Elementary school–wide implementation of a blended learning program for reading intervention

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ABSTRACT

The authors examined the implementation of a blended learning program for literacy instruction across kindergarten through Grade 5 in a Title I urban elementary school, including a population of students (18%) who are English learners. Student progress in the online component of the blended learning program was a significant predictor of growth in reading performance on a standardized reading assessment (Group Reading Assessment and Diagnostic Evaluation, Pearson Assessment, Boulder, CO) when controlling for student grade level, initial student skill level, and English learner status; however, students in kindergarten through Grade 2 showed more substantial gains than students in later grades. These results suggest there is a benefit of a blended learning approach to literacy instruction for a diverse cross-section of students, particularly when beginning instruction in the early grades.

Becoming a proficient reader by Grade 3 is a key predictor of future academic and career success, including high school graduation (Fiester, 2013); however, according to the U.S. Department of Education’s National Center for Education Statistics (2015), only one third of elementary students scored proficient on a national assessment of reading skills and scores did not improve from 2013 to 2015. Limitations in reading are even more evident for students from low socioeconomic status (SES) backgrounds in which 80% fail to meet reading proficiency milestones (Campaign for Grade-Level Reading, 2014; National Center for Education Statistics, 2016). In addition, approximately 90% of students who are English learners (ELs) score below the proficient level in reading (National Center for Education Statistics, 2015). Thus, there is an urgent need to identify instructional approaches that can effectively boost reading skills in elementary school students, particularly those from low-SES backgrounds and students who are ELs.

One approach to reading instruction that has gained popularity in recent years is blended learning (Horn & Staker, 2011). This approach, described in the next section, combines teacher-led instruction with the use of digital technology and application of student data to teacher instruction. Blended learning may be well suited to meet the needs of diverse groups of students, such as students with various degrees of English proficiency. At the present time, there is limited research examining the effectiveness of blended learning, especially at the elementary school level. To address this need, in the present study we considered a whole-school implementation of a blended learning program for reading instruction across grades K–5 in an elementary school in a low-SES neighborhood. This study extends previous research that reported significant benefits in reading when a blended learning program was implemented on a smaller scale with first and second-grade students from low-SES backgrounds (Schechter, Macaruso, Kazakoff, & Brooke, 2015). Results of the prior study revealed overall pretest–posttest gains in reading skills, particularly in the area of reading comprehension. A subanalysis also demonstrated the greatest reading gains occurred for ELs who were the lowest performers at pretest.

Blended learning

Blended learning incorporates face-to-face, teacher-led instruction along with digital technology using actionable data to provide students with a personalized educational path (Horn & Staker, 2011). With blended learning, students have some degree of control over the content, pace, time, and location of their learning (Powell et al., 2015). The real-time data typically provided through digital technology in a blended learning approach help teachers differentiate instruction based on students’ varied progress (Horn & Staker, 2011; Hilliard, 2015). Teachers utilizing blended learning can target instruction to the specific learning profiles of their students, from Tier III to gifted and talented, as blended learning models can support whole-class, small-group, and independent work (Freeland, 2015; Powell, Rabbitt, & Kennedy, 2014). By differentiating instruction, blended learning may provide opportunities for class- or schoolwide improvements in reading with diverse populations (Powell et al., 2015). Based on the purported benefits over traditional instructional models, blended learning is gaining popularity not only for targeted populations, but also in general education settings (Horn & Staker, 2011).

Blended learning can take various forms, thus allowing users to adapt a program that best fits their pedagogical goals and physical setting. Blended learning may include a station rotation, lab rotation, flipped classroom, or individual rotation
among other forms (Christensen, Horn, & Staker, 2013; Horn & Staker, 2011). In elementary schools, such as in the present study, a station rotation is a commonly implemented form of blended learning. This form is considered a good fit for elementary schools because it builds upon the traditional classroom model of activity centers (Evans, 2012). In this form of blended learning, students rotate in small groups within the classroom to stations, including at least one digital component (Powell et al., 2015). A lab rotation, also implemented in elementary schools, consists of students visiting a computer laboratory for the digital component of blended learning. In some cases, schools take an eclectic approach to blended learning, utilizing both station and lab rotations (and even home use of the digital technology), together with teacher-led whole-class or small-group instruction.

Research regarding the potential benefits of blended learning is limited, especially in elementary school settings. In studies that have explored blended learning in higher education, students in a blended learning program self-reported as more motivated (Vaughan, 2014), more supported (Lim, Morris, & Kupritz, 2014), and provided with more helpful resources (H. Kim, 2014) than did peers in traditional classes. In both higher education and high schools, blended learning is being used to personalize learning by providing students with a larger variety of courses than could be offered in traditional classes (Hilliard, 2015; Picciano, Seaman, Shea, & Swan, 2012).

