Longitudinal Impact of Virginia Public Libraries' Summer Reading Program on Student Reading Outcomes

Library of Virginia Year 3 Report

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Glossary of Statistical Terms

Analysis of variance – A statistical technique used to determine whether there are any significant differences between the means of three or more groups.

Correlation coefficient (□) – A coefficient that illustrates a quantitative measure of some type of correlation and dependence; in other words, statistical relationships between two or more random variables or observed data values.

Covariate – A variable that is controlled in a study such as gender, minority status, limited English proficiency, and pretest scores so that the outcomes (e.g., posttest scores) may be examined.

Effect size – Measure of the strength of a relationship and most often referred to as a measure of practical significance. It is calculated by taking the difference between the means of the participant and comparison groups and dividing that difference by the standard deviation of the comparison group's scores or by the standard deviation of the aggregated scores of both groups.

Intra-class correlation coefficient (ICC) – A descriptive statistic that is used to describe how strongly units in the same group resemble each other. For this study, it describes how similar students from the same library systems were in terms of their English/Reading Standards of Learning scale scores.

Latent growth curve modeling – A statistic to estimate growth over a period of time. It is widely used in the field of behavioral sciences, education and social sciences and is also referred to as *latent growth curve analysis*. Simply put, latent growth models represent repeated measures of dependent variables as a function of time and other measures.

Linear growth model – A statistical technique for longitudinal analyses used to estimate individual growth trajectories (i.e., increase or decrease) over a period of time.

Mixed linear modeling – A statistical technique used when data are found in nested categories or levels. For this study, level 1 was the English/Reading Standards of Learning scale scores and level 2 was the students. The individual student outcomes (i.e., English/Reading Standards of Learning scale scores) were measured three times; hence, individual outcomes were nested within individual students.

N – The upper case *N* refers to the number of subjects or cases in a study or the number of individuals in a population.

n – The lower case *n* refers the number in a sample (as contrasted with the number in a population) or the number of cases in a subgroup.

Mean (*M*) – The arithmetic average which is calculated by adding the values for each case and dividing by the total number of cases.

***p* value** – This term refers to the probability value or, in other words, the probability that a statistic could occur by chance or sampling error if the null hypothesis (i.e., no difference) is true.

Propensity score matching – A method used to identify a group of comparisons and ensure baseline equivalence on the observable variables that are known to be associated with the main outcomes of interest (i.e., reading achievement).

Maximum likelihood method – A statistical approach for estimating the population parameters most likely to have resulted in observed data. The restricted maximum likelihood method is an approach that, in general, produces less biased estimates (e.g., systematic errors) than the maximum likelihood method.

Statistical significance – A finding is said to have statistical significance when the value or measure of a value is significantly larger or smaller than would be expected by chance alone.

Standard deviation (*SD*) – This is a descriptive measure of variability or spread of scores around the mean. The wider the scores are spread, the larger the standard deviation. The standard deviation is calculated by taking the square root of the variance.

Standard error of the mean (*SE*) – This statistic indicates how great the mean score of a single sample is likely to be different from the mean score of the population. It is the standard deviation of a sample distribution of the mean. The standard error of the mean shows how much the sample mean differs from the expected value.

Student's *t* distribution (*t*) – A test for statistical significance that uses tables of a statistical distribution called Student's *t* distribution. It is referred to as Student's *t* as the author of the article that made this distribution well known used the pen name "Student." In articles and reports, it is often referred to as simply "*t*."

***t*-test** – A test of statistical significance which shows the differences between two group means.

References:

Bollen, K. A., & Curran, P. J. (2006). *Latent curve models: A structural equation perspective.* Hoboken, NJ: Wiley-Interscience.

Stuart, E. A., & Rubin, D. B. (2007). Best Practices in Quasi-Experimental Designs: Matching methods for causal inference. In J. Osborne (Ed.), *Best Practices in Quantitative Social Science* (Vol. 11, pp. 155-176). Thousand Oaks, CA: Sage.

Vogt, W. P. (1999). *Dictionary of statistics and methodology* (2nd ed.). Thousand Oaks, CA: Sage.

Executive Summary

McREL International was contracted by the Library of Virginia in April 2013 to study the impact of the 2013 Summer Reading Program offered by Virginia public libraries to children and teens and, to a lesser extent, young children (i.e., preschool age and below) who participate. The study provides crucial information for public library systems in Virginia to help them understand the impact of summer reading programs on their school-age patrons and to provide insights for improving future programming.

To examine the 2013 Summer Reading Program's impact on student achievement outcomes, McREL researchers conducted a quasi-experimental study. The overall findings suggest that students who attended the 2013 Summer Reading Program performed better academically and experienced greater gains in their academic performance than their nonparticipating peers. With these encouraging findings, the main purpose of this longitudinal impact study was to expand upon the previous study conducted in 2014 to investigate if the effects of the 2013 Summer Reading Program endured two years after program participation.

The overarching research question was: *What is the long-term impact of participation in the summer reading program on children's and teens' reading outcomes?* The subquestions were:

1. Does the summer reading program's impact on reading outcomes endure more than one year following participation?
2. How many children participate in the summer reading program for more than one year, and what are the characteristics of these repeat participants?
3. How do the reading outcomes and growth patterns of repeat participants differ from nonparticipants and from those participating during a single summer?

To answer these questions, McREL researchers documented the reading trajectory for participants and examined the extent to which the trajectories differed between participants and nonparticipants (i.e., comparisons). Additionally, because the Library of Virginia's Summer Reading Program is provided in local libraries annually, some participants and comparisons of the 2013 Summer Reading Program became participants in 2014. Without parsing the effect of group membership, the longitudinal effect of the 2013 Summer Reading Program on children's learning trajectories may be under- or over-estimated. Hence, the second and third research questions were designed to gain an understanding of how these repeat participants differed from the other two groups (i.e., single summer reading program participants and nonparticipants) in terms of their demographic characteristics and achievement scores, as well as to what extent their learning trajectories differed from the other two groups.

Key Findings

Researchers conducted mixed linear modeling to examine the long-term effects of the 2013 Summer Reading Program on student achievement outcomes over time, including the

English/Reading Standards of Learning scale scores measured before participation in the summer reading program (i.e., spring 2013), one year after program participation (i.e., spring 2014), and two years after program participation (i.e., spring 2015). Findings suggest that participation in the 2013 Summer Reading Program continued to prevent summer reading loss two years later. This is encouraging as this study involved a rigorous research design (i.e., quasi-experimental design with matched comparisons) with a large-scale group of 4,199 fourth, fifth, and sixth grade students across 46 public library systems in the Commonwealth of Virginia. Specifically, 2,115 students were 2013 Summer Reading Program participants from 38 public library systems, and 2,084 students were comparisons who were not involved in the 2013 Summer Reading Program across 46 public library systems. Key findings for each research question are summarized as follows.

Research Question 1: Does the summer reading program's impact on reading outcomes endure more than one year following participation?

Participants in the 2013 Summer Reading Program performed better academically two years after program participation as compared to nonparticipants (i.e., comparisons). Further examination of individual achievement trajectories over time (i.e., before summer reading program participation and two years after program participation) revealed that the 2013 Summer Reading Program participants, on average, seemed to maintain the same achievement level over time, while nonparticipants had a significant decrease in their English/Reading Standards of Learning scale scores over time. This finding is consistent with research that suggests, while children tend to demonstrate reading loss during the summer months, student participation in summer reading programs seems to mitigate the loss as they provide students with access to reading materials and activities that encourage reading (Mraz & Rasinski, 2007). Findings of this study suggests that such an effect seemed to be retained two years after participation in the summer reading program.

Research Question 2: How many children participate in the summer reading program for more than one year, and what are the characteristics of these repeat participants?

As mentioned previously, a total of 4,199 students who were entering fourth, fifth, and sixth grades after the summer of 2013 were included in this study. Of those, 2,115 participated in the 2013 Summer Reading Program, and 2,084 were comparison students (i.e., nonparticipants) who were identified through propensity score matching conducted in 2014. Some of these participants and comparisons also participated in the 2014 Summer Reading Program, which resulted in four distinct groups:

1. 2013 participants who did not participate in the 2014 Summer Reading Program (P1; n = 1,375);
2. 2013 participants who also participated in the 2014 Summer Reading Program (P1+; n = 740);
3. comparisons who did not participate in either the 2013 or 2014 Summer Reading Programs (C1; n = 1982); and
4. comparisons who participated in the 2014 Summer Reading Program (C1+; n = 102).

