STUDY OF *IMAGINE LANGUAGE & LITERACY* IN GRADES K-2

JANUARY 2020

RMC RESEARCH

STUDY OF *IMAGINE LANGUAGE & LITERACY* IN GRADES K-2

PREPARED FOR:

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RMC Research used a case study approach to document implementation of *Imagine Language & Literacy* and a correlational design to examine the relationship between student program usage and student academic achievement outcomes for students in Grades K-2. The study was conducted during the 2018/19 academic year at eight schools in two school districts in the Southeastern United States. The case study approach involved interviews with administrators, focus groups with teachers, and observations of *Imagine Language & Literacy* in six schools to gather detailed information about implementation. For all study schools, RMC Research and Imagine Learning collected usage data and administrative data including demographic information and scores on the formative Dynamic Indicators of Basic Early Literacy Skills (DIBELS) Next assessment for all students in Grades K-2 to examine the relationship between student program usage and student academic achievement. Findings focus on implementation factors and the impact of the amount of instruction received in *Imagine Language & Literacy* on spring DIBELS Next scores.

FINDINGS

In general, teachers and administrators found the professional development provided to be sufficient for beginning implementation of *Imagine Language & Literacy*. Teachers and administrators reported that the initial professional development they received from Imagine Learning was informative and sufficient to get them started using *Imagine Language & Literacy*.

Teachers suggested additional training or documentation on using *Imagine Language & Literacy*. Teachers indicated they would have liked additional training on how to use many of the components of *Imagine Language & Literacy* and that they would specifically like training regarding the student-level reports available in the system. Additionally, some teachers requested a "Frequently Asked Questions (FAQ)" or other documentation be available to aid them in finding information within *Imagine Language & Literacy* such as reports and additional resources.

Implementation was hindered by technology problems. All teachers and administrators reported experiencing technology problems, many of which negatively affected implementation of *Imagine Language & Literacy.*

Students enjoyed engaging with *Imagine Language & Literacy*. Teachers and administrators reported their students enjoyed working in *Imagine Language & Literacy* and the program was engaging for students*.*

Fewer than 60% of students in each grade level met the recommendation for average number of minutes per week of participation. Imagine Learning recommends that students in Kindergarten engage with *Imagine Language & Literacy* for at least 45 minutes per week and students in Grades 1 and 2 engage with the program for at least 60 minutes per week. On average, 56% of Kindergarten students, 47% of students in Grade 1, and 24% of students in Grade 2 met the recommended total minutes per week.

Average student participation varied by school. Across the schools in the study, participation in *Imagine Language & Literacy* varied. School averages for total weeks ranged from 15 to 30 weeks, averages for total minutes ranged from 647 to just under 2,000 minutes, and averages for activity minutes ranged from 507 to 1,604 minutes.

Extent of participation (dosage) was related to performance on the spring DIBELS Next assessment for students in Kindergarten. All indicators of dosage were positively related to spring scores on the DIBELS Next assessment for students in Kindergarten. For example, after accounting for prior achievement and demographic characteristics, an increase in participation of 167 total minutes, 125 activity minutes, 2.7 weeks, 3.5 minutes per week, or 2.8 activity minutes per week was associated with a one-point increase on the DIBELS Next Letter Naming Fluency test for students in Kindergarten. For students in the analytic sample, a one-point increase on this test would be related to an additional 1.8% of students meeting DIBELS Next benchmark scores for progress and 2.6% fewer students being identified as at risk.

Extent of participation (dosage) was related to performance on the spring DIBELS Next assessment for students Grade 1. All indicators of dosage were positively related to spring scores on the DIBELS Next assessment for students in Grade 1. For students in Grade 1, an increase of 125 total minutes, 111 activity minutes, 1.4 weeks, 3.7 minutes per week, or 3.2 activity minutes per week was associated with a one-point increase in DIBELS Next Nonsense Word Fluency: Correct Letter Sounds score and increases in participation of 250 total minutes, 250 activity minutes, 3.2 weeks, 7.4 minutes per week, or 6.2 activity minutes per week were associated with a similar increase on the DIBELS Next Nonsense Word Fluency: Whole Words Correct score. For students in the analytic sample, a one-point increase on this test would be related to an additional half percent of students meeting DIBELS Next benchmark scores for progress and 0.2% fewer students being identified as at risk on the DIBELS Next Nonsense Word Fluency: Correct Letter Sounds test and an additional 1.1% of students meeting DIBELS Next benchmark scores for progress and 2.8% fewer students being identified as at risk on the DIBELS Next Nonsense Word Fluency: Whole Word Correct test.