In the case of elementary schools, there is a body of research examining digital technology (historically referred to as computer-assisted instruction [CAI] in acquiring literacy skills; however, this research typically has not considered the use of digital technology immersed in an English language arts (ELA) curriculum a blended learning approach, combining digital and paper-and-pencil activities. Earlier studies have shown benefits of CAI for developing phonological awareness (Cassady & Smith, 2004; de Graaff, Bosman, Hasselman, & Verhoeven, 2009; Lonigan et al., 2003; Macaruso & Walker, 2008; M. J. Mitchell & Fox, 2001; Savage et al., 2013; Segers & Verhoeven, 2005; Wild, 2009) as well as word attack (i.e., letter-sound) knowledge (Macaruso, Hook, & McCabe, 2006; Segers & Verhoeven, 2005), word identification skills (Hecht & Close, 2002; Macaruso & Rodman, 2011b; Saine, Lerkkanen, Ahonen, Tolvanen, & Lyytinen, 2011; Shelley-Tremblay & Eyer, 2009; van Daal & Reitsma, 2000), and rapid naming or word reading fluency (Johnson, Perry, & Shamir, 2010; Saine et al., 2011). Benefits of CAI have also been reported for students who are ELs, including those from low-SES backgrounds (Macaruso & Rodman, 2011a; Rodriguez, Filler, & Higgins, 2012).

The use of digital technology as a key component of blended learning allows for sufficient, independent practice that may not be possible within a traditional classroom setting without technological support (Johnson, Perry, & Shamir, 2010). The application of blended learning, especially in elementary schools, is a “cultural shift in instruction and learning” (Powell et al., 2015, p. 6) and whole-school implementation poses its own unique benefits and challenges. Teachers who have incorporated blended learning into their classes believe that support from administrators and colleagues was paramount to their success (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012). Whole-school conversion of traditional instruction to blended learning requires a large community investment to overcome potential difficulties (Powell et al., 2015). A number of key qualities, such as a shared vision, a viable instructional design, the ability to integrate offline teacher-led instruction with online digital technology, professional development for teachers, and a supportive IT department are all needed to achieve a successful implementation of blended learning (A. Kim, 2015).

Blended learning and subpopulations

Blended learning can support diverse learner profiles through differentiated instruction. One subset of students who may show particular benefits from blended learning is students who are ELs. As indicated previously, students who are ELs typically score below the proficient level in reading at high rates nationally (National Center for Education Statistics, 2015). Additionally, U.S. schools have seen an increase in the number of students who are ELs and also Black (Anderson, 2015). To address this growing population, the U.S. Department of Education’s Office of English Language Acquisition and the White House Initiative on Educational Excellence for African Americans have launched a series of tools and programs to support educational growth, including research on EL students who are Black (Harris, 2015). This partnership represents an interest in understanding how to best address the learning needs of students who are ELs and Black, as well as students who are ELs in general (C. Mitchell, 2015). At this point, there is a lack of research on which reading interventions best serve students who are ELs (Begeny, Ross, Greene, Mitchell, & Whitehouse, 2012). It is certainly possible that being immersed in a blended learning program may provide these students with an opportunity to enhance their reading skills and perhaps close the gap with their peers who are not ELs.

When considering growth in language and literacy skills, various factors come into play, which may impact the performance of students who are ELs. These include age, length of exposure to oral language or literacy in both their native language and English, quality of oral language or literacy exposure in the two languages, and SES level (Lesaux, Koda, Siegel, & Shanahan, 2006). While some research has shown that, in terms of basic reading skills such as phonological awareness, letter-sound knowledge, and word identification, students who are ELs tend to show similar developmental paths as students who are not ELs (Lesaux, Koda, Siegel, & Shanahan, 2008), other studies have demonstrated students who are ELs typically underperform relative to their peers who are not ELs in English oral language proficiency (Geva & Yaghoub Zadeh, 2006). As such, reading programs for students who are ELs should take into account individual differences in oral language and reading abilities and provide personalized instruction to meet each student’s needs (August, McCardle, & Shanahan, 2014). A properly implemented blended learning program may be well suited for this purpose.

Students who are ELs may be provided with access to digital technologies both for their own English language development and as part of school- or classwide program use. While research is limited, some studies have explored the use of digital technology as an intervention for students who are ELs. Two early
studies by Troia (2004) and Denton, Anthony, Parker, and Hasbrouck (2004) reported modest or no benefits in using digital technology with students who are ELs. Troia used a digital technology program as an intensive intervention with students who are ELs and found that benefits in reading were only seen when analyses were restricted to the least fluent students. Denton et al. found that in contrast to traditional one-to-one tutoring, in which benefits in reading were seen with students who are ELs, no benefits were seen when students who are ELs used a digital technology program instead. More promising results were reported by Lopez (2010), who found that students who are ELs in classrooms with interactive whiteboard technologies outperformed students who are ELs in traditional classrooms on state reading and mathematics tests. It was also found that students who are ELs in technology-rich classrooms started to close the learning gap with their peers who are not ELs (Lopez, 2010).

**Research questions**

The following research questions were addressed in the present study:

Research Question 1: Do students from a Title I school (indicating a low-SES background) make significant gains on a standardized reading test following participation in a blended learning program?

Research Question 2: Are there differences in gains on a standardized reading test based on student grade?

Research Question 3: Are there differences in gains on a standardized reading test for students who are ELs compared to students who are not ELs?

Research Question 4: Is there a relationship between progress in a blended learning program and gains on a standardized reading test?

**Method**

The study school utilized a blended learning approach to ELA instruction during the 2014–2015 school year by adopting Lexia Reading Core5 (Lexia Learning, Concord, MA) as the main component of their curriculum. Reading performance was pre- and posttested with the Group Reading Assessment and Diagnostic Evaluation (GRADE; Williams, 2001).

