The Effects of Summer Vacation on the Academic Skills of White, Black, Latino, and Asian Students

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ABSTRACT

To what extent do summer learning losses depend on ethnicity and socioeconomic status? Prior research indicates that poor students undergo larger summer reading losses than their middle-class counterparts, and all students undergo similar losses in math. To explain this finding, scholars have relied on surveys of summer activities, which show that poor children have fewer opportunities to practice reading than middle-class children. As a result, socioeconomic gaps in reading are heightened during summer vacation, suggesting that differences in family background—not differences in school quality—create achievement inequalities.

Using data from a heterogeneous sample that includes all four major ethnic groups, this study reveals one predictable finding and one surprising finding. First, as suggested by prior research, summer reading losses are sensitive to income status. Low-income Asians and Latinos, and to a lesser extent low-income Blacks, lose ground in reading. Middle-income minorities also undergo reading losses, but these losses are smaller than those for low-income students. Second, low-income Blacks and both low- and middle-income Asians enjoy summer math gains, and the gains for middle-income Asians are especially large. This finding challenges the widely accepted research finding that *all* children's math skills remain flat or decline during summer vacation. Suggested explanations for both sets of findings focus on home and community circumstances, which influence achievement during summer vacation. Researchers, policymakers, and educators should look outside of schools to understand why achievement gaps form and how to remedy them. This paper concludes with some recommendations for policy and future research.

INTRODUCTION

Literature Review and Research Questions

Since the 1970s, numerous social scientists have explored the effects of summer vacation on academic achievement. These studies suggest that students acquire academic skills more slowly in summer than during the school year, and summer learning loss hurts the reading skills of poor students more than middle-class students (Cooper et al., 1996). More recently, scholars (Alexander, 2001; Entwisle & Alexander, 1992, 1994) have shown that cumulative summer learning losses explain most of the achievement gap that exists between poor and middle-class children by the end of elementary school. These gaps emerge because children from impoverished homes and communities have few opportunities to participate in summer learning and enrichment activities (e.g., visiting the library, taking field trips, reading at home) that enhance reading development. Given these findings, summer learning loss implicates differences in family background rather than differences in school quality as a major cause of unequal learning outcomes.

Despite the consensus regarding summer reading loss and its association with socioeconomic status, the research literature also reveals two inconsistencies. First, it is unclear whether math skills decline for all students or only for disadvantaged students, whether defined by minority or poverty status. Murnane (1975) first pointed out that since most students rely primarily on formal school instruction to learn math, summer vacation hurts the math skills of all students. While Cooper et al.'s (1996) meta-analytic findings support this view, Entwisle and Alexander (1992) have shown that math skills decline more for poor students than for middle-class students during summer vacation. Second, scholars disagree about the relationship between ethnicity and summer learning loss. Whereas Cooper et al. (1996) and Entwisle and Alexander (1992, 1994) find no association between ethnicity and summer losses, Heyns (1975) and Phillips and Chin (2002) find larger summer reading and math losses for Blacks than for Whites. If summer math achievement also depends on students' background characteristics, scholars should explore some reasons why some students fall behind and others speed ahead during summer vacation. Just as surveys have revealed a number of summer activities that are associated with reading gains, similar research might uncover some ways to improve children's math skills when schools are closed.

The major purpose of this study is to describe and analyze summer learning losses in both reading and math. Furthermore, the study addresses some limitations of the earlier studies on summer learning. Since the most influential works on summer learning took place in the 1970s or early 1980s and involved mostly Black and White students in a single urban district, the findings may not apply to more multi-ethnic, suburban schools. Given surging Asian and Latino enrollments in several metropolitan school districts, a more up to date study on summer learning loss should include all four ethnic groups.