Extent of participation (dosage) was not significantly related to performance on the spring DIBELS Next assessment for students in Grade 2. No indicators of dosage were found to be significantly related to spring scores on the DIBELS Next assessment for students in Grade 2. Overall implementation was lowest in Grade 2, with only 24% of students meeting optimal dosage recommendations. This finding suggests that weak implementation reduces the likelihood of detecting student outcomes.

RECOMMENDATIONS

Based on findings from this study, RMC Research offers the following recommendations to guide program development and improvement, and assess the impact of *Imagine Language & Literacy*.

1. **Provide additional hands-on experience with *Imagine Language & Literacy* programming and reports during the Getting Started training.**

2. **Document technology issues and share common solutions or a manual for common issues.**

3. **Continue monitoring implementation throughout the academic year.**

4. **Continue encouraging sites to implement programming and meet usage recommendations.**

INTRODUCTION

This section provides background information about the Imagine Language & Literacy program and the 2018/19 study of program implementation and outcomes.

BACKGROUND

Imagine Language & Literacy is a computer-based instructional program that helps students acquire English language and literacy skills through individualized instruction. The intervention is targeted towards elementary grades, emergent readers, struggling readers, English language learners, and students with disabilities. Imagine Learning contracted with RMC Research to conduct a study to describe implementation of *Imagine Language & Literacy* in a case study approach and to document correlational evidence of the relationship between program usage and student academic achievement for struggling readers using the program in Grades K-2.

IMAGINE LANGUAGE & LITERACY PROGRAM

Imagine Language & Literacy is designed as a comprehensive language and literacy intervention for elementary students. It works to close achievement gaps at an accelerated rate by automatically creating a unique computer-based curriculum for each student based on his or her needs. The program incorporates over 4,300 activities founded on research about English language learning, game-based learning, and acquisition of literacy skills to help students develop language and literacy proficiency. Language and literacy skills covered by the program include grammar, phonemic awareness, phonics, academic vocabulary, fluency, and reading comprehension. *Imagine Language & Literacy* provides strategic first-language support for English language learners and offers support materials in 15 languages. *Imagine Language & Literacy* assesses student performance and learning needs through benchmark and progress monitoring assessment tools. The program is designed to be interactive through multiple modalities to support student engagement. Educators receive regular reports through ongoing assessments and Lexile® measures.[1]

Imagine Language & Literacy includes the following key instructional components:

Thorough language and literacy instruction. Students receive systematic and explicit instruction in the five key areas of literacy as outlined by the National Reading Panel: phonics, phonemic awareness, fluency, vocabulary, and comprehension. In addition to instruction in these five areas, *Imagine Language & Literacy* also provides English language instruction, building skills in listening and speaking. Students also gain test-taking skills through regular use of the program. More than 4,300 engaging activities provide students with opportunities to learn and practice skills.

- *Phonemic awareness:* Students learn to recognize phonemes and how to blend phonemes to create words. Students also learn how to segment phonemes and learn the concept of rhyme.

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[1] Lexile measure is the numeric representation of an individual's reading ability or a text's readability (or difficulty).

English language learners receive explicit instruction regarding English phonemes that do not occur in their first language.

- *Phonics:* Students learn important phonics skills, including letter recognition, letter sounds, and word recognition. Students practice these skills in a selection of engaging activities.

- *Fluency:* Students practice fluency by reading a variety of books and creating audio recordings of their reading. The books range in difficulty from simple decodable texts to more complex natural texts. Content areas include science, social studies, literary genres (such as myths, plays, poems, and tall tales), biography, narrative, and mathematics. Selections are paired, so that one article provides background knowledge for the other. Additionally, each story is written at two levels of difficulty: easy and advanced. Recordings are saved, allowing teachers to track student progress.

- *Vocabulary:* Students learn basic and academic vocabulary through explicit instruction and through context. New vocabulary enables students to better understand science, mathematics, and social studies as well as communication arts. Translations of key vocabulary words are available for English language learners through first-language support.

- *Reading comprehension:* Students learn comprehension strategies and practice answering comprehension questions about main idea, cause and effect, problem and solution, author's purpose, and more.

