal probabilities of sample selection. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Heterogeneity in Average Summer Reading Learning Rates in the ECLS-K

	Gain Score Model		Lag Score Model	
	Exceptional	Mainstream	Exceptional	Mainstream
	(1)	(2)	(3)	(4)
$(d^D - d^C)$	0.006*	0.004***	0.007**	0.004***
	(0.003)	(0.001)	(0.003)	(0.001)
$(d^C - d^B)$ (Summer; S)	0.045***	0.018**	0.023*	0.014**
	(0.017)	(0.007)	(0.012)	(0.007)
$(d^B - d^A)$	0.005*	0.002**	0.003	0.001
	(0.003)	(0.001)	(0.002)	(0.001)
Lag-score×S	.	.	-0.013*	-0.003
			(0.007)	(0.002)
Poverty ×S	-0.032	-0.003	-0.047**	-0.005
	(0.022)	(0.007)	(0.021)	(0.006)
Org. Summer Activity×S	-0.020	-0.006	-0.002	-0.003
	(0.022)	(0.006)	(0.020)	(0.005)
Summer school×S	-0.026	-0.011	-0.012	-0.008
	(0.021)	(0.007)	(0.011)	(0.006)
Summer library/bookstore trips×S	-0.001	-0.001*	-0.000	-0.001
	(0.001)	(0.000)	(0.001)	(0.000)
Parent reads every day×S	-0.017	-0.002	-0.017	-0.002
	(0.018)	(0.005)	(0.015)	(0.005)
Attends summer camp×S	0.017	0.002	0.005	0.004
	(0.025)	(0.005)	(0.021)	(0.005)
Attends summer tutor×S	-0.041**	0.021	-0.041	0.013
	(0.017)	(0.013)	(0.035)	(0.014)
Attends summer day care×S	0.067***	0.000	0.025	0.001
	(0.023)	(0.007)	(0.017)	(0.007)
Adjusted R^2	0.18	0.03	0.81	0.80
Joint sig. of interactions (F)	7.91***	1.02	7.14***	1.18
N	100	1,250	100	1,250

Notes: Standard errors are clustered at the school level. All models include all un-interacted student-level controls and "summer length." The exceptionality indicator equals one if the student either spoke a language other than English at home (ELL) or had an Individualized Education Program (IEP). All regressions are weighted by NCES sampling weights to account for unequal probabilities of sample selection. *** p<0.01, ** p<0.05, * p<0.1.

Table A1: Heterogeneity in Average Summer Math Learning Rates in the ECLS-K

	Gain Score Model		Lag Score Model	
	Exceptional	Mainstream	Exceptional	Mainstream
	(1)	(2)	(3)	(4)
$(d^D - d^C)$	0.014***	0.007***	0.011***	0.007***
	(0.005)	(0.002)	(0.004)	(0.001)
$(d^C - d^B)$ (Summer; S)	0.022	-0.001	0.007	-0.008
	(0.018)	(0.006)	(0.021)	(0.005)
$(d^B - d^A)$	0.003	0.003**	-0.001	0.002
	(0.004)	(0.001)	(0.004)	(0.001)
Lag-score×S	.	.	0.004	0.008*
			(0.018)	(0.004)
Poverty ×S	-0.063	-0.006	-0.083	-0.008
	(0.050)	(0.008)	(0.055)	(0.009)
Org. Summer Activity×S	-0.026	0.003	-0.014	0.003
	(0.023)	(0.006)	(0.022)	(0.005)
Summer school×S	0.011	0.004	0.028	0.014
	(0.034)	(0.009)	(0.030)	(0.008)
Summer library/bookstore trips×S	0.001	-0.000	0.001	-0.000
	(0.001)	(0.000)	(0.001)	(0.001)
Parent helps with math every day×S	-0.012	0.004	0.001	0.008
	(0.046)	(0.009)	(0.041)	(0.008)
Attends summer camp×S	-0.047**	0.002	-0.047**	0.000
	(0.022)	(0.007)	(0.020)	(0.006)
Attends summer tutor×S	-0.005	0.023	0.005	0.021
	(0.032)	(0.024)	(0.060)	(0.024)
Attends summer day care×S	0.034	0.010	0.001	0.012
	(0.034)	(0.008)	(0.030)	(0.009)
Adjusted R^2	0.10	0.03	0.59	0.69
Joint sig. of interactions (*F*)	1.89*	0.79	2.02*	1.14
N	100	1,250	100	1,250

Notes: Standard errors are clustered at the school level. All models include all un-interacted student-level controls and "summer length." The exceptionality indicator equals one if the student either spoke a language other than English at home (ELL) or had an Individualized Education Program (IEP). All regressions are weighted by NCES sampling weights to account for unequal probabilities of sample selection. *** p<0.01, ** p<0.05, * p<0.1.

