Three-Year Longitudinal Study: Impact of a Blended Learning Program—Lexia® Core5® Reading—on Reading Gains in Low-SES Kindergarteners

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ABSTRACT
This three-year longitudinal study tracked the reading performance of 68 kindergarten students from low SES backgrounds. These students received instruction with a blended learning program ——Lexia® Core5® Reading—from the start of kindergarten through second grade. During each school year the students made significant gains on a standardized reading test. However, performance on the test declined significantly from the spring of one school year to the fall of the next, indicative of a substantial summer slide. Yet, further comparisons revealed that performance from the fall of one school year to the fall of the next showed significant improvement, pointing to the benefits of school-based instruction to help overcome the summer slide. More than 90% of low performers who started kindergarten scoring below average on the standardized test finished second grade scoring average or better. Benefits of Lexia Core5® Reading to support reading growth in elementary school students from low SES backgrounds are discussed.

Studies have shown that when students are unable to read proficiently by the end of third grade, they usually face persistent academic struggles throughout their academic career, and such students have particularly high attrition rates in high school (Fiester, 2013). The Nation’s Report Card from the U.S. Department of Education’s National Center for Education Statistics (2015) shows that only 36% of fourth-grade students scored at or above a proficiency level on the National Assessment for Educational Proficiency. As pointed out by Hernandez (2011), students in third grade who are still learning to read, rather than reading to learn, are likely to fall...
even further behind academically (Downey, von Hippel, & Broh, 2004). Notably, reading outcomes for U.S. students from low socioeconomic status (SES) backgrounds are even more dire. Just 21% of these students scored at or above proficiency level and 44% scored below a basic level in fourth grade (NCES, 2015). Recent findings show that socioeconomic disparities in reading achievement are much larger than gaps across race and ethnicity (Reardon, Valentino, & Shores, 2012).

Given the present situation, education researchers need to identify and promote the most effective forms of instruction to advance literacy skills, especially for students from low SES backgrounds. As reviewed by Shanahan and Lonigan (2010), several forms of individualized instruction have shown promise particularly for students with early literacy struggles. What they tend to have in common is a focus on identifying skill gaps and providing individualized instruction to reduce those gaps (Connor et al., 2013). With these features in mind, the current study addresses the potential benefits of a blended learning approach to reading instruction. Students in this longitudinal study were provided instruction starting in kindergarten and continuing to the end of second grade.

**Literature review**

**Blended learning**

Blended learning is an approach to individualized reading instruction that is composed of independent student-directed, online digital activities with teacher-led offline, individual or small-group instruction (Horn & Staker, 2011). The goal of blended learning is for teachers to differentiate and target instruction to the specific learning needs of their individual students. With blended learning teachers can access real-time data summarized through teacher-facing digital dashboards in order to make instructional decisions for individual students (Freeland, 2015; Powell, Rabbitt, & Kennedy, 2014).

A few earlier studies have investigated elements of blended learning in elementary schools. In one study, Chambers et al. (2008) implemented Success for All with first graders who were English language learners (ELLs) and from low SES backgrounds. Students were engaged in over 100 minutes per day of literacy instruction, which combined whole class lessons, small group work using digital technology, multimedia activities, and individual daily tutoring. Students were found to make significant gains in word attack, word identification, reading fluency and comprehension. To examine the particular role that digital technology can play in instruction, Saine, Lerkkanen, Ahonen, Tolvanen, and Lyytinen (2011), working with seven year olds, compared traditional teacher-led instruction with a form of blended learning that coupled digital activities with teacher-led instruction. They reported that using digital technology contributed to
better reading outcomes than traditional instruction, and that for students at risk for reading difficulties the blended program helped them close the gap with their non-at-risk peers.

**Longitudinal studies of reading development**

Longitudinal studies to date have typically considered long-term outcomes when students receive traditional teacher-led instruction. These studies consistently show that when there is a literacy gap in early grades—often between students from high and low SES backgrounds—the gap persists over time (e.g., Juel, 1988; Connor et al., 2013). As Juel (1988) highlighted in her seminal work, without intervention there is immutability in reading ability, meaning that if a student begins first grade as a struggling reader, that student leaves fourth grade still struggling in reading.