- *Listening and speaking:* Students learn conversational phrases and academic vocabulary. Students also practice listening comprehension skills by listening to texts that are read aloud and then answering a comprehension question.

- *Test-taking skills:* The comprehension questions students encounter in the program are similar to questions encountered on state tests. Students learn important skills that assist in test taking, such as how to answer intuitive questions and how to answer literal questions.

First-language support. *Imagine Language & Literacy* provides strategic first-language support for English language learners, including translations of vocabulary words, customized activities, explanations of difficult concepts, and more. This support gradually fades as the student progresses. First-language support is available in Arabic, Cantonese, English, French, Haitian Creole, Hmong, Japanese, Korean, Mandarin, Marshallese, Portuguese, Russian, Spanish, Somali, Tagalog, and Vietnamese. Print materials are also available in the following languages: Burmese, Farsi, Karen, Polish, and Urdu.

Differentiated instruction for each student. The program is automatically differentiated for each student. It recognizes if students need remediation or if they can be placed on an accelerated path. Curriculum is automatically adjusted to ensure students are provided with the content they need to support measurable growth. This removes much of the pressure from teachers to differentiate instruction for their diverse classes.

High level of engagement. The program uses multiple modalities and employs high-quality art, video, and music, as well as chants, games, and personalizable characters to keep students involved. These

engagement strategies help to ensure that students remember what they learned, so they can use their newly acquired skills in all content areas and on exams.

PRIOR RESEARCH

Several prior studies provide evidence of the effects of *Imagine Language & Literacy*. For example, Imagine Learning is one of four vendors that currently participates in the Utah Board of Education Early Intervention Reading Software Program. Annual evaluations of this program examine the effect of the overall program on student achievement, implementation of each vendor's program, and impact of each vendor's program. Recent findings suggest about half of students who participated in *Imagine Language & Literacy* met minimum participation recommendations and that the program has had a significantly positive effect on student achievement with effect sizes[2] ranging from 0.04 to 0.24 for students in Grades K-2, based on comparison with nonparticipating students (Hobbs, 2016; Hobbs, 2017; Hobbs, 2018).

A Regression Discontinuity Design study conducted in the 2013/14 academic year demonstrated that elementary students who engaged with *Imagine Language & Literacy* for at least 20 hours demonstrated greater growth on the Scantron Reading Foundations assessment than students in a comparison condition (Heller & Carter, 2015). The authors note the sample size was a limiting factor in interpreting results, suggesting the study was underpowered. A correlational study conducted during the 2016/17 academic year identified a positive relationship between and minutes of program usage per week and Lexile growth (Imagine Learning, 2018-a).

A series of case studies using academic achievement outcomes in single user districts or schools documented correlational relationships between *Imagine Language & Literacy* program usage and school and student-level outcomes in California (Imagine Learning, 2018-b), Connecticut (Imagine Learning, 2018-c), Florida (Imagine Learning, 2018-d), an Oklahoma school district (Imagine Learning, 2018-e), and two Texas school districts (Imagine Learning, 2018-f; Imagine Learning, 2018-g). A study examining the proportion of students in Grades 3-5 who met English language arts proficiency levels on the Florida State Assessment during the 2016/17 year found that schools implementing *Imagine Language & Literacy* had higher proportions of proficient students (Imagine Learning, 2018-d).

RMC Research conducted a quasi-experimental design study with propensity score matching to evaluate the impact of *Imagine Language & Literacy* on the reading achievement of low-performing students in Grades 1-5 (Espel, Meyer, & Weston-Sementelli, 2019; Espel & Meyer, 2019). The study was conducted during the 2017/18 academic year at 63 schools in five school districts representing three states in the Midwest, Northeast, and Southeast regions of the United States. *Imagine Language & Literacy* was implemented in intervention schools during the spring 2018 semester. Findings focus on the impact of the program on student reading achievement, based on formative and summative student reading achievement measures. Analyses also examined variation in program implementation and the relationship between measures of program implementation and reading achievement on formative and summative assessments. The study demonstrated that implementation varied. No statistically significant effect of participation in *Imagine Language & Literacy* on reading achievement was found. The study found a mix of null and negative relationships between dosage and student outcome scores.

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[2] Effect size (ES) is a name given to a family of indices that measure the magnitude of a treatment effect, represented by differences in outcomes across groups. Unlike significance tests, these indices are independent of sample size. An effect size (Cohen's *d*) of .8 or greater is considered a large effect.