Online Appendix

The Summer Learning of Exceptional Students

The tables reported in this online appendix correspond to tables 1, 5, 6, and A1 of the main text. Instead of using the standardized test scores, the models estimated in these tables use raw IRT Scale Scores.

Table B1: Scale Score Descriptive Statistics

	Exceptional Students		Mainstream Students	
	Mean	S.D.	Mean	S.D.
Reading Achievement				
Unadjusted summer 1 gain ($y^D - y^A$)	5.99	4.99	6.49	5.71
Unadjusted K school-year gain	9.33	6.46	11.10	6.23
Unadjusted 1st grade school-year gain	17.66	7.85	18.26	7.79
Math Achievement				
Unadjusted summer 1 gain ($y^D - y^A$)	5.37	5.95	5.15	5.12
Unadjusted K school-year gain	7.13	5.60	9.12	5.41
Unadjusted 1st grade school-year gain	11.60	6.22	10.79	5.42
N (Students)	100		1250	
N (Schools)	50		100	

Notes: Means and standard deviations (SD) are weighted by NCES provided sampling weights to account for unequal probabilities of sample selection. The IRT scores were scaled to have a mean of 50 and SD of 100. *** p<0.01, ** p<0.05, and * p<0.1 indicate the statistical significance of the mean difference between exceptional and mainstream students.

Table B2: Exceptional Students' Summer Learning Using Unstandardized IRT Scale Scores

	Math				Reading			
	Gain-Score		Lag-Score		Gain-Score		Lag-Score	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$(d^D - d^C)$	0.072***	0.072***	0.079***	0.078***	0.067***	0.066***	0.063***	0.063***
	(0.016)	(0.015)	(0.013)	(0.013)	(0.015)	(0.014)	(0.014)	(0.014)
$(d^C - d^B)$ summer vacation	0.005	0.004	-0.009	-0.010	0.060*	0.059	0.070**	0.069*
	(0.045)	(0.045)	(0.043)	(0.043)	(0.036)	(0.036)	(0.035)	(0.035)
$(d^B - d^A)$	0.026**	0.025**	0.013	0.012	0.007	0.006	0.014	0.013
	(0.010)	(0.010)	(0.011)	(0.011)	(0.012)	(0.012)	(0.012)	(0.012)
Exceptional	-9.882		-6.491		-11.018		-12.274	
	(10.700)		(9.422)		(7.636)		(7.461)	
ELL		-21.332		-18.219		-6.714		-6.986
		(15.728)		(14.055)		(12.917)		(12.169)
IEP		-4.222		-0.513		-22.761***		-24.343***
		(14.779)		(13.083)		(8.601)		(8.984)
Exceptional×$(d^C - d^B)$	0.128		0.076		0.135		0.154*	
	(0.131)		(0.115)		(0.092)		(0.090)	
ELL×$(d^C - d^B)$		0.276		0.230		0.095		0.101
		(0.196)		(0.173)		(0.161)		(0.152)
IEP×$(d^C - d^B)$		0.056		-0.001		0.268**		0.292***
		(0.175)		(0.154)		(0.103)		(0.107)
Adjusted R^2	0.05	0.05	0.70	0.70	0.05	0.05	0.81	0.81
Tests of Equality (*p* values)								
(*ELL*) = (*IEP*)		0.37		0.32		0.34		0.29
ELL×$(d^C - d^B)$ = IEP×$(d^C - d^B)$		0.33		0.27		0.40		0.34

Notes: N = 1,350. Standard errors are clustered at the school level. All models include student-level controls: race, poverty status, mother's educational attainment, summer activities, and school characteristics. The exceptionality indicator equals one if the student either spoke a language other than English at home (ELL) or had an Individualized Education Program (IEP). All regressions are weighted by NCES sampling weights to account for unequal probabilities of sample selection. *** p<0.01, ** p<0.05, * p<0.1.