**Participants**

Participants were students in kindergarten through Grade 5 from an urban elementary school that, according to U.S. Department of Education’s Office for Civil Rights (2012), was part of a district with one of the country’s largest populations of students who are both ELs and Black. For the state in which the study was conducted, only 24% of students who are ELs scored proficient or above on the 2013–2014 state reading and language arts assessment, well below the 69% proficient or above for all students in the state (National Clearinghouse for English Language Acquisition, 2016).

A total of 722 students accessed the digital component of Core5 during the 2014–2015 school year. Of these students, 641 were both pre- and posttested with the GRADE and included in the final sample. The remaining students were excluded from analyses because they did not receive both pre- and posttests. Most students in the sample were either Black (46.0%) or White (34.5%), with the rest Latino (11.7%), multirace (5.0%), Asian (2.2%), American Indian or Alaskan Native (0.5%) or Native Hawaiian or Pacific Islander (0.2%). The school was a Title I school, with over 70% of participants qualified for free or reduced-price lunch. Schools with a high percentage of students who are from low-SES backgrounds, similar the school in this study, are eligible to receive Title I funds for schoolwide initiatives to support academic achievement (U.S. Department of Education, 2015).

Students who are ELs comprised 18.4% of the sample (118 students), based on scores obtained in January 2015 from WIDA ACCESS for ELs (The Board of Regents of the University of Wisconsin System, 2009), an English language proficiency assessment. Of those 118 students who were ELs in this study, nearly all (90%) were also Black (representing 37% of the students who are Black in the total sample). The native language for the vast majority of students who are ELs was Haitian-Creole (86.4%). Other native languages included Cape Verdean (5.9%), Portuguese (3.4%), Spanish (3.4%), and Urdu (0.8%). The proportion of students in the sample who are ELs and students who are not ELs by grade is presented in Table 1.

**Procedure**

The school is classified as having over 95% of its classrooms taught by highly qualified teachers according to the state’s Department of Education. Teachers were asked to employ a blended learning approach to reading instruction by incorporating Core5’s digital technology and offline materials into their existing ELA framework. The ELA Common Core State Standards (CCSS; National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010) provided structure for the ELA curriculum and teachers were allowed to use various resources to meet CCSS requirements.

There were a total of 31 classes in the study. The number of classrooms varied per grade, with four kindergarten classes, six classes per grade in Grades 1 and 2, and five classes per grade for Grades 3–5. Each grade had one sheltered English instruction (SEI) class in which students who are ELs were taught by teachers who modified the curriculum to accommodate their students’ limited English proficiency (Freeman & Freeman, 1988). Modifications included more exposure to oral language activities including vocabulary through repetition, as well as adapting lesson plans to repeat specific activities, if needed.

| Grade | Non-EL | EL | Total |
|-------|--------|----|-------|
|       | %      | n  | %     | n    |       |
| Kindergarten | 79.8 | 67 | 20.2 | 17 | 84 |
| 1     | 81.1  | 90 | 18.9 | 21 | 111 |
| 2     | 78.9  | 86 | 21.1 | 23 | 109 |
| 3     | 79.4  | 100 | 20.6 | 26 | 126 |
| 4     | 86.4  | 89 | 13.6 | 14 | 103 |
| 5     | 84.3  | 91 | 15.7 | 17 | 108 |
| Total | 81.6  | 523 | 18.4 | 118 | 641 |

EL = English learner.

Table 1. Proportion of non-EL and EL students, by grade.
teachers for these classes had an SEI endorsement, which included training in recent theories and evidence-based pedagogy on instruction for students who are ELs. The SEI classes followed a similar curriculum as the general education classes in their respective grades. The majority of students who were ELs in this study (75.4%) were taught in SEI classes.

District-wide, teachers were encouraged to use the Daily 5 framework (Boushey & Moser, 2006), a classroom management program in which students rotate between five literacy activities while teachers work one-to-one or in small groups with students. The Daily 5 activities included reading to self, writing, reading to someone else, listening to reading, and independent work (Boushey & Moser, 2006). The Daily 5 is consistent with a station rotation form of blended learning.

To institute a blended learning approach to reading instruction, the school adopted Core5’s digital technology and offline materials. Core5 served as the main component of the ELA curriculum with other digital and offline resources playing a supplemental role, as needed. Core5 includes online activities and progress monitoring along with teacher-led lessons and paper-and-pencil tasks for independent work. Research has shown that elements of this blended learning approach have supported development of phonological awareness and word identification skills in kindergartners who are low performers (Macaruso & Walker, 2008; Macaruso & Rodman, 2011b) or ELs (Macaruso & Rodman, 2011a), and reading comprehension for first- and second-grade students from a low-SES background (Schechter et al., 2015).