A few longitudinal studies have considered the extent to which reading interventions can alter the trajectory of development for struggling readers. In one study Simmons et al. (2008) found that small-group, phonics-based intervention for low performers in kindergarten was effective at increasing literacy skills by the end of the school year. Students who showed low performance in subsequent years were given further instruction resulting in additional improvements through third grade. Connor et al. (2013) decided to assess more systematically the importance of *number of years* of intervention. Struggling readers in first through third grade were provided with one or more years of individualized instruction designed to treat difficulties in word reading, vocabulary, and comprehension. Students who received three years of instruction showed more advanced reading skills than students who received fewer years.

More recently, Lovett et al. (2017) extended the findings of previous studies by examining the impact of *when* reading interventions were initiated for struggling readers. They reported on a highly intensive intervention program in first through third grade in which trained teachers delivered lessons in 50-minute pull-out sessions to small groups of students with homogenous skill deficits. Students in the study who received instruction beginning in early grades, especially first grade, showed greater long-term reading gains than students who began later on.

In terms of examining digital technologies, longitudinal studies have nearly always considered short-term program use (e.g., three months) and looked at residual benefits once the program is completed (Hurwitz, 2018). The present study, on the other hand, addresses benefits of digital technology as part of a blended learning program implemented over three years. The program—Lexia® Core5® Reading—was implemented in an elementary school in a low SES neighborhood. Students began the program in
kindergarten, and their reading scores were tracked through the end of second grade. In an earlier, one-year study Schechter, Macaruso, Kazakoff, and Brooke (2015) reported benefits of Core5 for low SES students. First- and second-grade students who used Core5 showed significantly greater reading gains on a standardized test than control students not using Core5. The aim of the present study was to determine whether additional evidence in support of this approach would be seen in a multi-year implementation.

**Summer slide**

In the context of multi-year, school-based studies, it is important to consider the possible impact of a summer learning loss between school years. Historically, there have been concerns about time off from school in the summer and its effect on student performance. In an oft-cited study, Cooper, Nye, Charlton, Lindsay, and Greathouse (1996) conducted a meta-analysis of studies dating back to 1906 and concluded that summer learning loss, or summer slide, is about one month using a grade-level equivalent scale. More recently, Sandberg Patton and Reschly (2013) compared DIBELS Oral Reading Fluency scores from spring to fall and reported a significant decline for students in Grades 2 and 3, but not older students.

A consistent finding on summer slide is that its impact is worse for students from low SES compared to high SES backgrounds (Cooper et al., 1996; McEachin & Atteberry, 2017; Sandberg Patton & Reschly, 2013). The cumulative effects of summer slide were well documented by Alexander, Entwisle, and Olson (2007). They traced the achievement gap between high and low SES high school students to performance discrepancies that occurred over the previous nine summers, which may be attributed to more limited learning experiences in the summer for low SES students.

In the present three-year longitudinal study, we examined reading gains within each school year by comparing fall scores and spring scores from the same school year. In addition, we had an opportunity to investigate summer slide by comparing scores in the fall of one school year with scores from the spring of the previous school year. (Results from just the kindergarten year of this study were reported in Prescott, Bundschuh, Kazakoff, and Macaruso, 2017.)

**Research questions**

1. Does participating in Core5 lead to yearly gains on a standardized reading test for elementary school students from a low-SES background?
2. Is there evidence of summer slide for students from a low-SES background who participated in Core5?

3. Is there evidence of long-term reading gains for students from a low-SES background who participated in Core5 despite the possibility of a summer slide?

4. Is there evidence of long-term reading gains for students who initially showed low performance on a standardized reading test and then participated in Core5?

5. Is performance in Core5 consistent with the pattern of reading scores across three years of the study?

**Method**

This longitudinal study was conducted over three years, beginning in the fall of the 2014-2015 school year when the students started kindergarten and ending in spring of the 2016-2017 school year when they completed second grade. The school used Core5 (Lexia Learning, Concord, MA) as the main component of its blended learning approach to English language arts (ELA) instruction in each school year. Reading performance was assessed with the Group Reading Assessment Diagnostic Evaluation (GRADE; Williams, 2001) at six time points—fall and spring in kindergarten (Year 1), first grade (Year 2), and second grade (Year 3).