Overall, all four groups were very similar in their characteristics, such as grade level, gender, race, and economically disadvantaged status, with some exceptions. Key differences are summarized as follows:

- P1 and P1+ had higher percentages of sixth graders but lower percentages of fifth graders as compared to C1 and C1+.
- C1+ had a lower percentage of male students as compared to the P1, P1+, and C1 student groups.
- P1+ and C1+ had higher percentages of nonminority students as compared to P1 and C1.
- P1+ had a higher percentage of Asian students as compared to P1, C1, and C1+.
- P1+ and C1+ had lower percentages of students with economically disadvantaged status as compared to P1 and C1.
- Students from the different groups performed differently on the English/Reading Standards of Learning scale scores over time. In general, P1+ and C1+ students demonstrated higher achievement scores as compared to P1 and C1 students in most cases.

Research Question 3: How do the reading outcomes and growth patterns of repeat participants differ from nonparticipants and from those participating during a single summer?

Students participating in the summer reading programs for two years (i.e., P1+) had different achievement outcomes as compared to those who only participated for one year (i.e., P1 and C1+) or those who did not participate at all in a summer reading program (i.e., C1). This study revealed that both P1 and P1+ students maintained the same level of achievement outcomes from before participating in the summer reading program (i.e., baseline) to two years after program participation; while C1 and C1+ students demonstrated significant rates of decrease in their achievement scores over time. Nevertheless, after two years of participation in the 2013 and 2014 Summer Reading Programs, P1+ students had higher English/Reading Standards of Learning scores than did their P1 and C1 peers. These findings suggest that participation in summer reading programs does have a positive effect on student achievement outcomes by preventing learning loss even two years after participation.

Summary and Recommendations for Future Research

In summary, this study suggests that summer reading programs may prevent summer reading loss or even facilitate learning gains when schools are not in session. To investigate how and why summer reading programs work to support student reading outcomes, further research is warranted. For instance, what are the key elements of summer reading programs that support student achievement? Such a study may provide additional research for the field as to the evidence-based practices that best support student reading outcomes.

There are several limitations of the current study which are important to note. First, this study only included students who were entering fourth, fifth, and sixth grade after they participated in the 2013 Summer Reading Program. It is unclear if the same findings would hold for students from lower or higher grade levels. Second, researchers utilized student demographic and achievement variables that were available from the Virginia Department of Education to identify a group of matched comparisons. It is certain that the selected comparisons were similar to participants on the prescribed demographic and achievement variables. However, it is uncertain how different they were on the unobserved characteristics that may also contribute to student achievement outcomes (e.g., home environment, parental involvement, participation in other reading programs, etc.). Future studies may wish to include data on these key variables and include them in the matching process.

A final limitation is that the main criterion utilized to identify students' participation status was that as long as the student was registered to participate and read at least one book during the summer reading program period, he or she was counted as a participant. The same criterion was used for both the 2013 and 2014 Summer Reading Programs. This may partially contribute to the finding that participants, both P1 and P1+, did not demonstrate a significant rate of change (i.e., increase or decrease over time) in their English/Reading Standards of Learning scores due to variations in their levels of participation. Further research may consider more conservative criteria, such as the number of books read and time spent on reading, to understand how the different levels of participation (i.e., dosage) may mitigate the effects of summer reading programs on student outcomes.

Introduction

McREL International was contracted by the Library of Virginia in April 2013 to study the impact of the 2013 Summer Reading Program offered by Virginia public libraries to children and teens and, to a lesser extent, young children (i.e., preschool age and below) who participate. The study provides information for public library systems in Virginia to help them understand the impact of summer reading programs on their school-age patrons. Further, the study contributes to the larger collection of research literature about the impact of summer reading programs on students' academic achievement. Funding for the study is provided by the Library of Virginia through the Institute of Museum and Library Services, which serves as the primary source of federal support for the nation's 123,000 libraries and 17,500 museums.

To encourage summer reading and prevent summer reading loss, the Library of Virginia provides support and materials for the summer reading program to each of the 92 public library systems in the Commonwealth of Virginia. The summer reading program is offered for four target populations: young children (birth to age 5), children (ages 6 to 12), teens (ages 13 to 17), and adults (age 18 and older)[1]. The goals of the summer reading program are to

- encourage children and teens to continue reading during the summer with the hope that they will discover that reading can be fun and enjoyable;
- provide safe and fun activities for children and teens to enjoy while they are out of school; and
- build healthy communities by offering programs and services to develop the "40 Developmental Assets" as defined by the Search Institute (2007).

Research indicates that the summer months when children are not involved in formal education are particularly critical to students' reading achievement. For instance, Matthews (2010) reports that the difference in reading gains between low- and high-income students does not occur during the school year, but rather during the summer months. Cooper, Nye, Charlton, Lindsay, and Greathouse (1996) conducted a meta-analysis of 39 studies and indicated that the achievement loss occurring over summer break is equivalent to one month of grade-level instruction. McGill-Franzen and Allington (2004) discovered that summer reading loss during the elementary grades accumulates to an achievement gap of 18 months by the end of sixth grade, and such a lag accumulates to two or more years in reading achievement by the end of middle school. Other researchers have found that achievement gains in reading were significantly higher from fall to spring than from spring to spring when the summer months are included in analyses, indicating the presence of summer reading loss (Borman & D'Agostino, 1996). Furthermore, summer learning loss is even greater for low-achieving students and students from economically disadvantaged backgrounds, such as those whose parents did not pursue postsecondary education and those with limited access to reading materials at home (Matthews, 2010; McGill-Franzen & Allington, 2004; Mraz & Rasinski, 2007).

[1] Although adults are encouraged to participate in the summer reading programs, they were not the main population of interest for this study.

The research on summer reading loss supports the need to provide students—particularly low-achieving students from low-income families—with opportunities to engage in reading and have access to reading materials during the summer months. These findings have led stakeholders to consider alternative solutions that attempt to level the playing field for reading achievement and prevent reading loss over the summer months. The research on these alternatives indicates that summer reading programs offered by public libraries have positive impacts on students' reading skills and enthusiasm about reading (Matthews, 2010). An experimental study comparing library summer reading programs to traditional summer camps without a reading component suggests that students in summer reading programs read significantly better than students attending summer programs not focused on reading (Celano & Neuman, 2001), indicating that library time enhances students' reading achievement and skills more than recreational types of summer programs. Another study that investigated the effects of a school-based summer reading program for kindergarten and first-grade students at risk for poor reading achievement found significant results favoring summer reading programs (Luftig, 2003).

Although the literacy community strongly encourages and advocates the use of summer reading programs, more studies are needed to understand the effectiveness of the programs and the impact on children. The study commissioned by the Library of Virginia is designed to further the research in this area.

Longitudinal Impact Study Purpose and Questions

In 2014, McREL researchers conducted a quasi-experimental study to examine the immediate effect of the 2013 Summer Reading Program on student reading outcomes (Good, Ho, Muñoz-Miller, Ncube, & Turner, 2015). The overall findings suggest that students who attended the 2013 Summer Reading Program offered by Virginia's library systems performed better academically (ES = 0.15 – 0.18) and experienced greater gains (ES = 0.14 – 0.24) in their academic performance than their nonparticipating peers. With these encouraging findings, the main purpose of this longitudinal impact study was to expand upon the previous study to investigate if the effects of the 2013 Summer Reading Program endured two years after program participation.

The overarching research question was: *What is the long-term impact of participation in the summer reading program on children's and teens' reading outcomes?* The subquestions were:

1. Does the summer reading program's impact on reading outcomes endure more than one year following participation?
2. How many children participate in the summer reading program for more than one year, and what are the characteristics of these repeat participants?
3. How do the reading outcomes and growth patterns of repeat participants differ from nonparticipants and from those participating during a single summer?

To answer these questions, McREL researchers documented the reading trajectory for participants and examined the extent to which the trajectories differed between participants and nonparticipants (i.e., comparisons) (Question 1). Additionally, because the Library of Virginia's Summer Reading Program is provided in local libraries annually, it is possible that some comparison students who did not participate in 2013 Summer Reading Program became participants in 2014 (i.e., post-hoc participants). Similarly, for the 2013 Summer Reading Program participants, it is possible that a subgroup may return to the libraries and participate again in 2014 (i.e., repeat participants). Therefore, McREL researchers tracked both 2013 Summer Reading Program participants and comparison students and identified their summer reading program status for the 2014 Summer Reading Program (Question 2). Table 1 shows the four possible group memberships that might occur between 2013 and 2014. Without parsing the effect of group membership, the longitudinal effect of the 2013 Summer Reading Program on children's learning trajectories may be under- or over-estimated. As such, Question 3 was designed to address this issue.