The online component of Core5 provides a systematic and personalized path for reading instruction. The program contains target six strands of reading: phonological awareness, phonics, structural analysis, automaticity or fluency, vocabulary, and comprehension. Activities in these strands address the CCSS for ELA and are systematically aligned to the reading foundational skills, reading informational text, and reading literature standards for kindergarten through Grade 5. The activities are organized into 18 levels: preschool (Level 1), kindergarten (Levels 2–5), Grade 1 (Levels 6–9), Grade 2 (Levels 10–12), Grade 3 (Levels 13–14), Grade 4 (Levels 15–16), and Grade 5 (Levels 17–18). Students begin the online component of Core5 in Grade 1 and progress at their own pace, with activities designed to build automaticity of skills, expand language abilities, and generalize skills from the digital technology to paper and pencil. Semi-structured interviews with teachers in each grade implementing Core5 in the schools corroborated their use of the online and offline components (full qualitative findings from these interviews will be presented in a future publication).

Teachers had access to an online implementation dashboard which tracked students’ progress in meeting weekly usage recommendations.

Teachers were instructed to have students use the online component in accordance with recommended minutes (20–80 min/week), which were assigned to students on a monthly basis. Recommended minutes were automatically assigned to students based on their overall risk level, which is defined as their likelihood of completing all of the levels in Core5 for their grade by the end of the school year. As a general program rule, students are considered to have met usage recommendations for the school year if they used the online component for at least 20 weeks and met recommended minutes for at least 50% of those weeks. In this study, 74% of students met usage recommendations and all students were included in analyses regardless of meeting usage.

The average number of weeks students used the online component of the program was 28.56. The percentage of students who met usage recommendations also varied by grade, with the strongest usage in kindergarten (100%), Grade 1 (91.0%) and Grade 2 (92.7%), followed by Grade 4 (64.1%), Grade 3 (62.7%) and Grade 5 (44.4%). In addition to tracking usage, the dashboard provides information about which students are struggling on activities in the online component with suggested lessons to be administered as part of teacher-led instruction. The dashboard also recommends paper-and-pencil tasks that students can work on independently when they have successfully completed a level in the online component. These tasks are designed to build automaticity of skills, expand language abilities, and generalize skills from the digital technology to paper and pencil. Semi-structured interviews with teachers in each grade implementing Core5 in the schools corroborated their use of the online and offline components (full qualitative findings from these interviews will be presented in a future publication).

The data on student usage indicate that in general the online component of Core5 was implemented with high fidelity. To further assess fidelity of implementation, six members of the research team visited the 31 classes in January 2015 to observe students using the online component. Observations were made at two time points in a session, except one class that had a single time point. At each time point, students working on the online component were rated as engaged, not engaged, or not at his or her seat. There were a total of 357 observation events, in which 80.1% (286 of 357 events) occurred in the classroom and 19.9% (71 of 357 events) in the school library. Observations were made by two observers at 60.2% (215 of 357) of the events and by a single observer at 39.8% (142 of 357) of the events. There was strong interobserver agreement, 93% (200 of 215), on students’ engagement with the online component. For the 15 events in which there was a disagreement, one observer rated the student as engaged and the other observer rated the same student as not engaged. Overall, there were 572 individual observations. Students were rated as engaged for 90% (515 of 572) of these observations.

In addition to Core5’s online and offline materials, teachers had access to supplemental resources in support of their ELA curriculum. These resources, consistent with a systematic and structured approach to literacy instruction, included Pearson Reading Street, Early Reading Intervention (kindergarten), Lively
Letters (kindergarten to Grade 2), Scholastic News magazines (My Weekly Reader), Sight Words You Can See (Grades 1–2), and Reading A to Z (grades 3–5). For students who required more intensive intervention, Project Read Phonics, Written Expression, and Bonnie Kline Stories, Fly Leaf, Fountas & Pinnell Leveled Literacy Intervention Systems (Grades 1–3), and S.P.I.R.E (Grades 2-5) were all available for use by trained interventionists. Reach by National Geographic was also used with ELs.

**Measures**

**Growth on the GRADE.** As an assessment of reading performance, students were administered the GRADE, Level K (kindergarten), Level 1 (Grade 1), Level 2 (Grade 2), Level 3 (Grade 3), Level 4 (Grade 4) or Level 5 (Grade 5; Williams, 2001). Students received Form A in October 2014 as a pretest and Form B in May 2015 as a posttest. Standard administration of the GRADE was conducted in all cases.

The GRADE contains developmentally appropriate subtests designed to measure component reading skills at each grade level (e.g., phonological awareness in Level K, word reading in Level 2, passage comprehension in Level 5). For the present study, analyses were conducted using Total Test standard scores. The Total Test is a composite score, designed to provide an overall assessment of students’ reading performance across all grade levels, which is necessary for studying the impact of a schoolwide blended learning approach.

Standard scores reflect a student’s performance relative to a norm sample of students in the same grade administered the same test at the same time point in the school year. A standard score of 100 represents the mean for the norm sample, and scores within one standard deviation of the mean (85–115) fall in the average range. Standard scores were examined at preand posttest and growth on the GRADE was determined by subtracting pretest from posttest standard scores.

**EL status and student grade.** EL status was indicated as a binary variable (1 for students who are ELs, 0 for students who are not ELs) as determined by the WIDA Access measure. Student grade was indicated as 0 (kindergarten) to 5 (Grade 5).

**Beginning-of-year skill level.** Students begin the online component of Core5 with an embedded assessment that placed them in a level consistent with their reading ability. Beginning-of-year (BOY) skill level was calculated based on the level in which students were placed in Core5 compared to their grade. For example, a third-grade student placed at Level 11 in Core5 (a Grade 2 skill level) would have a BOY skill level of –1, indicating one grade level below the student’s grade.