**Participants**

Participants were students who attended kindergarten in an urban elementary school during the 2014-2015 school year. Initially there were 83 kindergartners who accessed the digital component of Core5 during the 2014-2015 school year. Of these students, 68 continued to use Core5 in first grade (Year 2) and second grade (Year 3). These 68 students received the GRADE at the beginning and end of each school year and constitute the final sample. The remaining students were excluded from analyses because they either left the school before the study was completed and/or did not receive the GRADE at all six time points. An average yearly attrition rate of 6% (15 students over three years) is considered low, especially for students from a low SES background (Hansen, Tobler, & Graham, 1990; Hurwitz, Schmitt, & Olsen, 2017).

The study school was designated as a Title I school, with 74% of the students in the final sample qualified for free or reduced-price lunch. Schools with a high percentage of students from low-SES backgrounds receive Title I funds for school-wide initiatives to support academic achievement (U.S. Department of Education, 2015). The final sample had the following
demographic characteristics: gender (53% male, 47% female); ethnicity (43% Black, 37% White; 16% Hispanic; 4% Other); English learner (EL) status (16% EL, 84% non-EL).

**Procedure**

Students in the study were first taught in four kindergarten classes, followed by six first-grade classes and then five second-grade classes. The school is classified as having over 95% of its classes taught by highly qualified teachers according to the state’s department of education. Teachers in the district were encouraged to use the Daily 5 framework during their ELA block (Boushey & Mosher, 2006). The Daily 5 has students rotate between literacy centers (e.g., reading to self, reading to someone else, listening to reading) while teachers work one-to-one or in small groups with students.

**Instructional program**

The school adopted Core5 as the main component of its blended learning approach to ELA instruction. Core5 includes online activities and progress monitoring along with teacher-led lessons and paper-and-pencil tasks for independent work.

The online component of Core5 provides a systematic path for reading instruction. The program targets six strands of reading: phonological awareness, phonics, structural analysis, fluency, vocabulary, and comprehension. The activities in these strands are aligned to the Common Core State Standards (CCSS; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) for kindergarten through fifth grade and organized into 18 levels: preschool (Level 1), kindergarten (Levels 2-5), first grade (Levels 6-9), second grade (Levels 10-12), third grade (Levels 13-14), fourth grade (Levels 15-16), and fifth grade (Levels 17-18).

**Placement**

An auto-placement tool is utilized by the online component of Core5 to place students at their appropriate Core5 level in the program. For example, a first grader who is reading below grade level might be placed in Level 2 (beginning of kindergarten) while her classmate who is reading at grade level might be placed in Level 6 (beginning of first grade). Students were given the auto-placement tool at the beginning of each school year. This allowed the program to begin the year providing instruction at each student’s skill level. Given the possibility of summer slide, it is valuable to re-assess a student’s skill level at the start of each school year.
**Scaffolding**
In the online component of Core5, students are required to reach 90%–100% accuracy for each unit in an activity before moving on to higher units. When students struggle in a unit, the online component provides support by using a scaffolded task with fewer stimuli and more structure. If students continue to struggle, the online component provides direct instruction that explicitly addresses the errors made. Students must successfully complete all (non-scaffolded versions of) activities in a level to move up to the next level.

The online component of Core5 also provides teachers with an implementation dashboard that highlights students who are struggling on activities with suggested Lexia Lessons to be administered by the teacher or designated educator. In addition, once students complete a level in the online component, paper-and-pencil tasks called Lexia Skill Builders are made available for students to work on independently to build automaticity and generalize skills beyond the online component.

**Other ELA resources**
In addition to the online component and supporting materials from Core5, teachers had access to other resources in their ELA curriculum. These included Early Reading Intervention (kindergarten), Sight Words You Can See (first and second grade), Pearson Reading Street, and Lively Letters. For students with more intensive needs, Project Read Phonics, Bonnie Kline Stories, and Fountas & Pinnell Leveled Literacy Intervention Systems were also available.