Table 1. Group Memberships in the Longitudinal Impact Study Design

Group Membership		2014 Summer Reading Program (SRP) Participation Status	
		No	Yes
2013 SRP Participation	Yes (Participants)	**Group 1 (2013 SRP Participants)**	**Group 3 (2013 SRP Repeat Participants)**
	No (Comparisons)	**Group 2 (2013 Comparisons)**	**Group 4 (2013 Post-hoc Participants)**

Study Design and Methods

During the summer of 2013, a total of 46 public library systems (20 county, 15 city, and 11 multi-jurisdictional) including 180 buildings (60 county, 66 city, and 54 multi-jurisdictional) agreed to participate in the Library of Virginia's Summer Reading Program impact study. Each participating public library system executed a memorandum of agreement with the Library of Virginia that documented the requirements for participation in the study.

To examine the effects of the 2013 Summer Reading Program on participant outcomes, the 2014 study was designed as a quasi-experimental study. Specifically, propensity score matching methods were utilized to identify a group of comparisons who were from the same school districts as participants and who shared similar student-level attributes (i.e., gender, race, grade, economically disadvantaged status, limited English proficiency status, and baseline achievement status[2]) prior to program participation. The propensity score matching methods ensure baseline equivalence on the observable variables that are known to be associated with the main outcomes of interest (i.e., reading achievement) (Stuart & Rubin, 2007). In the field of educational research where random assignment is not feasible, propensity score matching has been used increasingly to help researchers draw causal inferences for programs like the 2013 Summer Reading Program (Stuart, 2010).

For this study, McREL researchers utilized a subgroup from the 2014 study sample to examine the longitudinal effects of the 2013 Summer Reading Program on student achievement outcomes. Specifically, a subset of participants who were entering the fourth, fifth, and sixth grades following participation in the 2013 Summer Reading Program were included in this study. The main reason for including only a subset is so that each individual participant has at least three years of continuous assessment data measured by the same test, which is the Standards of Learning assessment utilized by the Virginia Department of Education.

Study Sample

According to the Evanced™ Summer Reader database, an online tracking system developed by Evanced Solutions, LLC to track student participation status, a total of 14,575 children between the ages of zero and 17 participated in the 2013 Summer Reading Program. Of those, McREL researchers were able to match and identify 4,598 participants between kindergarten and 12th grade from the Virginia Department of Education's database, the providers of the Standards of Learning student achievement data for the 2014 study.

In addition to requesting data from the Virginia Department of Education for participants who participated in the summer reading program, McREL researchers also requested data for all other students who were from the same school districts as the participating students. Using this data pool, McREL researchers conducted propensity score matching to identify a group of 4,598 comparisons who were similar to the participating group (n = 4,598) in the following characteristics:

[2] Baseline achievement status was defined as achievement on the Virginia Standards of Learning English/Reading subtest during the 2012-2013 school year.

- Demographic characteristics
  - Gender (i.e., male or female)
  - Race (i.e., White, African American, Hispanic, Asian, Hawaiian or other Pacific Islander, American Indian, or multiracial)
  - Grade (i.e., kindergarten to 12th grade)
  - Economically disadvantaged status (i.e., those eligible for free or reduced-price meals, Temporary Assistance for Needy Families, or Medicaid, and/or those who have been identified as experiencing homelessness)
  - Limited English proficiency status[3]
- 2012-2013 achievement data (assessment scores before participation in the 2013 Summer Reading Program)
  - Kindergarten group: Phonological Awareness Literacy Screening rhyme awareness and beginning sounds awareness scores
  - Grades 1-3: Phonological Awareness Literacy Screening Entry Level Sum Score, instructional reading level, and above/below benchmark status
  - Grades 3-12: Standards of Learning English/Reading scaled score, Comprehension of Printed Materials subscale score, Word Analysis Strategies and Information Resources subscale score, and proficiency level.

As noted above, participants from different grade levels completed different tests. Thus, McREL researchers conducted propensity score matching separately for three groups: Kindergarten, grades 1-3[4], and grades 3-12. After the matching process was complete for each group, balance diagnostics were conducted to check the quality of the matches. The results suggested that the participants and selected comparisons were similar by key demographics as well as assessment covariates before the 2013 Summer Reading Program. A complete report of the propensity score matching results is available in the 2014 study report: *Impact of Virginia Public Libraries' Summer Reading Program: Library of Virginia Year 2 Report* (Good et al., 2014).

For this longitudinal study, a subset of the 2014 study participants and comparisons who were entering fourth, fifth, and sixth grades after participating in the 2013 Summer Reading Program were included in this study. Tables 2 and 3 show the demographic characteristics and baseline achievement status of the 2014 study participants and comparisons, respectively. Overall, the participating and comparison groups were very similar in terms of individual characteristics, including gender, grade level, race, economically disadvantaged status, limited English proficiency

[3] Limited English proficiency data were only available for students taking the Phonological Awareness Literacy Screening assessment.

[4] In Virginia, third grade students take the Phonological Awareness Literacy Screening assessment in the fall; those who did not pass the benchmark in the fall retake the test in the spring. Third grade students also take the Standards of Learning assessment in the spring. For this study, Standards of Learning assessment scores were used as the key covariates for the matching. For those who did not have data available from the Standards of Learning assessment (n = 7), scores from the Phonological Awareness Literacy Screening assessment were used.

status, and baseline achievement status. Also provided in Table 4 is a list of the library systems in which the selected participants (n = 2,115) were involved during the 2013 Summer Reading Program.

Table 2. Sample Demographic Characteristics by Groups

Demographic Characteristics	Participants (N = 2,115)		Comparisons (N = 2,084)	
	n	%	*n*	%
Gender (male)	**809**	**38.3%**	**804**	**38.6%**
Grade Level				
Fourth Grade	1,192	56.4%	962	46.2%
Fifth Grade	306	14.5%	688	33.0%
Sixth Grade	617	29.2%	434	20.8%
Race				
White	1,454	68.7%	1,367	65.6%
African American	355	16.8%	410	19.7%
Hispanic	101	4.8%	150	7.2%
Asian	93	4.4%	58	2.8%
Hawaiian or Other Pacific Islander	7	0.3%	9	0.4%
American Indian	2	0.1%	5	0.2%
Multiracial	103	4.9%	85	4.1%
Disadvantaged Status	**534**	**25.2%**	**499**	**23.9%**
Limited English Proficiency Status	**60**	**2.8%**	**64**	**3.1%**

Table 3. 2012-2013 Assessment Scores by Groups

Variables	Participants (n = 2,115)		Comparisons (n = 2,084)		t-test p value
	M	*SD*	*M*	*SD*	
SOL English/Reading Scaled Score	467.36	63.39	468.82	65.94	0.462
SOL Comprehension of Printed Materials subscale score	36.32	6.67	36.53	6.86	0.309
SOL Word Analysis Strategies and Information Resources subscale score	36.47	6.73	36.50	6.85	0.895
SOL Proficiency level [a]	4.17	0.67	4.19	0.68	0.543

Note. SOL = Standards are Learning

[a] Proficiency level was coded into six categories: 1 = Fail/Does Not Meet; 2 = Fail/Below Basic; 3 = Fail/Basic; 4 = Pass/Proficient; 5 = Pass/Advanced; and 6 = Advanced/College Path.