**Levels completed.** Advances in the online component of the blended learning program (levels completed) were measured by subtracting a student’s placement level in Core5 from the student’s end-of-year level in Core5. Because there are 18 levels in Core5, levels completed could range from 0 to 18.

**Analytic plan**

Repeated measures analyses of variance. To assess whether the 641 students showed significant growth on the GRADE overall, repeated measures analyses of variance (ANOVAs) were conducted in SPSS 24.0 for Windows. Greenhouse-Geisser–adjusted F statistics are reported for tests within groups for all repeated measures ANOVAs to control for possible sphericity (Abdi, 2010). The interaction between time point (pretest, posttest) and EL status (EL, non-EL) was tested to examine whether the degree of growth from pretest to posttest differed for students who were ELs and those who were not ELs. To examine pre- and posttest differences both within and between groups, post hoc tests were run with Bonferroni corrections. Resulting effect sizes were interpreted using Cohen’s (1988) values for partial eta squared (ηp²), where a value of below .01 is considered small, .06 is considered medium, and .14 is considered large.

**Multiple regression.** Multiple regression in SPSS 24.0 for Windows was used to examine how well the number of levels completed in Core5 predicted growth on the GRADE. Control variables included EL status, student grade, and BOY skill level for all 641 students. Each student grade was treated as a categorical variable, with dummy variables created for each grade. Third grade was chosen as the comparison grade because of its relative importance in literacy development. Grade 3 is when students transition from learning to read to reading to learn (Fiester, 2010; Campaign for Grade-Level Reading, 2014), when high-stakes testing begins in most schools (Fiester, 2013; O’Brien, 2008), and when students may be held back if they perform below proficiency levels (Zakariya, 2015). The final model included only significant independent and control variables. As a result of the sample selection, students included in the analyses had no missing data on any of the variables.

**Results**

**Gains on a standardized reading assessment**

Repeated measures ANOVAs were conducted by grade, including all 641 students to determine if students showed significant growth on the GRADE. Time point (pretest, posttest) served as a within-subjects factor and EL status as a between-subjects factor, with an interaction term for time by EL status as a within-subjects factor. Separate analyses were conducted by grade (see Table 1 for proportion of students who are ELs and students who are not ELs by grade). Mean differences in GRADE Total Test standard scores by grade and EL status are shown in Table 2.

**Kindergarten.** Kindergarten students (n = 84) as a whole showed significant growth on the GRADE from pretest to posttest, within time: Greenhouse-Geisser–adjusted F(1, 82) = 158.529, p < .001, ηp² = .659. The interaction between time point and EL status was not significant, indicating that students who were ELs and students who were not ELs showed similar growth on the GRADE. Greenhouse-Geisser–adjusted F(1, 82) = 2.562, p = .113, ηp² = .030. The main effect of EL status was significant, F(1, 82) = 13.124, p < .01, ηp² = .138, as students who were ELs scored below students who were not ELs both at pretest and posttest. However, as seen in Table 2, students who were ELs showed improvement on the GRADE. At pretest, students who were ELs scored well below the average range (M = 79.88), whereas at posttest they scored solidly within the
average range (100.18), closing the gap with their peers who are not ELs.

**Grade 1.** First-grade students \((n = 111)\) showed significant growth on the GRADE from pretest to posttest, within time: Greenhouse-Geisser–adjusted \(F(1, 109) = 36.065, p < .001, \eta_p^2 = .249.\) The interaction between time point and EL status was significant, within time by EL: Greenhouse-Geisser–adjusted \(F(1, 109) = 9.030, p < .01, \eta_p^2 = .077,\) and the main effect of EL status was not significant, between EL: \(F(1, 109) = 2.237, p = .138, \eta_p^2 = .020.\) Post hoc testing with Bonferroni corrections revealed that students who were ELs were statistically equivalent to students who were not ELs at pretest \((p = .832),\) but students who were ELs fell behind their peers who were not ELs at posttest \((p < .05).\) Additional post hoc testing with Bonferroni corrections indicated that students who were not ELs showed significant growth from pretest to posttest \((p < .001),\) whereas students who were ELs did not \((p = .100).\) Despite their differences in growth \((4.10\) for students who were ELs, \(12.39\) for students who were not ELs), both groups had pretest and posttest means in the average range.

**Grade 2.** Second-grade students \((n = 109)\) showed significant growth on the GRADE from pretest to posttest, within time: Greenhouse-Geisser–adjusted \(F(1, 107) = 45.694, p < .001, \eta_p^2 = .299.\) The interaction between time point and EL status was not significant, indicating similar growth for students who were ELs and students who were not ELs, within time by EL: Greenhouse-Geisser–adjusted \(F(1, 107) = .582, p = .447, \eta_p^2 = .005.\) The main effect of EL status was significant, \(F(1, 107) = 15.978, p < .001, \eta_p^2 = .130,\) with students who were ELs scoring lower than students who were not ELs at both time points.