METHODS

District Demographics and Analytic Sample

Participants from this study attend Lake County Public Schools, a large, suburban district located in a fast-growing, high-immigration metropolitan region in State-A (Frey & Geverdt, 1998). According to the 2000 Census (U.S. Census Bureau, 2001), minorities make up one-third of Lake County's population, with Asians (13%), Latinos (11%), and Blacks (8.6%) contributing approximately equal shares to the minority population. Most Asians are primarily from one of four countries: Korea (27.2%), India (20.4%), Vietnam (18.3%), and China (13.5%). Latinos come from several countries in South America (18.3%), Central America (29.8%), and Mexico (11.1%). Because this diverse sample includes large numbers of Asian and Latino students as well as Blacks and Whites, it permits analyses involving the four major ethnic groups.

In creating the analytic sample, we capitalize on the spring-fall testing cycle that occurs in grade 3-4, grade 5-6, and grade 8-9. State-A administers a criterion-referenced test (CRT) in the spring and a norm-referenced test (NRT) in the fall. This testing cycle permits examination of spring-to-fall changes in reading and math achievement scores, and test scores come from three consecutive years (1998, 1999, and 2000) and three grade cohorts (grade 3-4, grade 5-6, and grade 8-9). Next, we stratify each grade cohort by socioeconomic status and ethnicity to create a total of eight groups: low-income White, Black, Latino, and Asian students, and middle-income White, Black, Latino, and Asian students. In this study, receipt of free- and reduced-price meals (FRM) serves as a crude proxy for poverty status. While more fine-grained information on parental income is preferable, receipt of FRM is widely used in education research to distinguish between low- and middle-income students (Entwisle & Alexander, 1992, 1994; Cooper et al., 1996; Karweit & Riciutti, 1997). The analytic sample excludes students who belong to several ethnic groups and disability categories, which are too small to permit statistical analyses with sufficient power.[1] Furthermore, results from these analyses lack widespread policy implications. Finally, the sample excludes students who take the fall tests under non-standardized conditions (e.g., extra time). In doing so, the goal is to make accurate comparisons about summer learning loss among students who complete the standardized tests under similar conditions.

Measures

As mentioned earlier, State-A requires local districts such as Lake County to administer two standardized tests. Students take the CRT at the end of May in grades 3, 5, and 8, and the NRT in early October in grades 4, 6, and 9. The CRT is tied to a series of grade-specific learning standards adopted by educators and policymakers in State-A. The tests are also cumulative: the grade 3 CRT assesses student mastery of kindergarten, first-, second-, and third-grade standards; the grade 5 CRT includes fourth- and fifth-grade standards; and the grade 8 CRT includes sixth-, seventh-, and eighth-grade standards. State-A attaches high-stakes consequences to performance on the CRT by using the results to determine policies governing school accreditation and high school graduation. The NRT, however, is neither a high-stakes test nor is it tied to a local or state curriculum. Despite these key differences, the content in the general reading and math CRT and NRT is quite similar. The NRT includes two sub-tests in reading

[1] The analytic sample excludes Native American, undesignated, and multiethnic students (3% of sample) and special education students, who are not classified as emotionally disturbed, learning disabled, or gifted and talented. The other special education codes represent a distinct disability status; therefore, it makes little conceptual sense to assign a single "special education" code to these categories. Some categories

(vocabulary, comprehension) and math (problem solving, procedures), and these skills are also assessed in the CRT.

The key difference between the CRT and NRT stems from the interpretation of the scores. Each CRT scale runs from 0 to 600 and 400 denotes the pass score cutoff, that is, performance at the "proficiency" level. However, the raw score needed to earn a pass score varies for each subject and grade-level CRT. Therefore, scores cannot be used to compare performance between different CRTs, since the number of correct answers that correspond to 400-point pass cutoff differs among tests.[2] Furthermore, because scaled scores on the CRT represent a non-linear transformation of the raw scores from which they are obtained, the distance between each interval on the CRT scale is unequal, with larger intervals at the upper range (e.g., 500) than the low- and middle-range (e.g, 400). For policy purposes, State-A report scores as a binary outcome (pass/fail) rather than a continuous outcome (scaled score). Unlike the CRT, each NRT reading and math test rests on a single, continuous scale that permits comparison of test scores across grades. The intervals between scale scores are equivalent: a 20-point improvement in reading scores in fourth-grade and ninth-grade represents equal achievement gains.