Table 4. Library of Virginia Summer Reading Program Impact Study Participating Library Systems[5]

COUNTY (building numbers)	CITY (building numbers)	MULTI-JURISDICTIONAL (REGIONAL) (building numbers)
Allegheny County (1) Amherst County (2) Augusta County (5) Bedford County (6) Buchanan County (1) Campbell County (4) Caroline County (4) Chesterfield County (9) Essex County (1) Franklin County (2) Halifax County (2) Orange County (3) Pittsylvania County (5) Powhatan County (1) Pulaski County (2) Roanoke County (6) Russell County (2)	Chesapeake City (7) Hampton City (4) Newport News City (4) Norfolk City (12) Petersburg City (1) Poquoson City (1) Portsmouth City (4) Radford City (1) Roanoke City (7) Salem City (1) Staunton City (1) City of Virginia Beach (9) Waynesboro City (1)	Albemarle County, Greene County, Louisa County, Nelson County, Charlottesville City (8) Brunswick County, Greensville County, Emporia City (2) Clarke County, Frederick County, Winchester City (3) Floyd County, Montgomery County (4) Goochland County, Hanover County, King and Queen County, King William County (10) Prince George County, Dinwiddie County, Hopewell City (7) Stafford County, Westmoreland County, Spotsylvania County, Fredericksburg City (8)
***Number* = 17 (56)**	***Number* = 13 (53)**	***Number* = 7 (42)**

Data Collection Methods

Two data sources were used in this study. First, in the fall of 2013 and 2014, McREL researchers secured the list of 2013 and 2014 Summer Reading Program participants via the Evanced™ Summer Reader database.[6] The list of 2013 Summer Reading Program participants was used to identify the primary participants for the study while the 2014 Summer Reading Program participant list was used to identify the participation status of participants and comparisons after the summer of 2013. Secondly, as previously mentioned, the Virginia Department of Education provided the Standards of Learning student achievement data, which included the 2012-2013 (baseline; T1), 2013-2014 (T2), and 2014-2015 (T3) English/Reading Standards of Learning scale scores and subscales scores.

Data Analysis

Due to the nature of the data structure (i.e., students were nested within schools, and achievement outcomes were nested within students [repeated measure]), the intra-class correlation coefficient (ICC) was first calculated to see if there were any significant clustering effects that might

[5] Nine public library systems that agreed to be a part of the original study did not have any participants remaining following the data cleaning and merging process in 2014; thus, the reason for only 37 public library systems being listed as participating in the impact study.

[6] Not all of the 2013 Summer Reading Program participants were retained in this study. Only the participants who remained in the dataset after merging the Evanced™ Summer Reader and Virginia Department of Education databases and were entering fourth, fifth, and sixth grades after participating in the 2013 Summer Reading Program were included in this study (see the Study Sample section for more detail).

need to be taken into account (i.e., ICCs greater than 0.10). Results showed that the ICCs for the T1 (2012-2013), T2 (2013-2014), and T3 (2014-2015) English/Reading Standards of Learning scale scores were 0.04, 0.05, and 0.05, respectively. These results suggest that the clustering effects were small and negligible. Therefore, to answer the proposed research questions, researchers conducted mixed linear modeling to examine the long-term effects of the 2013 Summer Reading Program on students' learning trajectories overtime as measured by the English/Reading Standards of Learning assessment. For Question 1: *Does the summer reading program's impact on reading outcomes endure more than one year following participation?,* researchers examined the differences in student achievement trajectories between the 2013 Summer Reading Program participants and the comparison students. The statistical model for this research question is presented in Figure 1 below. This part of the analysis involved two steps. The first step was to model an individual rate of change (i.e., a linear growth model), which was the change occurring from baseline (i.e., prior to participating in the 2013 Summer Reading Program) to two years after program participation for the English/Reading Standards of Learning scale scores over time. The focus was to do a preliminary exploration to ascertain if there was any individual variability among the intercept (outcome mean that was coded as 0) and the slopes (rate of change). The intercept for this study was set as the English/Reading Standards of Learning scale scores at T3. The second step of the analysis process was to examine whether the intercept and the rate of change differed by group after controlling for the covariates.

Level-1 Model

$y_{ij} = \beta_{0j} + \beta_{1j}*(Time_{ij}) + \Upsilon_{ij}$ $\quad \Upsilon_{ij.} \sim N(0, \sigma^2)$

Level-2 Model

$\beta_{0j} = \Upsilon_{00} + \Upsilon_{01}*(Group_j) + \Upsilon_{02}*(Gender_j) + \Upsilon_{03}*(Minority_j) + \Upsilon_{04}*(Disadvantaged_j) + \upsilon_{0j}$

$\beta_{1j} = \Upsilon_{10} + \Upsilon_{11}*(Group_j) + \Upsilon_{12}*(Gender_j) + \Upsilon_{13}*(Minority_j) + \Upsilon_{14}*(Disadvantaged_j) + \upsilon_{1j}$

$$\begin{pmatrix}\upsilon 0j\\ \upsilon 1j\end{pmatrix} \sim N\left[\begin{pmatrix}0\\0\end{pmatrix}, \begin{pmatrix}\tau 00 & \\ \tau 10 & \tau 11\end{pmatrix}\right]$$

Coding:

- Time: T1 = -2, T2 = -1, and T3 = 0 (The main outcome of interest was students' English/Reading Standards of Learning scale scores at T3.)
- Group: 2013 Summer Reading Program participants = 1; comparisons = 0
- Gender: male = 1; female = 2
- Minority: racial/ethnic minority students = 1; White students = 0
- Disadvantaged: Students with economically disadvantaged status = 1; students without economically disadvantaged status = 0

Figure 1. Statistical model for research question 1

To answer Question 2: *How many children participate in the summer reading program for more than one year, and what are the characteristics of these repeat participants?*, McREL researchers descriptively describe the demographic characteristics of the 2013 Summer Reading Program participants who also participated in the 2014 Summer Reading Program. Also discussed is how the participants differ from the comparison students.

To address Question 3: *How do the reading outcomes and growth patterns of repeat participants differ from nonparticipants and from those participating during a single summer?*, researchers examined students' achievement trajectories across four groups:

1. 2013 Summer Reading Program participants (P1);
2. 2013 Summer Reading Program participants who also participated in the 2014 Summer Reading Program (P1+);
3. comparisons who did not participate in either the 2013 or 2014 Summer Reading Programs (C1); and
4. comparisons who participated in the 2014 Summer Reading Program (C1+).

The statistical model for Question 3 is presented in Figure 2 below. The focus of this part of the analysis was to examine if the intercept and rate of change in the outcomes differed between the P1+ group and the other three groups (i.e., P1, C1, and C1+) after controlling for the covariates.

Level-1 Model

$y_{ij} = \beta_{0j} + \beta_{1j}*(Time_{ij}) + \gamma_{ij}$ $\quad \gamma_{ij.} \sim N(0, \sigma^2)$

Level-2 Model

$\beta_{0j} = \gamma_{00} + \gamma_{01}*(Group\_dummy1_j) + \gamma_{02}*(Group\_dummy2_j) + \gamma_{03}*(Group\_dummy3_j) + \gamma_{04}*(Gender_j) + \gamma_{05}*(Minority_j) + \gamma_{06}*(Disadvantaged_j) + \upsilon_{0j}$

$\beta_{1j} = \gamma_{10} + \gamma_{11}*(Group\_dummy1_j) + \gamma_{12}*(Group\_dummy2_j) + \gamma_{13}*(Group\_dummy3_j) + \gamma_{14}*(Gender_j) + \gamma_{15}*(Minority_j) + \gamma_{16}*(Disadvantaged_j) + \upsilon_{1j}$

$$\begin{pmatrix} \upsilon 0j \\ \upsilon 1j \end{pmatrix} \sim N\left[\begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \tau 00 & \\ \tau 10 & \tau 11 \end{pmatrix}\right]$$

Coding:

- Time: T1 = -2, T2 = -1, and T3 = 0 (The main outcome of interest was students' English/Reading Standards of Learning scale scores at T3.)
- Group_Dummy1: C1 = 1; P1+ = 0
- Group_Dummy2: C1+ = 1; P1+ = 0
- Group_Dummy3: P1 = 1; P1+ = 0
- Gender: male =1; female =2
- Minority: racial/ethnic minority students = 1; White students = 0
- Disadvantaged: Students with economically disadvantaged status = 1; students without economically disadvantaged status = 0

Figure 2. Statistical model for research question 3

It should be noted that of the students included in this study (n = 4,199), 5% did not have 2013-2014 achievement data available and 10% did not have 2014-2015 achievement data available; hence, the estimations reported in this study were based on the restricted maximum likelihood method as it provides unbiased estimates when data are unbalanced.

Findings

This section discusses the findings for each research question. Before examining the effect of summer reading program participation on students' achievement outcomes, McREL researchers conducted an analysis of latent growth curve modeling to understand if the study sample demonstrated a significant rate of change (i.e., amount of increase or decrease over time) on the English/Reading Standards of Learning scale scores over time. Results showed that students, on average, demonstrated a significant rate of decrease in these scores over time (= -1.10, *SE* = 0.38, $p = 0.003$). That is, on average, students showed a 1.10-point decrease on their English/Reading Standards of Learning scale scores every year. Researchers further examined if the individual rate of change differed by the groups after controlling for the covariates (i.e., gender, minority status, and economically disadvantaged status); results are reported in the following sections by research question.