**Instructional program implementation**
In each school year teachers were instructed to have students use the online component of Core5 in accordance with recommended minutes (20 to 60 minutes per week). Students were said to have met minimum program requirements for a school year if they used the online component for at least 20 weeks and met usage recommendations for at least 50% of those weeks. All students in the study met the minimum program requirements.

| Table 1. Instructional program implementation location and amount of use, years 1–3. |
|---------------------------------------------------------------|
| **Primary location of use** | Kindergarten Year 1 | Grade 1 Year 2 | Grade 2 Year 3 |
| Number and type of devices | Classroom | Classroom | Classroom |
| 2-4 desktops | 4-6 desktops | Approx. 15 laptops |
| Secondary location of use | library | library | — |
| Average number of weeks met use | 26 | 34 | 33 |
| Average number of minutes | 2,140 | 2,492 | 2,276 |
during the school year. Table 1, provides details about the location and amount of online use in each school year.

**Educator interviews**

To learn more about implementation of Core5 in the classrooms, interviews were conducted with two kindergarten teachers in Year 1, two first-grade teachers in Year 2, and four second-grade teachers in Year 3. Every teacher reported using the online component of Core5 as a center in their ELA block. All but one teacher mentioned using the dashboard to monitor students’ time in the online component, and also finding extra computer time (e.g., at the beginning of the school day or in the library) for students not meeting recommended minutes. In addition, all teachers indicated that they gave Lexia Lessons in small groups to students identified as struggling in the online component. The sections below highlight comments made by teachers in each grade.

- **Year 1.** Both kindergarten teachers used visual displays in the classroom to chart student progress. They held mini-celebrations when students completed a level in the online component.
- **Year 2.** Both first-grade teachers pointed out how much their students enjoyed using the program, in some cases asking to use it during recess or questioning why on certain days use of the program was being replaced by another activity. The teachers also indicated that they printed out student progress reports to discuss and share with parents at parent-teacher conferences.
- **Year 3.** The second-grade teachers had been implementing Core5 for over two years and thus had become quite adept at using various features of the dashboard. For example, two teachers used “low accuracy/slow rate” markers to add students to groups receiving a Lexia Lesson even when the students were not explicitly flagged for the lesson. The second-grade teachers also reported using Lexia Skill Builders as a center activity.

**Observations**

Members of the research team visited the four kindergarten, six first-grade, and five second-grade classes to observe students using the online

| Year 1 | Year 2 | Year 3 |
|--------|--------|--------|
| Kindergarten | Grade 1 | Grade 2 |
| Percentage of observer agreement | 96% (26/27) | 98% (112/114) | 98% (112/114) |
| Percentage rated “on task” | 98% (57/58) | 87% (226/260) | 67% (140/208) |
component of Core5. The observations occurred in January/February in each school year. Momentary time sample observations were collected at two time points in each session with the exception of one second-grade class that was observed only once. Observations took place in the classroom or the library. Independent observations were made by two observers for all classes with the exception of one kindergarten class that was seen by only one observer. Specific data on the observations in each grade are provided in Table 2.

Reading assessment
As an assessment of reading performance, the GRADE was administered in the fall (September/October) and spring (May/June) of each school year. Participants were tested with Level K in kindergarten, Level 1 in first grade, and Level 2 in second grade. Level K has seven subtests—Sound Matching, Rhyming, Print Awareness, Letter Recognition, Same/Different Words, Listening Comprehension, and Word Reading. Levels 1 and 2 both have five subtests—Word Reading, Word Meaning, Sentence Comprehension, Passage Comprehension, and Listening Comprehension. Separate forms were given at the beginning and end of each year. The GRADE was normed using a national sample of over 30,000 students with diverse SES backgrounds, ethnicities, and learning abilities (Pearson).

The GRADE was administered following standard testing procedures in the classrooms. According to the GRADE scoring protocols, raw scores on the subtests at each level (with the exception of Word Reading in Level K, and Listening Comprehension in Levels 1 and 2) were summed to obtain Total Test raw scores. These were converted into Total Test standard scores which were used in the analyses.

Results
The first section below examines students’ performance on the GRADE across the three school years. This is followed by a section on the GRADE performance of students identified as low performers. The final section considers students’ performance in the online component of the instruction program.