Descriptive Statistics for Analytic Sample

Each table throughout the remainder of this paper organizes the information in the same format and discusses in the results in the same order. With respect to format, the first column breaks down each of the four ethnic groups into low-income and middle-income students. Next, the discussion of result proceeds in two parts. The first part

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include "autistic resource," "mild retarded resource," "multiple handicapped," "traumatic brain injury," and "visually impaired partially."

[2] It should be noted that the raw score corresponding to the 400 pass score differs for each test. For example, on the CRT3 reading, at least 32 items out of 45 must be answered correctly for a student to pass.

discusses data for reading as shown in columns 2 to 4, and the second part focuses on data for math as shown in columns 5 to 7.

Table 1: Descriptive statistics for grade 3-4 cohort, reading and math (1998).

(1) Ethnicity-SES	**(2) Read**	**(3) Spring CRT**		**(4) Fall NRT**		**(5) Math**	**(6) Spring CRT**		**(7) Fall NRT**	
Low-Income (FRM)	(N)	Mean	SD	Mean	SD	(N)	Mean	SD	Mean	SD
WhiteFRM	355	401	57	628	38	354	430	76	606	37
BlackFRM	441	369	58	605	40	447	375	79	584	35
LatinoFRM	381	393	56	613	34	380	418	74	599	32
AsianFRM	249	402	54	624	33	254	449	69	617	35
Middle-Income	(N)	Mean	SD	Mean	SD	(N)	Mean	SD	Mean	SD
White	5313	447	60	658	39	5373	486	74	635	39
Black	443	401	63	626	38	453	417	77	604	35
Latino	285	411	60	631	39	289	437	80	612	37
Asian	883	437	58	645	36	879	486	71	641	37

To begin, Table 1 displays descriptive statistics in reading and math for the 1998 grade 3-4 cohort. Looking down column 1, we see stark income differences among the four ethnic groups. Among Whites, only 6% (355/5313) qualify for free- and reduced-price meals (FRM). However, 50% of Blacks (441/884), 56% of Latinos (381/666), and 20% of Asians qualify for FRM. In general, minority students, especially Latinos and Blacks, are more likely to be low-income than Whites.

Next, we move to a two-part discussion of the descriptive statistics. Columns 2 to 4 display descriptive statistics for reading. In the top panel, it is also clear that, among low-income students, the average scaled score on the spring reading test is lower for Blacks (369) and Latinos (393) than for Whites (401) and Asians (402). Given the 400-point pass cutoff on the spring CRT, neither the Black mean nor the Latino mean satisfy the minimum standard. Similarly, on the fall NRT, the average scores of low-income Blacks (605) and Latinos (613) lag behind the average score for Whites (628) and Asians

On the CRT3 math, 36 out of 50 must be answered correctly. For the CRT5 reading (28/42), CRT5 math (34/50), CRT8 reading (27/42), and CRT9 math (37/60).

(624). For middle-income students, the average score for all four groups exceeds the 400-point cutoff, with Whites posting the highest fall reading score of 447, followed by Asians (437), Latinos (411), and Blacks (401). The same pattern of achievement applies to the fall NRT reading scores.

Turning to math, we first examine the scores of low-income students, as shown in columns 5 to 7. The Asian mean on the spring and fall test is higher than the White mean, which is followed by Latinos and Blacks. The bottom right panel contains math scores for the four middle-income groups. On the spring test, the mean for Whites and Asians is equal, followed by Latinos and Blacks. On the fall test, the Asian mean (641) is slightly higher than the White mean (635).