Research Question 1: Does the summer reading program's impact on reading outcomes endure more than one year following participation?

Results of the linear mixed model examining the effect of program participation on student growth are presented in Table 5. Findings indicate that the 2013 Summer Reading Program participants performed better on the English/Reading Standards of Learning assessment than did the comparisons two years after participation in the summer reading program (= 8.61, *SE* = 1.75, $p < 0.001$). Although, comparison students did demonstrate a significant rate of decrease in their English/Reading Standards of Learning scale scores over time (= -3.07, *SE* = 0.68, $p < 0.001$), and the rate of change did differ by students' program participation status (= 3.44, *SE* = 0.75, $p < 0.001$) when the covariates (i.e., gender, minority status, and economically disadvantaged status) were taken into account. Specifically, the estimates of simple slopes indicated that 2013 Summer Reading Program participants did not demonstrate a significant rate of change in their English/Reading Standards of Learning scale scores over time (= 0.37, *SE* = 0.67, $p = 0.580$), while comparisons demonstrated a significant rate of decrease in their English/Reading Standards of Learning scale scores over time (= -3.07, *SE* = 0.68, $p < 0.001$). These findings suggest that participation in summer reading programs may have a positive effect on student achievement outcomes by preventing learning loss even two years after participation. Figure 3 includes a visual representation of the simple slopes for each group.

Summer reading programs may have a positive effect on student achievement outcomes by preventing learning loss even two years after participation.

While it is not the main interest of this study, it is worth noting that males, minority students, and economically disadvantaged students had lower English/Reading Standards of Learning scale scores at T3 (i.e., during the 2014-2015 school year) (= -13.12, *SE* = 1.80, $p < 0.001$; = -14.17, *SE* = 1.97, $p < 0.001$; and = -37.27, *SE* = 2.14, $p < 0.001$, respectively). Examination of the simple slopes, shown in Figure 4, indicate that both females and males demonstrated a significant decline in the English/Reading Standards of Learning scale scores over

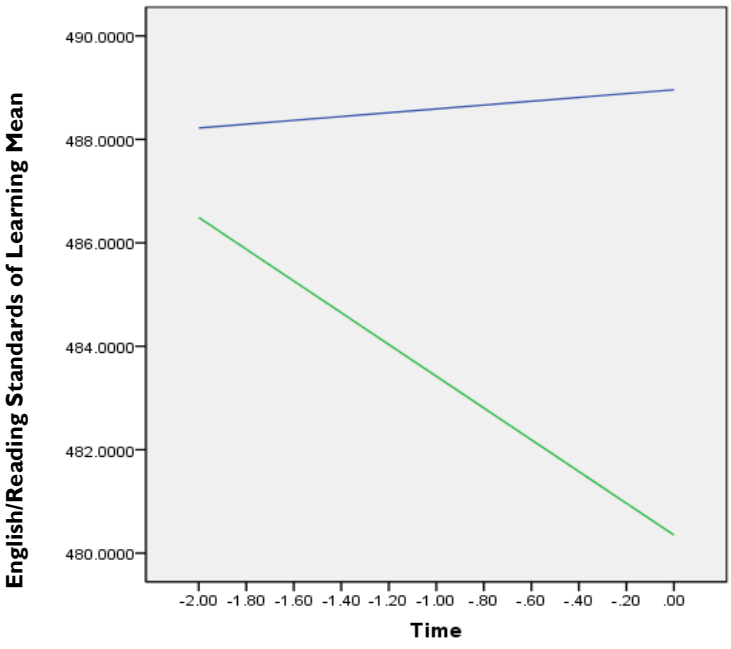
time (= -4.72, *SE* = 0.78, $p < 0.001$ and = -3.07, *SE* = 0.68, $p < 0.001$, respectively); yet the rate of decrease was greater for males than for females (= -1.65, *SE* = 0.77, $p = 0.033$).

In terms of minority status, students from racial/ethnic minority backgrounds had lower English/Reading Standards of Learning scale scores than did their nonminority peers at T3 (= -14.17, *SE* = 1.97, $p < 0.001$), and the rate of change was found to differ by students' minority status (= 2.30, *SE* = 0.84, $p < 0.001$). As displayed in Figure 5, while minority students did not demonstrate a significant rate of change, neither increasing nor decreasing, over time (= -0.77, *SE* = 0.90, $p = 0.391$), nonminority students showed a significant decrease in their achievement over time as measured by the English/Reading Standards of Learning assessment (= -3.07, *SE* = 0.68, $p < 0.001$).

Students from economically disadvantaged backgrounds had significantly lower achievement scores at T3 (= -38.31, *SE* = 2.78, $p < 0.001$). Yet, the rate of change (shown in Figure 6) did not differ by students' economically disadvantaged status (= 0.35, *SE* = 0.92, $p = 0.707$). The individual characteristics of students (i.e., group, gender, minority status, and economically disadvantaged status) explained about 17% of the between-person variances in the Standards of Learning outcomes.

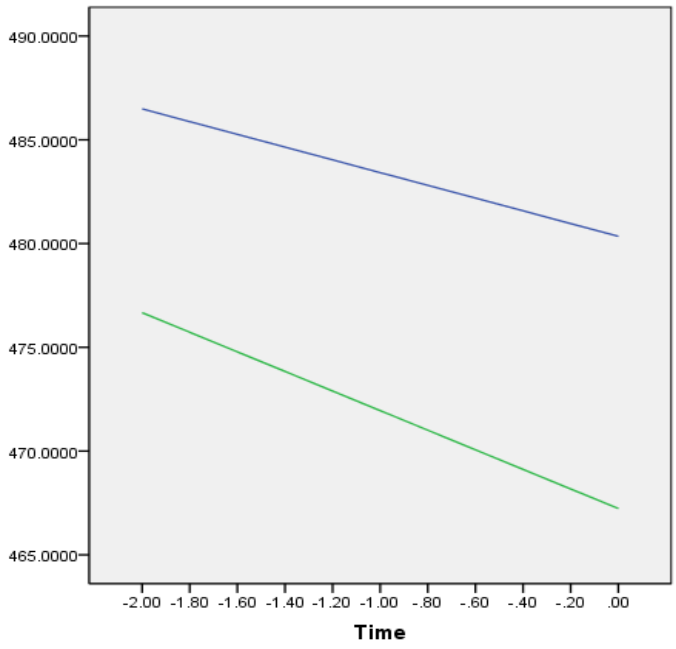
Table 5. Linear Mixed Modeling Results for Research Question 1

Parameter Estimates	Linear Growth Model			Final Model		
Fixed Effects		*SE*	*p*		*SE*	*p*
Intercept (r_{00})	465.90	0.93	< 0.001	480.35	1.59	< 0.001
Slope (Time, r_{10})	-1.10	0.38	0.003	-3.07	0.68	< 0.001
Group (r_{01})	--	--	--	8.61	1.75	< 0.001
Gender (r_{02})	--	--	--	-13.12	1.80	< 0.001
Minority (r_{03})	--	--	--	-14.17	1.97	< 0.001
Disadvantaged (r_{04})	--	--	--	-37.27	2.14	< 0.001
Time * Group (r_{11})	--	--	--	3.44	0.75	< 0.001
Time * Gender (r_{12})	--	--	--	-1.65	0.77	0.033
Time * Minority (r_{13})	--	--	--	2.30	0.84	0.006
Time * Disadvantaged (r_{14})	--	--	--	0.35	0.92	0.707
Variance Components	*Variance*	*SE*	*p*	*Variance*	*SE*	*p*
Variance among the intercepts (τ_{00})	2,613.59	81.83	< 0.001	2,177.77	75.64	< 0.001
Variance among the slopes (τ_{11})	15.26	17.58	0.386	12.26	17.54	0.484
Level-1 residuals (σ^2)	1,069.82	24.21	< 0.001	1,069.67	24.21	< 0.001
Variance Explained						
Within-person variance explained (level 1 R^2)	0.00%					
Between-person variance explained (level 2 R^2)	16.68%					