**Grade 3.** Third-grade students \((n = 126)\) showed significant growth on the GRADE from pretest to posttest, within time: Greenhouse-Geisser–adjusted \(F(1, 124) = 26.313, p < .001, \eta_p^2 = .175.\) In addition, students who were ELs did not perform as well as students who were not ELs, between EL: \(F(1, 124) = 35.651, p < .001, \eta_p^2 = .223,\) and the interaction between time period and EL status was significant, within time by EL: Greenhouse-Geisser–adjusted \(F(1, 124) = 5.953, p < .05, \eta_p^2 = .046,\) indicating that students who were ELs and students who were not ELs grew at significantly different rates. Post hoc testing with Bonferroni corrections revealed that students who were ELs performed significantly worse than students who were not ELs at pretest \((p < .001)\) and posttest \((p < .001),\) and that both students who were ELs \((p < .001)\) and students who were not ELs \((p < .01)\) showed significant growth from pretest to posttest. The finding of a significant interaction between time period and EL status indicates that students who were ELs displayed greater growth than students who were not ELs. As seen in Table 2, students who are ELs improved their performance from below the average range at pretest to within the average range at posttest.

**Grade 4.** Fourth-grade students \((n = 103)\) did not show significant growth on the GRADE from pretest to posttest, within time: Greenhouse-Geisser–adjusted \(F(1, 101) = .364, p = .548, \eta_p^2 = .004.\) In addition, students who were ELs did not perform as well as students who were not ELs \((between\ EL: F(1, 101) = 37.350, p < .001, \eta_p^2 = .270.\) The interaction between time point and EL status was not significant, indicating that the lack of growth from pretest to posttest was similar for students who were ELs and students who were not ELs, within time by EL: Greenhouse-Geisser–adjusted \(F(1, 101) = 1.456, p = .230, \eta_p^2 = .014.\)

**Grade 5.** Fifth-grade students \((n = 108)\) showed significant growth on the GRADE from pretest to posttest, within time: Greenhouse-Geisser–adjusted \(F(1, 106) = 29.502, p < .001, \eta_p^2 = .162.\) The interaction between time point and EL status was not significant, indicating similar growth for students who were ELs and students who were not ELs, within time by EL: Greenhouse-Geisser–adjusted \(F(1, 106) = 3.670, p = .058, \eta_p^2 = .033.\) The main effect of EL status was significant, \(between\ EL: F(1, 106) = 18.717, p < .001, \eta_p^2 = .150,\) with students who were ELs scoring lower than students who were not ELs at pretest and posttest.

**Relationship between blended learning program and reading assessment**

In preliminary models, EL status and BOY skill level were not significant predictors of growth on the GRADE. As a result they were removed from the final model, which is presented in Table 3. The model was a significant improvement in fit beyond both the null and a model including only student grade, \(F(6, 634) = 39.688, p < .001.\) A total of 26.6% of the variance in growth on the GRADE was explained by student grade and levels completed in the online component of Core5.

| Table 2. Mean differences in GRADE total test standard scores by grade and EL status. |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Grade           | Pretest M       | Posttest M      | Difference      | Pretest M       | Posttest M      | Difference      | Pretest M       | Posttest M      | Difference |
| Kindergarten    | 90.45           | 107.10          | 16.64***        | 79.88           | 100.18          | 20.29*          | 93.13           | 108.85          | 15.72*      |
| 1               | 97.91           | 108.73          | 10.82***        | 97.29           | 101.38          | 4.10            | 98.06           | 110.44          | 12.39***    |
| 2               | 97.28           | 104.69          | 7.41***         | 87.17           | 93.35           | 6.17*           | 99.98           | 107.72          | 7.74*       |
| 3               | 99.06           | 101.87          | 2.82***         | 84.92           | 90.69           | 5.77***         | 102.73          | 104.78          | 2.05**      |
| 4               | 99.86           | 100.14          | 0.27            | 85.21           | 83.43           | -1.79*          | 102.17          | 102.76          | 0.60*       |
| 5               | 98.47           | 101.41          | 2.94***         | 88.24           | 94.12           | 5.88*           | 100.39          | 102.77          | 2.38*       |

Note **"p < .01. ***p < .001.**

| Table 3. Model fit summary statistics. |
|-----------------|-----------------|-----------------|-----------------|-----------------|
|                 | \(R^2\)         | Adjusted \(R^2\) | \(SE\)          | \(\Delta F\)    | \(df\) 1 | \(df\) 2 | \(\Delta F\) sig. |
| Model 1         | .267            | .261            | 8.790           | 46.229          | 5       | 635    | .000          |
| Model 2         | .273            | .266            | 8.760           | 5.388           | 1       | 634    | .021          |
The parameter estimates for the model are presented in Table 4. There were significant differences between GRADE pretest and posttest for most of the grades when controlling for levels completed in the online component of Core5. Students in kindergarten, Grade 1, and Grade 2 showed significantly more growth on the GRADE than students in Grade 3. Students in Grade 4 showed significantly less growth than students in Grade 3, and students in Grade 5 did not differ significantly from students in Grade 3 in their growth on the GRADE. Across all grades, an additional level completed in the online component predicted a .398 increase in growth on the GRADE.