In sum, the descriptive statistics for the grade 3-4 cohort in 1998 reveal both differences along ethnic and socioeconomic lines.[3] In reading, the mean score for Whites is higher than for Asians on both the spring and fall test, followed by Latinos and Blacks. Moreover, there are clear socioeconomic differences within each ethnic group: mean scores for middle-income students are higher than the mean for low-income students. In math, the mean for Asians is highest on both the spring and fall test. These descriptive statistics provide useful snapshots of achievement at two time points on two different tests, but they do not allow us to estimate spring-to-fall changes in achievement, because the test metric for the spring and fall test are different.

[3] Descriptive statistics for the grade 5-6 and grade 8-9 (1998 sample) are displayed in the Appendix. Because the achievement patterns are similar to those in the grade 3-4, it would not be necessary to provide another set of explanations for the grade 5-6 and grade 8-9 data.

Estimating Summer Learning Loss Using Effect Sizes

Because CRT and NRT scores rest on a different underlying scale, the results are not numerically comparable. Thus, we convert scores from both tests to a standardized scale with a mean of 0 and standard deviation of 1. Standardized scores, or z-scores, express scaled scores in standard deviation units and denote the position of each student's score relative to the mean of 0. For example, a student scoring one-fourth a standard deviation above the mean on the spring and one-fourth a standard deviation below the mean on the fall would receive a z-score of .50 on the CRT and -.50 on the NRT.

Using z-scores on the spring and fall test, we compute a standardized mean gain effect size (ES), or *d*-index (Cohen, 1998), to estimate the effect of summer vacation on fall achievement scores. The effect size indicates whether the relative position of each of the eight sub-groups increases, decreases, or remains unchanged from the spring to fall. Computation of the standardized mean gain effect size involves "subtracting the sample's average achievement score in the spring from its average score in the fall and dividing this difference by the average of the two associated standard deviations (Cooper et al., 1996, p. 250)" as shown in formula (1):

$$ES = \frac{x_{NRT} - x_{CRT}}{\frac{s_{NRT} + s_{CRT}}{2}}$$

(1)

The effect size denotes each of the eight group's fall performance on the NRT relative to spring CRT scores. Thus, a d-index of +.50 in reading for White students would suggest that the mean score for Whites in the fall is one-half a standard deviation higher than their spring average. To conduct hypothesis tests to determine whether the effect size is significantly different from 0, we also compute confidence intervals using a stringent (α=.05) and relaxed (α=.10) type I error rate, using a formula (2) provided by Lipsey and Wilson (2000, p. 114):

$$\overline{ES}_L = \overline{ES} - z_{(1-\alpha)}(SE_{\overline{ES}})$$
$$\overline{ES}_U = \overline{ES} - z_{(1-\alpha)}(SE_{\overline{ES}})$$

(2)

Computation of the lower and upper bound estimates of the confidence interval depends on the mean effect size estimate, the z-critical value (95% confidence interval = 1.96; 90% confidence interval = 1.65), and the standard error. Becker (1988, p. 263) has developed a procedure for computing the standard error of the standardized mean gain effect size (SE_{sg}) based on formula (3):

$$SEsg = \sqrt{\frac{2(1-r)}{n} + \frac{ES^2}{2n}}$$

(3)

where, for each of the eight groups, *r* is the correlation between the spring and fall scores, *n* is the sample size, and *ES* is the mean effect size. Appendix 2 displays correlations between the spring and fall scores for each of the eight groups by age cohort and by year. In sum, we use three algebraic equations to compute the effect size estimates and the 95% and 90% confidence intervals around the point estimates.

Interpreting the Magnitude of the Effect Size

To aid in interpreting the magnitude of summer learning losses and gains, the reader should consider some qualitative descriptions of effect sizes and place the results in a broader, research context. Cohen (1988) has suggested that effect sizes of .20, .50, and .80 correspond to "small," "medium," and "large" effects. Small effect sizes, like the mean difference in heights between 15- and 16-year old years, are barely noticeable to the naked eye. Large effect sizes, like the mean difference in heights between 13- and 18-year olds, are easy to detect. In addition to Cohen's widely used standards, results from previous meta-analyses and research syntheses should inform whether effects are "small," "average," or "large." Based on Cooper et al.'s (1996) meta-analysis, we know that, on average, summer learning loss equals about one-tenth of a standard deviation relative to spring scores. Moreover, summer reading losses are two to three times greater for low-income students than middle-income students. Cooper et al. point out that "on average, summer vacations created a gap of about 3 months between middle- and lower-class students (pp. 261-262)." Although an effect size of .10 or .20 is "small" by Cohen's standards, these "small" effects are, in fact, the average in the research literature on summer learning loss.