Performance on GRADE
A repeated measures analysis of variance (ANOVA) was conducted to determine if there were significant differences in GRADE scores across time points in the study. Total Test standard scores on the GRADE served as the dependent variable and time point as the independent variable. Time
point had six values: Year 1 fall, Year 1 spring, Year 2 fall, Year 2 spring, Year 3 fall, and Year 3 spring. Following a significant main effect of time point, post-hoc pairwise comparisons were conducted using Bonferroni adjustments for multiple tests to determine which pairs of time points differed significantly from one another.

Mauchly's Test of Sphericity showed that the assumption of sphericity had been violated, $X^2(14) = 58.254$, $p < .001$. Given this outcome, Greenhouse-Geisser corrected $F$ statistics were used in subsequent analyses. As shown in Table 3, a repeated measures ANOVA revealed a significant main effect of time point (Greenhouse-Geisser corrected $F(3.471, 232.545) = 58.755$, $p < .001$). Mean standard scores on the GRADE at each time point are shown in Figure 1. Post-hoc comparisons showed significant yearly gains within each grade: For kindergarten, the mean in Year 1 spring (106.85) was greater than mean in Year 1 fall (90.65); for first grade, the mean in Year 2 spring (110.72) was greater than the mean in Year 2 fall (96.35); and for second grade, the mean in Year 3 spring (107.34) was greater than the mean in Year 3 fall (100.43). A graph of student growth from Year 1 to Year 3 can be seen in Figure 1.

In addition to yearly gains within each grade, the outcomes in Figure 1 show clear evidence of summer slide. The first-grade mean in Year 2 fall (96.35) was significantly lower than the kindergarten mean in Year 1 spring.

**Table 3.** Repeated measures ANOVA.

|                  | Sum of squares | $df$  | Mean square | $F$      | $p$     | Partial $\eta^2$ |
|------------------|----------------|-------|-------------|----------|---------|-----------------|
| Time point       | 19810.571      | 3.471 | 5707.746    | 58.755   | <.001   | .467            |
| Error            | 22590.596      | 232.545 | 97.145     |          |         |                 |

**Figure 1.** Means (standard deviation bars) on GRADE over three years. *(Note: The line at the 100 mark refers to the normed mean.)*
Likewise, the second-grade mean in Year 3 fall (100.43) was significantly lower than the first-grade mean in Year 2 spring (110.72).

Despite the summer slide, significant long-term gains were found across the three school years. That is, the first-grade mean in Year 2 fall (96.35) was significantly higher than the kindergarten mean in Year 1 fall (90.65), and the second-grade mean in Year 3 fall (100.43) was significantly higher than the first-grade mean in Year 2 fall (96.35).

**Performance on GRADE – low performers**

Table 4, provides means and standard deviations on reading gains for students identified as “low performers” in the fall of kindergarten. These students obtained a Total Test standard score on the GRADE below 85 (i.e., less than the 16th percentile or below the “average” range).

Mauchly’s Test of Sphericity showed that the assumption of sphericity had been violated, $X^2(14) = 29.664, p = .009$. Thus, Greenhouse-Geisser corrected $F$ statistics were used in subsequent analyses. As shown in Table 5, a repeated measures ANOVA resulted in a significant main effect of time point (Greenhouse-Geisser corrected $F(2.942, 61.775) = 26.263, p < .001$). Post-hoc comparisons showed significant yearly gains for the low performers within each grade: For kindergarten, the mean in Year 1 spring (97.23) was greater than mean in Year 1 fall (78.41). For first-grade the mean in Year 2 spring (102.64) was greater than the mean in Year 2 fall (85.64), and for second grade the mean in Year 3 spring (97.77) was greater than the mean in Year 3 fall (90.59).

In addition to yearly gains within each grade, results for the low performers showed a significant summer slide following kindergarten and first grade. The first-grade mean in Year 2 fall 2015 (85.64) was much lower than the kindergarten mean in Year 1 spring (97.23). Similarly, the second-grade mean in Year 3 fall 2016 (90.59) was much lower than the first-grade mean in Year 2 spring (102.64).