Table B3: Heterogeneity in Average Summer Reading Learning Rates in the ECLS-K

	Gain Score Model		Lag Score Model	
	Exceptional	Mainstream	Exceptional	Mainstream
	(1)	(2)	(3)	(4)
$(d^D - d^C)$	0.086**	0.058***	0.088**	0.055***
	(0.034)	(0.014)	(0.034)	(0.014)
$(d^C - d^B)$ (Summer; S)	0.439***	0.137*	0.827***	0.316***
	(0.142)	(0.082)	(0.242)	(0.104)
$(d^B - d^A)$	0.048*	0.009	0.043	0.015
	(0.028)	(0.014)	(0.031)	(0.014)
Lag-score×S	.	.	-0.016*	-0.004
			(0.009)	(0.003)
Poverty ×S	-0.524*	-0.053	-0.610**	-0.063
	(0.264)	(0.077)	(0.272)	(0.079)
Org. Summer Activity×S	-0.141	-0.031	-0.030	-0.044
	(0.256)	(0.065)	(0.260)	(0.067)
Summer school×S	-0.106	-0.054	-0.159	-0.106
	(0.157)	(0.082)	(0.146)	(0.082)
Summer library/bookstore trips×S	-0.007	-0.006	-0.006	-0.007
	(0.009)	(0.005)	(0.009)	(0.005)
Parent reads every day×S	-0.281	-0.036	-0.219	-0.027
	(0.195)	(0.069)	(0.194)	(0.064)
Attends summer camp×S	0.099	0.045	0.067	0.053
	(0.290)	(0.063)	(0.269)	(0.061)
Attends summer tutor×S	-0.417	0.138	-0.528	0.173
	(0.327)	(0.191)	(0.453)	(0.175)
Attends summer day care×S	0.501**	0.034	0.327	0.009
	(0.226)	(0.096)	(0.227)	(0.095)
Adjusted R^2	0.17	0.04	0.81	0.80
Joint sig. of interactions (*F*)	4.64***	0.53	7.14***	1.18
N	100	1,250	100	1,250

Notes: N = 1,350. Standard errors are clustered at the school level. Standard errors are clustered at the school level. All models include all un-interacted student-level controls and "summer length." The exceptionality indicator equals one if the student either spoke a language other than English at home (ELL) or had an Individualized Education Program (IEP). All regressions are weighted by NCES sampling weights to account for unequal probabilities of sample selection. *** p<0.01, ** p<0.05, * p<0.1.

Table B4: Heterogeneity in Average Summer Math Learning Rates in the ECLS-K

	Gain Score Model		Lag Score Model	
	Exceptional	Mainstream	Exceptional	Mainstream
	(1)	(2)	(3)	(4)
$(d^D - d^C)$	0.128***	0.065***	0.109***	0.067***
	(0.044)	(0.015)	(0.040)	(0.014)
$(d^C - d^B)$ (Summer; S)	0.169	-0.024	-0.065	-0.306**
	(0.168)	(0.055)	(0.459)	(0.130)
$(d^B - d^A)$	0.016	0.024**	-0.007	0.017
	(0.037)	(0.011)	(0.038)	(0.011)
Lag-score×S	.	.	0.005	0.008*
			(0.019)	(0.004)
Poverty ×S	-0.652	-0.070	-0.798	-0.075
	(0.483)	(0.080)	(0.525)	(0.090)
Org. Summer Activity×S	-0.218	0.038	-0.134	0.028
	(0.212)	(0.054)	(0.214)	(0.050)
Summer school×S	0.144	0.053	0.270	0.129
	(0.308)	(0.080)	(0.285)	(0.080)
Summer library/bookstore trips×S	0.014	-0.002	0.014	-0.002
	(0.011)	(0.004)	(0.012)	(0.005)
Parent helps with math every day×S	-0.086	0.050	0.005	0.078
	(0.422)	(0.081)	(0.392)	(0.078)
Attends summer camp×S	-0.446**	0.017	-0.448**	0.004
	(0.196)	(0.062)	(0.190)	(0.062)
Attends summer tutor×S	-0.029	0.202	0.051	0.200
	(0.344)	(0.226)	(0.571)	(0.232)
Attends summer day care×S	0.244	0.098	0.014	0.119
	(0.300)	(0.079)	(0.282)	(0.082)
Adjusted R^2	0.10	0.04	0.59	0.69
Joint sig. of interactions (*F*)	1.92*	0.79	2.02*	1.14
N	100	1,250	100	1,250

Notes: Standard errors are clustered at the school level. All models include all un-interacted student-level controls and "summer length." The exceptionality indicator equals one if the student either spoke a language other than English at home (ELL) or had an Individualized Education Program (IEP). All regressions are weighted by NCES sampling weights to account for unequal probabilities of sample selection. *** p<0.01, ** p<0.05, * p<0.1.