The next section presents effect size estimates of summer learning by grade cohorts. It focuses on the magnitude of a loss or gain in reading and math, its statistical significance, and its consistency across years. A finding that merits discussion should satisfy all three criteria. First, estimates of losses or gains should be approximately one-tenth of a standard deviation, which is a real-world estimate of the average learning loss based on Cooper et al.'s meta-analysis. Second, effect sizes should be statistically different from zero, but still near .10, since large samples are likely to produce significant effects even if the loss or gain is tiny. Third, robust findings should produce consistent results for more than one year, since a significant loss or gain in a single summer may be idiosyncratic to a particular cohort. By focusing on results that meet all three criteria, the upcoming discussion highlights essential findings and ignores those that are inconsistent and trivial.

RESULTS

Because of the large number of effect size estimates, the results are broken down for grade 3-4, grade 5-6, and grade 8-9 in three separate tables. Each table displays estimates of summer learning loss for a single grade cohort for three consecutive years. Table 2 displays effect sizes in reading and math for the grade 3-4 cohort in 1998, 1999, and 2000, Table 3 displays results for the grade 5-6 cohort, and Table 4 displays results for the grade 8-9 cohort.

Table 2: Grade 3-4 results for reading and math (ethnicity-FRM status)

(1) Ethnicity-SES	(2) 1998 Read	(3) 1999 Read	(4) 2000 Read	(5) 1998 Math	(6) 1999 Math	(7) 2000 Math
Low-Income (FRM)						
WhiteFRM	0.03	-0.01	0.01	-0.04	-0.01	-0.01
BlackFRM	-0.02	-.10*	0.00	.11*	.13*	.14*
LatinoFRM	-.22*	-.18*	-.14*	-.07~	0.06	0.02
AsianFRM	-.11*	-.20*	-.15*	0.01	.11*	.19*
Middle-Income						
White	.04*	.05*	.04*	-.03*	-.05*	-.07*
Black	-0.01	-0.04	-0.01	.08*	0.01	.11*
Latino	-0.05	-0.08	-0.02	0.01	-0.06	0.03
Asian	-.12*	-0.11	-.11*	.12*	.24*	.19*

*p<.05, ~p<.10

Results for grade 3-4 cohorts (Table 2)

Reading

Among low-income students, Latinos and Asians suffer significant reading losses for three consecutive years. In 1998, fall reading scores for Latinos are approximately one-fifth of a standard deviation lower than spring scores; in 1999 and 2000, the losses are somewhat smaller. For Asians, the reading losses range from a low of d = -.11 and d = -.20. The bottom panel displays results for middle-income students. Spring-to-fall changes in reading are quite small for most groups. The effect size reaches statistical significance for Whites because the sample size for this group is over 5,000. Note, however, that the effect size for White, Black, and Latinos are quite small (less than one-tenth). Only the reading losses for middle-income Asians are consistent for three years. In comparing the reading effect sizes of the middle-income and low-income students, we find clear evidence of the differential effects of summer vacation on reading. Low-income minorities suffer losses that are generally larger and more consistent than those for middle-income students.

Math

The math results are shown in columns 5 to 7, starting with low-income students. Blacks register gains for three consecutive years, suggesting that fall scores are about one-tenth of a standard deviation higher than spring scores. Asians also register gains above in 1999 and 2000. For middle-income students, one clear and consistent finding stands out: the math skills of Asians improve over summer break. The largest effect size of d = .24 in 1999 suggests that middle-income Asian's math skills are one-fourth of a standard deviation higher relative to the spring score. Whites register significant losses in three years but the magnitude of the change is small and largely explained by the huge sample size. Latinos show no change for three consecutive years and results are somewhat mixed for Blacks, who show small gains in 1998 and 2000 and no gain in 1999.