Another recent quasi-experimental design study which used propensity score matching compared growth in reading scores on the State of Texas Assessments of Academic Readiness (STAAR) for fourth- and fifth-grade students who used *Imagine Language & Literacy* and those who did not (SEG Measurement, 2018). This study was conducted during the 2017/18 academic year at three districts in Texas and included 2,346 students. After controlling for initial ability, the study found that students who used *Imagine Language & Literacy* scored higher than those who did not engage with the program. The study found the effect size for fourth-grade students to be .24 and the effect size for fifth-grade students to be .14.

These studies provide initial and promising evidence of the impact of *Imagine Language & Literacy*. Imagine Learning wishes to develop additional and more rigorous evidence of the relationship between participation in *Imagine Language & Literacy* and student achievement outcomes.

THIS STUDY

The *Every Student Succeeds Act* (ESSA), which is the reauthorization of the *Elementary and Secondary Education Act* describing federal regulations for education in the United States, directs state and local educational agencies, school administrators, and educators to provide evidence-based interventions to support student learning. This mixed-methods study used a case study approach and correlational analyses examining the relationship between program implementation and outcomes. The study was designed with the potential to provide promising evidence (Tier 3) of effectiveness under ESSA[3] and provides descriptive information about *Imagine Language & Literacy* implementation that may provide feedback for program improvement and inform priorities for future research.

As of late 2019, "promising evidence" is defined in U.S. Department of Education regulations (§77.1: Definitions that apply to all Department programs)[4] as follows:

> *Promising evidence means that there is evidence of the effectiveness of a key project component in improving a relevant outcome, based on a relevant finding from one of the following: (i) A practice guide prepared by WWC reporting a "strong evidence base" or "moderate evidence base" for the corresponding practice guide recommendation; (ii) An intervention report prepared by the WWC reporting a "positive effect" or "potentially positive effect" on a relevant outcome with no reporting of a "negative effect" or "potentially negative effect" on a relevant outcome; or (iii) A single study assessed by the Department, as appropriate, that—(A) Is an experimental study, a quasi-experimental design study, or a well-designed and well-implemented correlational study with statistical controls for selection bias (e.g., a study using regression methods to account for differences between a treatment group and a comparison group); and (B) Includes at least one statistically significant and positive (i.e., favorable) effect on a relevant outcome.*

The two national organizations that review evidence in terms of the ESSA evidence levels, however, define promising evidence somewhat differently. Evidence for ESSA, based at the Center for Research and Reform in Education at Johns Hopkins, identifies mathematics and reading programs as evidence-

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[3] ESSA defines promising evidence as being supported by "at least one well-designed and well-implemented correlational study with statistical controls for selection bias (Elementary and Secondary Education Act of 1966, §8101 (21)(A), 2018.
[4] Available here: https://www.ecfr.gov/cgi-bin/text-idx?node=34:1.1.1.1.24&rgn=div5

based according to ESSA evidence levels based on reviews only of experimental and quasi-experimental group design studies (Evidence for ESSA, n.d.). Studies that do not meet the "strong" or "moderate" evidence levels are eligible to be used as evidence for "promising" interventions. The What Works Clearinghouse only reviews studies that meet the "strong" or "moderate" evidence levels and offers no "promising" evidence designation.

The present study builds on prior research and was designed to document program implementation and the relationship between implementation and outcomes, using a sample of students from two districts in two Southeast region states during the fall and spring semesters of the 2018/19 school year. The study examines the relationship between extent of participation (dosage) and student achievement in Grades K-2 on formative assessments. Student achievement was measured using data from fall and spring Dynamic Indicators of Basic Early Literacy (DIBELS) Next Benchmark Assessments referred to in this report as "DIBELS Next".

The next section presents study methodology, followed by a presentation of findings. Findings first present descriptive information related to the case studies of each site and then present correlational analyses documenting the relationship between program implementation and student outcomes. The final section presents conclusions and recommendations.

METHODOLOGY

This section describes the study research question, design, intervention, quantitative and qualitative data, and analyses.