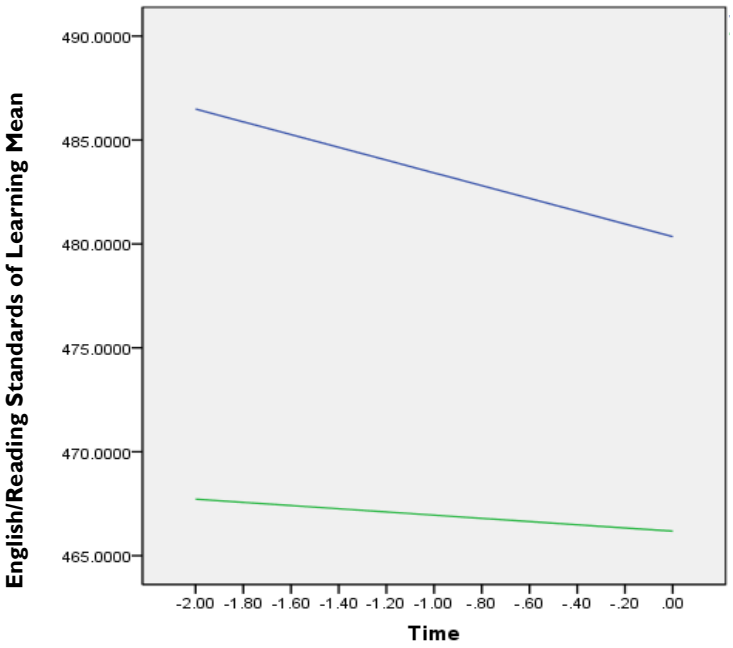
Participants and Comparisons

Figure 3. Simple slopes by participation status.



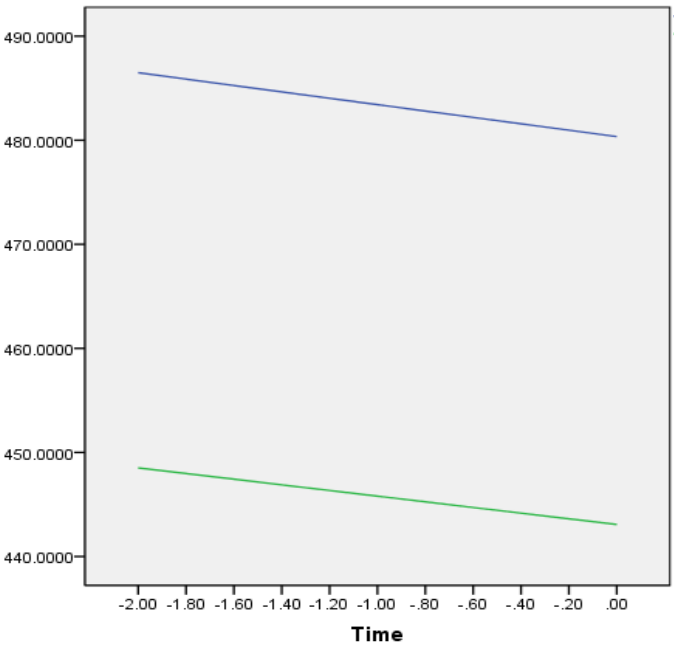
Females and Males

Figure 4. Simple slopes by gender.



Nonminority and Minority

Figure 5. Simple slopes by minority status.



Non-Disadvantaged and Disadvantaged

Figure 6. Simple slopes by disadvantaged status.

Research Question 2: How many children participate in the summer reading program for more than one year, and what are the characteristics of these repeat participants?

According to the Evanced™ Summer Reader database, 35% (n = 740) of the participants and 5% (n = 102) of the comparisons included in the study (i.e., fourth, fifth, and sixth graders) also participated in the 2014 Summer Reading Program. Table 6 shows the characteristics of the repeat participants (i.e., participants who were involved in both the 2013 and 2014 Summer Reading Programs [Pl+]) as well as the other three groups (i.e., 2013 Summer Reading Program participants who did not participate in the 2014 Summer Reading Program [P1]; comparisons who did not participate in either the 2013 or 2014 Summer Reading Programs [C1]; and comparisons who did not participate in the 2013 Summer Reading Program but did participate in the 2014 Summer Reading Program [C1+]). Overall, P1, P1+, C1, and C1+ students were widely distributed across 37, 25, 46, and 17 library systems, respectively. Table 7 shows the list of library systems involved with each of the four groups.

35% of the participants and 5% of the comparisons (i.e., 4th, 5th, and 6th graders) participated in the 2014 Summer Reading Program

In terms of student demographic characteristics, all four groups were very similar in their grade level, gender, race, and economically disadvantaged status with some exceptions (see Table 6). Exceptions include the following:

All four groups (P1, P1+, C1, and C1+) were very similar in their grade level, gender, race, and economically disadvantaged status with only a few exceptions.

- P1 and P1+ had higher percentages of sixth graders but lower percentages of fifth graders as compared to C1 and C1+.
- C1+ had a lower percentage of male students as compared to P1, P1+, and C1 students.
- P1+ and C1+ had higher percentages of nonminority students as compared to P1 and C1.
- P1+ had a higher percentage of Asian students as compared to P1, C1, and C1+.
- P1+ and C1+ had lower percentages of students with economically disadvantaged status as compared to C1 and P1.

Students from the four groups did perform differently on the English/Reading Standards of Learning assessment over time (refer to Table 6), with results of one-way analyses of variances indicating those differences on the English/Reading Standards of Learning scale scores over time (T1: F (3, 4195) = 11.09, $p < 0.001$; T2: F (3, 3998) = 21.31, $p < 0.001$; and T3: F(3, 3785) = 15.53, $p < 0.001$). More specifically:

Students from the four groups did perform differently on the English/Reading Standards of Learning assessment over time.

- For T1, C1+ students had higher English/Reading Standards of Learning scale scores when compared to the other three groups ($p < 0.01$), while P1+ students had higher scores compared to P1 and C1 students ($p < 0.01$).
- At T2, P1+ students had higher English/Reading Standards of Learning scale scores than did P1 and C1 students ($p < 0.01$), while P1 and C1+ students had higher scale scores than C1 students ($p < 0.01$).
- At T3, P1+ students also had higher English/Reading Standards of Learning scale scores than did P1 and C1 students ($p < 0.01$), while C1+ had higher scores than P1 and C1 students ($p < 0.01$).
- Overall, P1+ and C1+ students had higher achievement scores as compared to P1 and C1 participants in most cases.

Table 6. Characteristics of the Four Groups of Study Participants and Nonparticipants

Characteristics	P1 (*n* = 1,375)	P1+ (*n* = 740)	C1 (*n* = 1,982)	C1+ (*n* = 102)
Number of Library Systems Involved	37	25	46	17
Fourth Grade (%)	57.2%	54.7%	45.5%	58.8%
Fifth Grade (%)	14.6%	14.2%	33.1%	31.4%
Sixth Grade (%)	28.1%	31.1%	21.4%	9.8%
Male (%)	39.7%	35.5%	39.1%	29.4%
White (%)	67.1%	71.9%	65.3%	70.6%
Black (%)	18.3%	13.9%	20.1%	11.8%
Hispanic (%)	4.9%	4.6%	7.2%	6.9%
Asian (%)	3.9%	5.3%	2.7%	3.9%
Other race (%)	5.8%	4.3%	4.6%	6.9%
Disadvantaged Status (%)	28.3%	19.6%	24.5%	12.7%
Reading/English SOL T1 (M/SD)	464.02 (62.66)	473.55 (64.30)	467.31 (65.72)	498.14 (63.68)
Reading/English SOL T2 (M/SD)	470.23 (60.86)	479.43 (63.05)	459.82 (61.28)	479.95 (54.52)
Reading/English SOL T3 (M/SD)	464.27 (58.56)	477.60 (61.93)	461.79 (60.61)	485.97 (57.78)

Note. P1 = 2013 Summer Reading Program participants; P1+ = 2013 Summer Reading Program participants who also participated in the 2014 Summer Reading Program; C1 = 2013 comparisons; and C1+ = 2013 comparisons who participated in the 2014 Summer Reading Program.