In sum, Table 2 reveals two key findings. First, low-income Latino and Asian students suffer reading losses that fall in line with the estimates from Cooper's meta-analysis. Since large numbers of limited English proficiency speakers in Lake County are Latino and Asian, it appears that a combination of poverty, minority status, and weak English skills may be associated with summer reading losses. Second, while the research literature suggests that math skills stagnate or decline for most children, this is not true for low-income Blacks and middle-income Asians. Both groups show consistent gains for three years, suggesting that supplemental activities including summer school and enrichment programs may enhance children's math skills. Whether these findings apply to older elementary school aged children is the focus of the next set of results.

Table 3: Grade 5-6 results for reading and math (ethnicity-FRM status).

(1) Ethnicity-SES	(2) 1998 Read	(3) 1999 Read	(4) 2000 Read	(5) 1998 Math	(6) 1999 Math	(7) 2000 Math
Low-Income (FRM)						
WhiteFRM	-0.05	-0.02	-0.04	0.00	-0.04	0.04
BlackFRM	0.02	-.10*	-0.03	-.09*	-0.02	0.05
LatinoFRM	-0.01	-.15*	-0.01	-.13*	-0.01	0.00
AsianFRM	-0.02	-.13*	0.00	.11*	0.06	0.00
Middle-Income						
White	0.01	.05*	-0.01	0.00	-.02~	-.03*
Black	-0.01	0.01	0.04	-.06~	0.03	0.05
Latino	0.00	-.10~	.09*	0.03	0.00	0.01
Asian	0.00	-.14*	.04*	.06*	.08*	.12*

*p<.05, ~p<.10

Results for grade 5-6 cohorts (Table 3)

Reading

Table 3 reveals some evidence of summer reading losses in the grade 5-6 cohort, but the results are inconsistent across years and less robust than those for the grade 3-4 cohort. We begin with the reading results for low-income students. The results are most consistent for Whites, whose reading scores undergo no change from the spring to fall. Similarly, non-White students generally experience no significant changes during summer break. However, in 1999, reading scores for Blacks, Latinos, and Asians are about one-tenth of a standard deviation lower in the fall relative to the spring. Since these losses are not seen in the 1998 and 2000 cohorts, they may be idiosyncratic to the 1999 cohort. The results are equally inconsistent among middle-income students. In reading, all four groups undergo no change, gains, and losses, depending on the year. None of the effect sizes have the same sign for three consecutive years.

Math

For most low-income students, summer vacation does not have a consistent effect on math scores, as shown in columns 5 to 7. Among low-income student in 1998, Blacks and Latinos register significant declines whereas Asians register gains. As with the 1999 reading results, however, the results for the 1998 math cohorts appear idiosyncratic to a single year. Math results are somewhat more consistent for middle-income students. From 1998 to 2000, Latinos show no change whereas Asians register gains. The grade 5-6 cohort results replicate only one finding from the earlier grade 3-4 cohort results: in both age cohorts, middle-income Asians show consistent math gains for three consecutive years. This finding challenges the widespread finding that math skills generally remain flat or decline for most students.

Table 4: Grade 8-9 results for reading and math (ethnicity-FRM status).