RESEARCH QUESTION

This study was designed to answer the question: How does *Imagine Language & Literacy* implementation vary, and how does variation in implementation relate to formative student achievement outcomes?[5]

DESIGN

RMC Research used a case study approach to document implementation of *Imagine Language & Literacy* and a correlational design to examine the relationship between student program dosage[6] and student academic achievement outcomes for students of all reading levels in Grades K-2. The study was designed so that in all study schools, all students in Grades K-2 participated in the intervention during the entire 2018/19 academic year. The case study approach involved site visits, interviews with administrators, focus groups with teachers, and observations of *Imaging Language & Literacy* in six schools to gather detailed information about implementation. For all study schools, RMC Research obtained *Imagine Language & Literacy* dosage data and administrative data including demographic information and scores on the formative DIBELS Next assessment for all students in Grades K-2 to examine the relationship between student program dosage and academic achievement outcomes.

IMAGINE LANGUAGE & LITERACY INTERVENTION

Participating districts and schools committed to implementation of *Imagine Language & Literacy* using recommended dosage; provision of technology support, equipment/devices, and personnel for program implementation; communication and support to school personnel; implementation monitoring; and provision of administrative data including student demographics and assessment scores. Free licenses for the *Imagine Language & Literacy* program were provided to participating schools.

Students in Grades K-2 in study schools participated in a whole-school intervention. For this study, Imagine Learning recommended that on average, Kindergarten students use the program for 45 minutes per week and students in Grade 1 and Grade 2 use the program for 60 minutes per week. Weekly dosage was monitored through the online *Imagine Language & Literacy* platform.

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[5] RMC Research initially designed the study in collaboration with Imagine Learning to examine the impact of *Imagine Language & Literacy* on K-2 student outcomes with additional research questions. Challenges with implementation beyond the control of the study team (e.g., natural disasters, school closings) and challenges with recruitment impeded the completion of the impact study. The current study was adapted from the original design and provides pilot data to inform future rigorous research studies.

[6] The term dosage refers to the extent of student participation in the program, and includes time spent in the program, activity time spent in the program, weeks spent implementing the program, and minutes per week spent in the program.

Teachers received key supports including:

- access to Imagine University with online training materials;
- training provided by Customer Success Managers;
- access to Imagine Learning's teacher care call center;
- onsite visits by Customer Success Managers;
- weekly student usage reports and Action Area Tools to support lesson planning;
- guidance related to planning and implementation, and
- technical support.

Training for teachers and administrators provided information about setting up classes, using the program, and using program resources to monitor student performance. Teachers were instructed to allot time during regular instruction for students to participate in the *Imagine Language & Literacy* program using computers. Students first completed a Language and Literacy Benchmark test that placed them in the lesson sequence that most closely aligned with their needs. Imagine Learning's formative assessments were administered throughout the intervention.

SAMPLE

Imagine Learning recruited two public school districts for the study from the Southeast region of the United States. Schools in each district were randomly selected to participate in the study and provided data for all students who participated in *Imagine Language & Literacy*. Both districts represented urban (small city) settings. Data from eight schools were included in quantitative analyses and data from six schools were included in qualitative analyses (both schools from one district and four randomly-selected schools of six schools in the other district). Students were excluded from the analytic sample for quantitative analyses if they used *Imagine Language & Literacy* but were not in one of the identified study schools, or if they were not in Grades K-2.

QUALITATIVE DATA

Site visits were conducted at six schools in two districts. Data were collected from December 11-12, 2018 at two schools in one district and from February 4-6, 2019 at four schools in the second district.

Qualitative data Site visits included:

- *Classroom observations.* In each school, a sample of classrooms was observed implementing *Imagine Language & Literacy*. A total of 22 classes were observed across the six schools. Classroom observations were scripted during visits.

- *Teacher focus groups.* At each school, focus groups were conducted with *Imagine Language & Literacy* teachers to assess experiences with implementation, including engagement in program activities such as technical support for the intervention technology, interaction with Imagine Learning support teams, training, usage review, and others. Some teachers were also site coordinators who had primary responsibility for implementation of *Imagine Language & Literacy.* Teachers were also asked to characterize perceived strengths and challenges, perceptions of the extent to which *Imagine Language & Literacy* met identified goals, other language and literacy supports students received, and perceived impacts on students involved

with *Imagine Language & Literacy*. Seven teacher focus groups were conducted, each of which included two to six teachers. A lab monitor and English as Second Language (ESL) teacher implementing *Imagine Language & Literacy* with their K-2 students were also interviewed using the same protocol.

- *School administrator interviews.* The principal at each of the six schools participating in the case study site visit was interviewed. These interviews collected information about reasons for participation in the study, roles and responsibilities of the site coordinators, the type and quality of professional development provided to teachers, the nature of *Imagine Language & Literacy* implementation in their school, the support and resources received from Imagine Learning and their district, factors facilitating and impeding implementation, alignment with curriculum, their impressions of *Imagine Language & Literacy*, and expected outcomes from participation in the program.