### Table 4. Means and standard deviations on the GRADE for low performers.

|                  | Kindergarten   | Grade 1       | Grade 2       |
|------------------|----------------|---------------|---------------|
|                  | Year 1         | Year 2        | Year 3        |
|                  | Fall Spring    | Fall Spring   | Fall Spring   |
| Mean             | 78.41 97.23    | 85.64 102.64  | 90.59 97.77   |
| SD               | 3.51 10.52     | 11.47 12.47   | 12.51 10.67   |

### Table 5. Repeated measures ANOVA for low performers.

|                  | Sum of squares | df    | Mean square | F     | p     | Partial $\eta^2$ |
|------------------|----------------|-------|-------------|-------|-------|------------------|
| Time point       | 8821.182       | 2.942 | 2998.707    | 26.263| <.001 | .556             |
| Error            | 7053.485       | 61.775| 114.180     |       |       |                  |
Significant long-term gains were found for the low performers across the three school years. This was evident by comparing the mean score in the fall of second grade (Year 3) with the mean score in the fall of kindergarten (Year 1). As seen in Table 3, the second-grade mean in Year 3 fall (90.59) was much greater than the kindergarten mean in Year 1 fall (78.41). Long-term gains for the low performers were also evident when considering outcomes for individual students. Only 9% of the low performers (2/22) continued to score below the average range (i.e., standard score less than 85) at the end of second grade (Year 2 spring). The remaining 91% scored in the average range or higher. In fact, 50% of the low performers (11/22) improved at least 15 standard score points and scored at or above the normed mean of 100.

**Performance in online component of instructional program**

This section considers students’ performance in the online component of Core5 over the three school years. Comparisons were made between the students’ auto-placement level in the fall and the last level students were working on in the spring. At each time point students were classified as working above, in, or below grade level in the online component of the program.

Table 6 shows that students made clear advances in the program, starting each school year working on skills below or in grade level and ending the year having completed grade-level skills and working above grade level. There was also evidence of summer slide in the program following kindergarten and first grade. Consider that 82% of first graders were working above grade level in Year 2 spring. Without a summer slide we would expect roughly 82% of the students to start second grade (Year 3 fall) working on skills in grade level (which corresponds to above grade level in Year 2 spring). Instead, only 57% of the students started Year 3 fall working in grade level (with the rest showing some regression, starting below grade level). Despite a summer slide, most students recovered, ending the next school year working above grade level in the program. These

| Table 6. Percentage of students performing in, above, or below grade level in Core5 per grade. |
|---------------------------------------------------------------|
| Year | Kindergarten | Grade 1 | Grade 2 |
|      |               |         |         |
|      | Year 1 | Year 2 | Year 3 |
|      | Fall   | Spring | Fall   | Spring |
| Above grade level | 0%    | 93%    | 0%    | 82%  | 0%    | 79%    |
| In grade level   | 47%   | 7%     | 65%   | 18%  | 57%   | 15%    |
| Below grade level| 53%   | 0%     | 35%   | 0%   | 43%   | 6%     |

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findings—advances in the program during the school year coupled with a summer slide—were consistent with the GRADE results reported.

**Discussion**

Results of this longitudinal study demonstrated that students from a low-SES background who had access to the blended learning program—Core5—experienced significant reading gains. These students, who began in kindergarten and were followed through the end of second grade, showed significant gains from fall to spring in each school year. Notable gains were found for students identified as low performers at the beginning of kindergarten. It is likely that with each year using Core5, teachers were becoming more proficient in its implementation and thus their students continued to reap yearly benefits.

While reading gains were evident within each school year, students in the study also experienced a summer slide, in which scores in the fall were significantly lower than scores from the previous spring. However, despite a summer slide, the students demonstrated long-term benefits of the blended learning program (i.e., we found evidence of cumulative reading growth over the three school years). Fall-to-fall comparisons revealed growth from the fall of one year to the fall of the next year. This fall-to-fall growth in essence shows that school-based performance was partly able to overcome the summer slide that occurred. Overall, mean performance on the standardized reading test improved 10 standard score points from the fall of kindergarten (Year 1) to the fall of second grade (Year 3). By the fall of second grade, mean performance matched the normed mean (100) for the standardized test.