Table 7. Library Systems Involved Across the Four Groups

P1 (*n* = 37)
Albemarle, Greene, Louisa, and Nelson Counties, and Charlottesville City; Allegheny County; Amherst County; Augusta County; Bedford County; Brunswick and Greensville Counties, and Emporia City; Buchanan County; Campbell County; Caroline County; Chesapeake City; Chesterfield County; Clarke and Frederick Counties, and Winchester City; Essex County; Floyd and Montgomery Counties; Franklin County; Goochland, Hanover, King and Queen, and King William Counties; Halifax County; Hampton City; Newport News City; Norfolk City; Orange County; Petersburg City; Pittsylvania County; Poquoson City; Portsmouth City; Powhatan County; Prince George and Dinwiddie Counties, and Hopewell City; Pulaski County; Radford City; Roanoke City; Roanoke County; Russell County; Salem City; Stafford, Westmoreland, and Spotsylvania Counties, and Fredericksburg City; Staunton City; Virginia Beach City; Waynesboro City
P1+ (*n* = 25)
Albemarle, Greene, Louisa, and Nelson Counties, and Charlottesville City; Allegheny County; Augusta County; Bedford County; Buchanan County; Chesapeake City; Chesterfield County; Clarke and Frederick Counties, and Winchester City; Floyd and Montgomery Counties; Franklin County; Goochland, Hanover, King and Queen, and King William Counties; Hampton City; Norfolk City; Orange County; Portsmouth City; Powhatan County; Prince George and Dinwiddie Counties, and Hopewell City; Roanoke City; Roanoke County; Russell County; Salem City; Stafford, Westmoreland, and Spotsylvania Counties, and Fredericksburg City; Staunton City; Virginia Beach City; Waynesboro City
C1 (*n* = 46)
Albemarle, Greene, Louisa, and Nelson Counties, and Charlottesville City; Alexandria City; Allegheny County; Amherst County; Augusta County; Bedford County; Brunswick and Greensville Counties, and Emporia City; Buchanan County; Campbell County; Caroline County; Carroll County; Chesapeake City; Chesterfield County; Clarke and Frederick Counties, and Winchester City; Cumberland County; Essex County; Floyd and Montgomery Counties; Franklin County; Goochland, Hanover, King and Queen, and King William Counties; Halifax County; Hampton City; James City County and Williamsburg City; King George County; Lancaster County; New Kent and Charles City Counties; Newport News City; Norfolk City; Orange County; Petersburg City; Pittsylvania County; Poquoson City; Portsmouth City; Powhatan County; Prince George and Dinwiddie Counties, and Hopewell City; Pulaski County; Radford City; Richmond City; Roanoke City; Roanoke County; Russell County; Salem City; Stafford, Westmoreland, and Spotsylvania Counties, and Fredericksburg City; Staunton City; Virginia Beach City; Washington County; Waynesboro City
C1+ (*n* = 17)
Alexandria City; Augusta County; Bedford County; Caroline County; Chesapeake City; Chesterfield County; Clarke and Frederick Counties, and Winchester City; Floyd and Montgomery Counties; Goochland, Hanover, King and Queen, and King William Counties; Hampton City; King George County; Orange County; Portsmouth City; Powhatan County; Salem City; Stafford, Westmoreland, and Spotsylvania Counties, and Fredericksburg City; Virginia Beach City

Research Question 3: How do the reading outcomes and growth patterns of repeat participants differ from nonparticipants and from those participating during a single summer?

Based on the findings to Question 2, participants in the 2013 Summer Reading Program who repeated the program in 2014 (P1+) and comparisons who did not participate in 2013 but participated in 2014 (C1+) appeared to have better achievement outcomes as measured by the English/Reading Standards of Learning assessment. The main purpose of Question 3 is to further investigate the outcomes and growth of students across the four groups (i.e., P1, P1+, C1, and C1+). Results of the linear mixed model are presented in Table 8.

Specifically, findings for Question 3 indicated that P1+ students had higher levels of performance on the English/Reading Standards of Learning assessment than did their P1 and C1 peers two years after participating in the summer reading program (= -14.65, *SE* = 2.41, $p < 0.001$ and = -8.27, *SE* = 2.56, $p = 0.001$, respectively). Although, while the overall rate of change was not significant (= 1.50, *SE* = 0.95, $p = 0.113$), it did differ by group status after taking the covariates into account. For instance, the rate of change in outcomes did differ between the P1+ and C1 groups (= -4.43, *SE* = 1.03, $p < 0.001$) and between the P1+ and C1+ groups (= -7.93, *SE* = 2.51, $p = 0.002$). The estimates of simple slopes indicated that the P1+ students did not have a significant rate of change in the English/Reading Standards of Learning scale scores over time (= 1.50, *SE* = 0.95, $p = 0.113$); while the C1 and C1+ students demonstrated a significant rate of decrease in the scale scores over time (= -2.93, *SE* = 0.69, $p < 0.001$ and = -6.43, *SE* = 2.37, $p = 0.007$, respectively). Figure 7 provides a visual representation of these student outcome trajectories by group through the display of simple slopes. As you will see in the figure, the individual characteristics (i.e., group, gender, minority status, and economically disadvantaged status) explained about 17% of the between-person variances in the Standards of Learning outcomes.

Repeat participants (P1+) seemed to benefit the most from their participation in the 2013 and 2014 Summer Reading Programs, followed by those who only participated in the 2013 program.

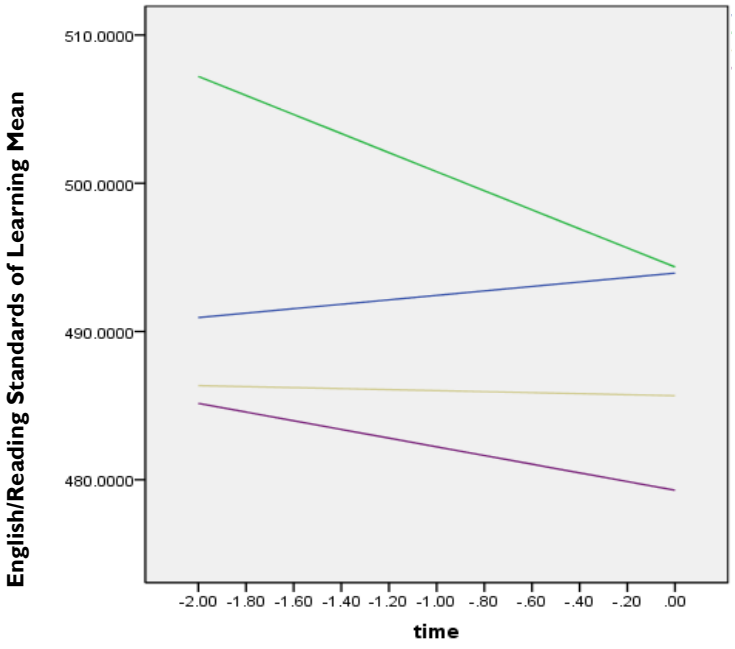
Overall, the repeat participants (P1+) seemed to benefit from their participation the most, followed by the participants who only participated in the 2013 Summer Reading Program (P1). These findings lead to the same conclusion as Question 1. Reading program participation may have a positive effect on student achievement outcomes as learning loss may be minimized or prevented altogether even two years after participation in the summer reading program.

Table 8. Linear Mixed Modeling Results for Research Question 3

Parameter Estimates	Linear Growth Model			Final Model		
Overall English/Reading Standards of Learning Subscale Score						
Fixed Effects	□	*SE*	*p*	□	*SE*	*p*
Intercept (r_{00})	465.90	0.93	< 0.001	493.94	2.21	< 0.001
Slope (Time, r_{10})	-1.10	0.38	0.003	1.50	0.95	0.113
Group_dummy1 (r_{01})	--	--	--	-14.65	2.41	< 0.001
Group_dummy2 (r_{02})	--	--	--	0.41	5.89	0.945
Group_dummy3 (r_{03})	--	--	--	-8.27	2.56	0.001
Gender (r_{04})	--	--	--	-12.81	1.80	< 0.001
Minority (r_{05})	--	--	--	-14.05	1.97	< 0.001
Disadvantaged (r_{06})	--	--	--	-36.63	2.15	< 0.001
Time * Group_dummy1 (r_{11})	--	--	--	-4.43	1.03	< 0.001
Time * Group_dummy2 (r_{12})	--	--	--	-7.93	2.51	0.002
Time * Group_dummy3 (r_{13})	--	--	--	-1.84	1.10	0.094

Parameter Estimates	Linear Growth Model			Final Model		
Overall English/Reading Standards of Learning Subscale Score						
Time * Gender (r_{14})	--	--	--	-1.64	0.77	0.034
Time * Minority r_{15})	--	--	--	2.32	0.84	0.006
Time * Disadvantaged (r_{16})	--	--	--	0.40	0.92	0.666
Variance Components	***Variance***	***SE***	***p***	***Variance***	***SE***	***p***
Variance among the intercepts (τ_{00})	2,613.59	81.83	< 0.001	2,166.32	72.41	< 0.001
Variance among the slopes (τ_{11})	15.26	17.58	0.386	11.70	17.53	0.505
Level-1 residuals (σ^2)	1,069.82	24.21	< 0.001	1,069.67	24.21	< 0.001
Variance Explained						
Within-person variance explained (level 1 R^2)	0.00%					
Between-person variance explained (level 2 R^2)	17.1%					

It is interesting to observe that although the C1+ students (i.e., comparisons who participated in the 2014 Summer Reading Program) had the highest English/Reading Standards of Learning scale scores at T1, this group, on average, had the most drastic rate of decrease over time (Slope = -7.93) as compared to other groups (i.e., P1, P1+, and C1).