**Table 4. Parameter estimates.**

| Parameter     | β    | SE  | p    |
|---------------|------|-----|------|
| Constant      | 1.256 | 1.031 | .223 |
| Kindergarten  | 13.400 | 1.248 | .000 |
| Grade 1       | 7.598 | 1.154 | .000 |
| Grade 2       | 4.290 | 1.154 | .000 |
| Grade 3       | –2.477 | 1.165 | .034 |
| Grade 4       | 0.237 | 1.150 | .837 |
| Grade 5       | 0.398 | 0.172 | .021 |

**Discussion**

Results of this study indicate that a blended learning program can provide a viable means to enhance reading performance for students attending a Title I elementary school. Thus, an affirmative response to the first research question was obtained: Students from a Title I school made significant gains on a standardized reading test following participation in a blended learning program. The second research question asked if there are differences in gains based on student grade. Significant gains were found for students in five of the six grades studied—kindergarten through Grades 3 and 5. As described subsequently, gains were generally greater for students in early grades compared with later grades. The third question asked if there are differences in gains for students who were ELs compared to students who were not ELs. All but Grade 1 gains were equally strong or slightly greater for students who were ELs compared to students who were not ELs. The final question asked if there is a relationship between progress in a blended learning program and gains on a standardized reading test. Regression analyses showed that advances in the online component of the blended learning program were predictive of gains on the reading test. Students who made the greater advances in the online component showed larger gains on the reading test.

Overall, kindergarten through second-grade students showed the greatest gains in reading, with kindergarten and first-grade students averaging double-digit gains on a standardized reading test. In contrast, gains were less pronounced for the later grades. This finding may be a result of differences in usage in the online component of the program across grades—kindergarten through second-grade students met their usage recommendations much more consistently than students in the later grades. This discrepancy highlights the importance of a strong implementation to achieve the anticipated benefits of a blended learning program.

It should be noted that Grade 3 represents a critical moment in reading, when students switch from learning to read to reading to learn (Fiester, 2010, 2013). Students in Grade 3 and beyond are expected to learn and use more complex vocabulary and sentence structures. This change in focus often makes it more challenging to accelerate reading skills as students in later grades, which may explain, in part, the lower gains seen in third through Grade 5. It is possible, however, that continued use of blended learning as an integral part of reading instruction throughout elementary school, including targeted instruction for struggling, older students, may contribute to improved reading performance in later grades.

Results of this study show that, in general, the blended learning approach led to significant standard score gains on a standardized reading test. Even more promising is that these findings occurred in a Title I school with many students from a demographic that tends to disproportionately struggle with reading proficiency starting in kindergarten and continuing into later grades (Lee & Burkam, 2002; Garcia, 2015). For example, students from low-SES backgrounds often have slower acquisition of language skills (Aikens & Barbarin, 2008), lower reading skills (Aikens & Barbarin, 2008), and enter school behind peers from higher SES families (Morgan, Farkas, Hillemeier, & Maczuga, 2009).

Further analyses showed that students who were ELs at an equal or greater rate compared to students who were not ELs in all grades except Grade 1. EL status did not turn out to be a significant predictor of growth on the standardized reading test, whereas levels completed in the online component of Core5 did predict improved performance on the test. These findings indicate that a blended learning approach was as effective or more effective for students who were ELs as it was for their peers who were not ELs. The indicated benefits of the blended learning program for students who were ELs could help mitigate some achievement gaps commonly found in the literature. For example, only 6% of fourth-grade students who were ELs scored at or above proficient on the National Assessment of Educational Progress reading assessment in 2009 compared to 36% of students who were not ELs (National Center for Education Statistics, 2009). The personalization of a blended learning program could be used to target individual instruction for students and help reduce specific skill gaps that would allow students who are behind grade level, for a variety of possible reasons, to catch up with on-level peers and improve test scores.

In contrast to the other five grades, first-grade students who were ELs unexpectedly began the school year with similar scores on the standardized reading test to first-grade students who were not ELs. This might have occurred because the first-grade students took part in a pilot study of the blended learning program during the second half of the previous school year when they were in kindergarten. As documented in this study, the blended learning program showed the most benefits for students who were ELs in kindergarten. Thus, it is possible the first-grade students who were ELs scored comparable to the first-grade students who were not ELs at pretest due to participating in the blended learning program in the previous year. It was also found that first-grade students who were not ELs showed greater gains over the school year than first-grade students who were ELs. These findings suggest that the first-grade students who were ELs might have reached a plateau in reading skills, whereas the program might have acted as a source of enrichment for the first-grade students who were not ELs.
Differentiating instruction

The finding that students who were ELs showed comparable or greater gains than students who were not ELs in all but one of the grades may be related to the teachers’ improved ability to differentiate instruction through a blended learning program. As students enter school with varying levels of reading ability, even within the same grade and classroom, a reading program that is able to differentiate instruction may be particularly effective, especially if students need to fill skill gaps below grade level or, in some cases, progress beyond the core curriculum. Digital tools aligned to standards at each grade level and supported by individually targeted teacher-led lessons allow for a structured and systematic approach to reading instruction and provide students with a personalized path. Differentiation below and above grade level is particularly difficult for classroom teachers, considering that the teachers often do not have experience teaching many of the reading skills outside the scope of their current grade. For example, expecting a Grade 4 teacher to teach phonological awareness to a reader who performs at a Grade 1 level may add a substantial burden that is not feasible in a classroom setting. The use of a blended learning approach, where much of the differentiated instruction is provided online, allows the teacher to allocate his or her time more efficiently and effectively (Freland, 2015; Powell et al., 2015).