In this study we found that Core5 was particularly impactful for low performing students in kindergarten. These students are most at risk for long-term reading failure (Fuchs, et al., 2001). In the context of the program nearly all low performers scored in the average range or better by the end of second grade. The program provided these students with multiple opportunities to master skills in the online activities and when flagged as having difficulties in the educator dashboard. The teachers reported monitoring the dashboard and using Lexia Lessons to support students struggling on the same skills. These findings are consistent with others showing that effective interventions can benefit at-risk students in early grades (Connor et al., 2013; Lovett et al., 2017; Simmons et al., 2008).

Compared to other studies reporting benefits of long-term interventions, use of a well-implemented blended learning program requires less direct teacher-led instruction and is thus more practical in typical classrooms and can be used with larger numbers of students. For instance, with blended
learning even pre-readers (e.g., kindergartners) can engage in independent online activities as part of a Daily 5 center, allowing teachers more time to provide targeted, small group instruction. Consider, as an alternative, the long-term intervention program reported in Lovett et al. (2017). It required students to participate in “pull out” sessions 60 minutes per day, 5 days a week. Students had over 100 sessions across the school year. This type of intervention is impractical in most classrooms that do not have an intensive pull-out capacity.

**Summer slide**

As reviewed previously, the low-SES students in this study showed clear evidence of summer slide. A significant decline in reading scores followed kindergarten and first grade. Fortunately, we found overall growth from fall of kindergarten to fall of second grade showing that the students were able to partly overcome the slide in the context of the blended learning program during the school year. Of course, we may have demonstrated more striking benefits of school instruction if greater efforts were made to lessen the impact of summer slide. One practical approach would be for school districts to provide easy, summer access to reading materials in low-SES neighborhoods. They could also implement reading programs with plenty of incentive-laden assignments for students to complete over the summer.

More organized approaches that offer summer learning programs for large numbers of students in low-SES neighborhoods have met with some success (e.g., McCombs et al., 2014). However, such programs typically do not allot enough time and attention to reading instruction. One intensive summer program for students with reading difficulties was recently reported by Christodoulou et al. (2017). Participation in their Lindamood-Bell program—Seeing Stars—was found to stem the effects of summer slide. Thus, targeted summer reading instruction for at-risk students would seem to be most effective, allowing teachers to focus more on accelerating reading growth in the school year rather than overcoming a slide.

**Limitations/weaknesses**

One of the main limitations of the present study is that we did not have access to a control group to compare to students participating in the blended learning program. Our attempts to locate control students from a low-SES school whom we could assess multiple times without offering instructional support went without avail. To address this shortcoming, we administered a standardized reading test at the beginning and end of each school year. Given that grade-based norming samples were used to obtain
standard scores at each time point, we were able to assess reading performance relative to norms over multiple school years.

Although the digital component of Core5 tracks usage information and student progress, other aspects of the blended learning program were not monitored as carefully. In interviews, educators reported that they made use of offline materials—Lexia Lessons and Skill Builders—when indicated in the educator dashboard. However, we were not able to gather exact information on delivery of these offline resources. (It should be noted that although not available during the time of this study, Core5 now has a feature to track delivery of offline resources.) Also, without a daily presence in the classrooms, we were unable to monitor the extent to which other classroom resources were used to support student learning. Thus, the ability to identify precisely which elements of the blended learning program contributed to reading gains was not fully captured in the study.

**Future directions**

While this study has demonstrated the longitudinal impact of Core5 in early elementary grades, it would be beneficial to examine its benefits for students in upper elementary grades as well. A vast amount of research over the last few decades has shown that reading success in later years can be determined as early as third grade (Fuchs et al., 2001). With third-grade reading proficiency guarantees now existing across the United States (National Conference of State Legislatures, 2018), it is a crucial time to investigate how well blended learning can affect reading performance in upper elementary grades and whether it has long-term effects into middle and high school years.

Though the intent of this work was not to study summer slide, our findings indicate that it was indeed a significant factor affecting reading scores for the low SES students in the study. Thus, in future studies we intend to investigate whether blended learning applied in the summer can be used to mitigate the effects of slide.

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