(1) Ethnicity-SES	(2) 1998 Read	(3) 1999 Read	(4) 2000 Read	(5) 1998 Math	(6) 1999 Math	(7) 2000 Math
Low-Income (FRM)						
WhiteFRM	0.04	-0.02	.12*	-0.03	-0.02	0.00
BlackFRM	0.02	-0.06	0.03	.07~	.10*	.14*
LatinoFRM	-.08~	-.15*	-0.06	-0.03	-0.03	0.00
AsianFRM	-.22*	-.23*	-.11*	.09*	-0.06	0.01
Middle-Income						
White	.03*	.05*	.02*	0.00	0.00	-0.02
Black	-0.03	-0.04	0.03	-0.05	-0.02	.05*
Latino	-0.04	-0.04	-0.05	-0.05	-.13*	0.00
Asian	-.10*	-.13*	-.07*	0.01	.05*	.05*

*p<.05, ~p<.10

Results for grade 8-9 cohorts (Table 4)

Reading

There are several similarities between the results for the grade 8-9 cohort and the grade 3-4 cohort. The top left panel displays reading results for low-income students. It shows that Latinos and Asians undergo consistent reading losses, with Asians showing somewhat larger declines. Among middle-income students, Asians undergo consistent reading losses. Latinos also undergo small losses for three consecutive years, but they do not reach significance. Whites, on the other hand, show small reading gains, which reach significance because of the large sample involved in the analysis.

Math

Moving to the top right panel, we see that math scores remain flat for most groups, with the exception of low-income Blacks, who register math gains for three consecutive years. Middle-income Asians show somewhat small gains in 1999 and 2000, but results for the other groups are mixed and inconclusive.

Summary of Key Findings

In sum, the results revealed one predictable finding and one unexpected finding. First, summer reading losses are sensitive to ethnicity and socioeconomic status. Low-income Asians and Latinos, and to a lesser extent low-income Blacks, lose ground in reading. Middle-income minorities also undergo reading losses, but these losses are smaller than those for low-income students. Second, low-income Blacks and both low- and middle-income Asians registered summer math gains, although the cumulative gains are especially large for middle-income Asians. These findings challenge the notion that math skills remain flat or decline during the school year. However, it is difficult to determine why these gains emerge. Some students may be attending summer school.

Others may be participating in enrichment activities that enhance quantitative skills. The next section provides some tentative explanations.

CONCLUSION

Discussion of Main Results

Although scholars have conducted numerous studies on summer learning loss, none includes all four major ethnic groups. This study addresses this research need by collecting spring and fall test scores for White, Black, Latino, and Asian students in three consecutive years. The findings for reading support prior research whereas the findings for math are somewhat surprising. Scholars (Entwisle & Alexander, 1994; Cooper et al., 1996) typically find that low-income students fall behind in reading compared to their middle-class counterparts. We find this to be true for low-income Latinos and Asians, who consistently lost ground in reading compared to Blacks and Whites. Why? In Lake County, since Latino and Asian students make up a large proportion of the English as a Second Language enrollment, they have weaker English skills than native born students. Moreover, English is usually not the language spoken at home. Thus, the absence of formal English language instruction during summer vacation may result in the deterioration of vocabulary knowledge and reading comprehension among low-income Latino and Asian children, whose parents may lack the skills and resources to improve their children's language skills.

Prior research also predicts that math skills remain flat or stagnate during summer recess, since most students depend primarily on formal school instruction to learn math. In our study, however, summer vacation consistently helps the math achievement of middle-income Asian students, whose parents have the resources to support summer enrichment activities that enhance math achievement. In Lake County, descriptive statistics in Table 1 clearly shows that Asian children typically outperform Whites in math, and these middle-class parents provide strong financial and cultural support for non-formal educational and enrichment activities that enhance learning during summer vacation (College Board, 1999). Although this study did not collection information on the activities of Asian families outside school, researchers find that Asian parents are more likely to enroll their children in art, music, ethnic studies, and computer classes (Schneider & Lee, 1990). These enrichment activities require frequent practice and may improve children's retention of math computation skills (Cooper, G. & Seller, 1987).