In addition, instruction demonstrated to be effective for students who were ELs, as found in this population, may at times require intensive one-to-one tutorial sessions or instruction conducted outside of the regular classroom environment (e.g., Begeny et al., 2012; Vadasy & Sanders, 2011). A blended learning approach can capitalize on the ability of the technology to deliver systematic, intensive practice that pinpoints each student’s skill gaps and reduces the amount of time that must be spent in one-to-one instruction.

Along with the support of targeted instruction, students who were ELs may also benefit from supplemental activities that address reading comprehension through enhancement of oral language skills (see August et al., 2014). The online component in this study leverages picture-based activities to strengthen word knowledge with an emphasis on advancing academic vocabulary (see Francis, Rivera, Lesaux, Kieffer, & River, 2006) and scaffolds students through complicated figurative language such as idioms, similes, and metaphors. These embedded aids may have been especially valuable for students who were ELs.

Limitations and future directions

Given that this study is one of the first to investigate implementation of a blended learning program at the elementary school level, all classrooms in this school were allowed to use the program. Ideally, the study would have included treatment and control classes within the same school or compared students who used the blended learning program in a treatment school with students from a similar school within the district who did not use the program. In terms of the latter possibility, this school was unique to the district in its demographic make-up and there was not a suitable control school. Future studies are underway to investigate blended learning programs using within-district control schools, including those with even larger populations of students who were ELs.

A further limitation of the present study centers on the inability to reliably tease apart the positive effects of the Core5 components of the blended learning approach from possible benefits of the supplemental resources available to the classroom teachers and interventionists. Of course, given that the study was conducted in the context of typical classroom instruction, it was expected that educators would utilize any available resources they believe would be beneficial to students. In fact, a blended learning approach not only includes the main curriculum but also the use of other supplemental digital and offline resources as needed. In the present study, it was emphasized that the Core5, the blended learning approach, would serve as the main component of the ELA curriculum and that other resources would play a supplemental role. However, future researchers will more carefully document and explore the impact of the Core5 components in relationship to the use of other resources.

This study demonstrated the overall benefits of a blended learning program on the reading performance of elementary school students from low-SES backgrounds. However, given that the study was conducted in one school year, there is certainly a need for longitudinal studies to examine whether a blended learning program can help mitigate some of the effects of the switch from learning to read to reading to learn beginning around Grade 3, and to further track the reading growth of students who were ELs compared to students who were not ELs. A longitudinal study is currently underway. Another avenue for future work is to investigate specific areas of reading growth for students receiving a blended learning program. For the present study overall scores on a standardized reading test were analyzed to assess students’ reading performance prior to and after implementation of the blended learning program. In future studies, students’ performance on specific reading sub-skills will be examined.

Conclusion

Blended learning is growing as a pedagogical approach to instruction in elementary school, despite little research on its effectiveness at that age level. This study found that students in a Title I school made great progress in a blended learning program and subsequently demonstrated significant growth on a standardized reading test. Gains remained robust even when controlling for student grade level, initial student skill level, and EL status, showing that benefits of the blended learning program were found to be similar across various types of students. These findings are particularly noteworthy because they show how a blended learning approach can provide supportive benefits for students from low-SES backgrounds or students who were ELs, who historically fall behind their peers in reading development Campaign for Grade-Level Reading (2014; National Center for Education Statistics, 2016).

The outcomes of this study are import for their contributions to the field of research on students who are ELs. National data indicate that students who are ELs do not perform as well as students who are not ELs in reading (National Center for Education Statistics, 2009), and given that the percentage of
students who are ELs in the United States is expected to rise to approximately 25% by 2030 (Cheung & Slavin, 2012), identifying effective reading curricula is essential. This study found that, in general, students who are ELs showed comparable or in some cases greater growth on a standardized reading test than their peers who were not ELs. Given that nearly all the students who were ELs in this study were Black, and that the study was located in a district with one of the highest populations of students who were both ELs and Black in the country, these findings are of added importance because they address a new subpopulation of interest to educational government agencies.

In terms of educational benefits for students who may be behind grade level, a blended learning program can offer a seamless approach to differentiated instruction, identifying areas of skill deficiencies and providing targeted instruction and extended practice to overcome such deficiencies. Of course, a blended learning program is likely to be effective only if educators make every effort to ensure that students are given ample opportunities to use the digital component of the program as recommended.

In sum, this study suggests that a blended learning approach can support the development of reading skills in diverse sets of students, including students who may be from low-SES backgrounds or students who are ELs. When only one third of elementary school students scored proficient on a national assessment of reading skills (National Center for Education Statistics, 2015) and 80% of students who are ELs fail to meet reading proficiency milestones (Campaign for Grade-Level Reading, 2014; National Center for Education Statistics, 2016), these findings point to a promising avenue to address the urgent need to enhance elementary school literacy.

**Conflict of interest disclosure**

This submission evaluates the effectiveness of a commercial product. Three authors of this paper are employed by Lexia Learning, a Rosetta Stone® Company, and one serves as a paid consultant and is employed by Community College of Rhode Island. None of the researchers receives compensation on sales of the products. Teachers and school personnel carried out the implementation of the program.

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