P1 (Yellow), P1+, C1, and C1+

Figure 7. Simple slopes by groups.

Summary and Recommendations for Future Research

Overall, findings of this study suggest that the 2013 Summer Reading Program continued to prevent summer reading loss even two years after students participated in the program. This is encouraging as this study involved a rigorous research design (i.e., quasi-experimental design with matched comparisons) with a large-scale group of 4,199 students who were entering fourth, fifth, and sixth grades across 46 library systems in the Commonwealth of Virginia. Specifically, 2,115 students were 2013 Summer Reading Program participants from 38 public library systems, and 2,084 students were comparisons who were not involved in the 2013 Summer Reading Program across 46 public library systems. Key findings for each research questions are summarized as follows.

Research Question 1: Does the summer reading program's impact on reading outcomes endure more than one year following participation?

Participants in the 2013 Summer Reading Program performed better academically two years after program participation as compared to nonparticipants (i.e., comparisons). Further examination of individual achievement trajectories over time (i.e., before summer reading program participation and two years after program participation) revealed that the 2013 Summer Reading Program participants, on average, seemed to maintain the same achievement level over time, while nonparticipants had a significant decrease in their English/Reading Standards of Learning scale scores over time. This finding is consistent with research that suggests while children tend to demonstrate reading loss during the summer months, student participation in summer reading programs seems to mitigate the loss as they provide students with access to reading materials and activities that encourage reading (Mraz & Rasinski, 2007). Findings of this study suggests that such an effect seemed to be retained two years after participation in the summer reading program.

Research Question 2: How many children participate in the summer reading program for more than one year, and what are the characteristics of these repeat participants?

As mentioned previously, a total of 4,199 students who were entering fourth, fifth, and sixth grades after the summer of 2013 were included in this study. Of those, 2,115 participated in the 2013 Summer Reading Program, and 2,084 were comparison students (i.e., nonparticipants) who were identified through propensity score matching conducted in 2014 (see Good et al. for more detail).

Some of these participants and comparisons also participated in the 2014 Summer Reading Program, which resulted in four distinct groups:

1. 2013 participants who did not participate in the 2014 Summer Reading Program (P1; n = 1,375);

2. 2013 participants who also participated in the 2014 Summer Reading Program (P1+; n = 740);
3. comparisons who did not participate in either the 2013 or 2014 Summer Reading Programs (C1; n = 1,982); and
4. comparisons who participated in the 2014 Summer Reading Program (C1+; n = 102).

Overall, all four groups were very similar in their characteristics, such as grade level, gender, race, and economically disadvantaged status with some exceptions. Key differences are summarized as follows:

- P1 and P1+ had higher percentages of sixth graders but lower percentages of fifth graders as compared to C1 and C1+.
- C1+ had a lower percentage of male students as compared to the P1, P1+, and C1 student groups.
- P1+ and C1+ had higher percentages of nonminority students as compared to P1 and C1.
- P1+ had a higher percentage of Asian students as compared to P1, C1, and C1+.
- P1+ and C1+ had lower percentages of students with economically disadvantaged status as compared to P1 and C1.
- Students from the different groups performed differently on the English/Reading Standards of Learning scale scores over time. In general, P1+ and C1+ students demonstrated higher achievement scores as compared to P1 and C1 students in most cases.

Research Question 3: How do the reading outcomes and growth patterns of repeat participants differ from nonparticipants and from those participating during a single summer?

Students participating in the summer reading programs for two years (i.e., P1+) had different achievement outcomes as compared to those who only participated for one year (i.e., P1 and C1+) or those who did not participate at all in a summer reading program (i.e., C1). This study revealed that both P1 and P1+ students maintained the same level of achievement outcomes from before participating in the summer reading program (i.e., baseline) to two years after program participation; while C1 and C1+ students demonstrated significant rates of decrease in their achievement scores over time. Nevertheless, after two years of participation in the 2013 and 2014 Summer Reading Programs, P1+ students had higher English/Reading Standards of Learning scores than did their P1 and C1 peers. These findings suggest that participation in summer reading programs does have a positive effect on student achievement outcomes by preventing learning loss even two years after participation.

In summary, this study suggests that summer reading programs may prevent summer reading loss or even facilitate learning gains when schools are not in session. To investigate how and why summer reading programs work to support student reading outcomes, further research is warranted. For instance, what are the key elements of summer reading programs that support student achievement? Such a study may provide additional research for the field as to the evidence-based practices that best support student reading outcomes.

There are several limitations of the current study which are important to note. First, this study only included students who were entering fourth, fifth, and sixth grade after they participated in the 2013 Summer Reading Program. It is unclear if the same findings would hold for students from lower or higher grade levels. Second, researchers utilized student demographic and achievement variables that were available from the Virginia Department of Education to identify a group of matched comparisons. It is certain that the selected comparisons were similar to participants on the prescribed demographic and achievement variables. However, it is uncertain how different they were on the unobserved characteristics that may also contribute to student achievement outcomes (e.g., home environment, parental involvement, participation in other reading programs, etc.). Future studies may wish to include data on these key variables and include them in the matching process.

A final limitation is that the main criterion utilized to identify students' participation status was that as long as the student was registered to participate and read at least one book during the summer reading program period, he or she was counted as a participant. The same criterion was used for both the 2013 and 2014 Summer Reading Programs. This may partially contribute to the finding that participants, both P1 and P1+, did not demonstrate a significant rate of change (i.e., increase or decrease over time) in their English/Reading Standards of Learning scores due to variations in their levels of participation. Further research may consider more conservative criteria, such as the number of books read and time spent on reading, to understand how the different levels of participation (i.e., dosage) may mitigate the effects of summer reading programs on student outcomes.

References

Borman, G. D., & D'Agostino, J. V. (1996). Title I and student achievement: A meta-analysis of federal results. *Educational Evaluation and Policy Analysis, 18*, 309-326.

Celano, D., & Neuman, S. (2001). *The role of public libraries in children's literacy development: An evaluation report.* Harrisburg, PA: Pennsylvania Library Association.

Cooper, H., Nye, B., Charlton, K., Lindsay, J., & Greathouse, S. (1996). The effects of summer vacation on achievement test scores: A narrative and meta-analytic review. *Review of Educational Research, 66*(3), 227-227.

Good, K., Ho, H., Muñoz-Miller, M, Ncube, M., & Turner, H M. III. (2014). *Impact of Virginia Public Libraries' Summer Reading Program: Library of Virginia Year 2 Report.* Charleston, WV: McREL International.

Luftig, R. L. (2003). When a little bit means a lot: The effects of a short-term reading program on economically disadvantaged elementary schoolers. *Reading Research and Instruction, 42*(4), 1-13.

Matthews, J. (2010). Evaluating summer reading programs: Suggested improvements. *Public Libraries, 49*, 34-40.

McGill-Franzen, A., & Allington, R. (2004). *Lost summers: Few books and few opportunities to read.* Retrieved from http://www.readingrockets.org/article/394/

Mraz, M., & Rasinski, T. V. (2007). Summer reading loss. *The Reading Teacher, 60*(8), 784-789.

Search Institute. (2007). *40 Developmental Assets for Adolescents*. Minneapolis, MN: Author. Retrieved from http://www.search-institute.org/content/40-developmental-assets-adolescents-ages-12-18

Stuart, E. A. (2010). Matching methods for causal inference: A review and a look forward. *Statistical Science, 25*, 1-21.

Stuart, E. A., & Rubin, D. B. (2007). Best Practices in Quasi-Experimental Designs: Matching methods for causal inference. In J. Osborne (Ed.), *Best Practices in Quantitative Social Science* (Vol. 11, pp. 155-176). Thousand Oaks, CA: Sage.