Implications for Research and Policy

Additional qualitative research should help to illuminate the presumed causal mechanisms that promote or impede cognitive growth when schools are closed. An ethnographic study might also be able to address questions such as: do middle-class students maintain their achievement advantage by participating in enrichment activities, special summer camps, music lessons, or trips to the zoo (Entwisle, Alexander, & Olson, 1997, p. 59)? Moreover, given the strong math performance of Asians after summer vacation, researchers might ask: What kinds of learning activities benefit Asian students' math performance when schools are closed? (add Massey survey)

The study findings should also encourage educators and policymakers to consider a variety of policies that might improve the learning of all school children, especially those at-risk of falling further behind. If the goal is to help low-income children, a focus on reading seems justified. However, although remedial summer programs boost short-term reading scores for disadvantaged students, they seem unable to produce long-term gains (Grossman & Sipe, 1992). Thus, instead of relying on summer school to prevent learning losses, several scholars encourage policymakers to extend the school year

(Barrett, 1990; Heyns, 2001), especially since additional school days are consistently associated with higher achievement (D'Agostino, Borman, Hedges, & Wong, 1998). Frazier (1998) also finds that quantitative changes in the school year lead to qualitative improvements in teaching and learning, since longer a academic year encourages teachers to plan and institute more thorough, rigorous lessons. Summer programs, however, fail to extend and reinforce the school year curriculum, leading to an ineffective instructional program and small, short-term achievement gains (Karweit, 1994).

A major limitation of this study relates to the calculation of the effect size, which may actually *understate* the summer learning loss for two reasons. First, the spring CRTs are administered at the end of May, and the fall NRTs are given in early October. Thus, the spring score does not capture learning that occurs in June, and the fall score includes at least four weeks of additional instruction during September. The greater amount of instructional time between the spring-to-fall interval tends to mitigate the negative effect of summer break (Cooper, 1996, p. 259). If, however, tests were given on the last day of the old school year and the first day of the new school year, the effect size would more accurately measure the summer learning gain or loss. Most likely, the effect would be dramatically more negative for low-income children (Klibanoff & Haggart, 1981, p. 6). Second, Lake County's summer school enrollments have increased steadily since 1998, preventing learning losses among students included in this study. In the absence of these summer programs, summer learning losses would almost certainly be larger than those obtained from this study. Future research should look at both efforts by families and communities as well as public schools in improving children's academic achievement during summer vacation.

APPENDIX 1: Descriptive statistics for reading and math, 1998 and 199.

A1: Descriptive statistics for grade 5-6 cohort, reading and math (1998).

Ethnicity-SES	Read	Spring CRT		Fall NRT		Math	Spring CRT		Fall NRT	
Low-Income (FRM)	(N)	Mean	SD	Mean	SD	(N)	Mean	SD	Mean	SD
WhiteFRM	347	422	51	670	33	343	400	50	666	40
BlackFRM	378	386	50	648	34	379	371	49	641	35
LatinoFRM	375	400	48	656	31	371	387	45	652	33
AsianFRM	279	415	45	666	33	283	401	51	675	39
Middle-Income	(N)	Mean	SD	Mean	SD	(N)	Mean	SD	Mean	SD
White	5474	456	50	696	35	5456	438	54	693	39
Black	499	413	49	665	35	497	393	52	658	35
Latino	271	433	52	679	34	270	411	47	675	37
Asian	871	446	49	689	34	876	443	57	699	40

A2: Descriptive statistics for grade 8-9 cohort, reading and math (1998).

Ethnicity-SES	Read	Spring CRT		Fall NRT		Math	Spring CRT		Fall NRT	
Low-Income (FRM)	(N)	Mean	SD	Mean	SD	(N)	Mean	SD	Mean	SD
WhiteFRM	246	418	67	701	36	234	421	55	690	35
BlackFRM	318	387	56	683	31	307	389	42	670	29
LatinoFRM	311	396	52	684	32	304	403	47	677	31
AsianFRM	270	423	55	696	28	271	430	50	702	37
Middle-Income	(N)	Mean	SD	Mean	SD	(N)	Mean	SD	Mean	SD
White	5441	465	59	726	32	5333	463	55	722	41
Black	548	427	60	703	33	537	418	49	687	34
Latino	268	436	63	708	36	263	434	57	699	40
Asian	908	460	58	719	33	888	470	58	727	41

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