QUANTITATIVE DATA

Data from eight schools were included in quantitative analyses and included the following:

DIBELS Next. The DIBELS Next Benchmark Assessment, developed by the University of Oregon Center on Teaching and Learning, was used to collect data for all students in fall 2018 and spring 2019. DIBELS Next is a standardized, evidence-based, criterion-referenced assessment of basic early literacy skills. It measures overall literacy and reading skills with a composite score. Subscales used for this study include:

- Letter Naming Fluency
- Nonsense Word Fluency: Correct Letter Sounds
- Nonsense Word Fluency: Whole Words Correct
- Oral Reading Fluency: Words Correct
- Oral Reading Fluency: Accuracy

Subscales were available for various grade levels across both study districts. Letter Naming Fluency was collected for Kindergarten, Nonsense Word Fluency was collected for Grade 1, and Oral Reading Fluency was collected for Grade 2. Each subscale yields a raw score and a percentile rank; an indicator of students' progress towards meeting DIBELS Next benchmark goals related to students' expected literacy and reading levels for an overall composite score and subscales; and an indicator of whether or not the student would be identified as being at risk for reading difficulty.

DIBELS Next is designed to be administered up to three times per year for universal screening and/or to monitor the effectiveness of school instructional supports. The assessment may be administered in a paper-and-pencil format or through online tablet applications, with an examiner. The assessment takes 5 to 10 minutes to complete. Prior studies have demonstrated the reliability and validity of the DIBELS Next Benchmark Assessment. DIBELS Next demonstrates alternate-form reliability with coefficients above .90 in Grades 1-6, and .66 in Kindergarten. Composite scores have high inter-rater reliability (.94 to .99). Predictive validity ranges from .48-.80. Concurrent validity is .73-.80 in Grades 1-5, and .40 in Kindergarten (Dewey, Kaminski, & Good, 2014). Cutpoints for DIBELS Next benchmarks and identifying students who are at risk for reading challenges and in need for support were drawn from University of Oregon Center on Teaching and Learning (2012).

Student, School, and District Demographics. RMC Research and Imagine Learning collected student, school, and district data expected to be related to outcome measures and of priority interest to Imagine Learning. These data elements included: school; district; gender; grade; race/ethnicity; free or reduced-price lunch eligibility; homeless status; migrant status; English language learner status; and special education status.

Imagine Language & Literacy **dosage.** Imagine Learning provided RMC Research with student-level information about participation in *Imagine Language & Literacy.* Data elements used to examine the relationship between dosage and achievement outcomes included: the total minutes students were engaged with *Imagine Language & Literacy* each week (used to calculate the number of weeks of program implementation and average minutes per week) and the total minutes students engaged in educational activities within *Imagine Language & Literacy*. Student total time and activity time were provided by week, and student data were excluded for a given week if the total minutes of activity time in that week was less than 5 minutes. Fewer than nine students each week had scores that were outliers (more than three standard deviations above the mean);[7] for these students, minutes of activity time each week and total weeks of implementation were adjusted to three standard deviations above the mean. The total time students spent in *Imagine Language & Literacy* and the total activity time were calculated using these adjusted values. Students were credited for having participated in a week of *Imagine Language & Literacy* if they had logged at least 5 minutes[8] in the system in that week. Students who engaged with *Imagine Language & Literacy* for less than one calendar month[9] (*n* = 28)[10] were excluded from the analytic sample.

The analytic sample for quantitative analyses consisted of 1,375 students including 450 students in Kindergarten (K), 467 students in Grade 1, and 458 students in Grade 2 for whom fall and spring DIBELS Next scores were available, and for whom student dosage and demographic data were available.[11] Exhibits 1 through 3 show that most students were White or African American. Across all grade levels the percentage of White students was roughly equal with between 57% and 60% per grade level. The percentage of African American students was also consistent across grade levels with between 33% and 36% of students identifying as African American. Between 45% and 58% of students who participated in *Imagine Language & Literacy* were female. Exhibit 4 provides additional demographic information by grade level. Over half of students in each grade level were eligible for free or reduced-price lunch with between 56% and 67% eligible. The percentage of students identified for special education services ranged from 8% (Kindergarten) to just over 11% (Grade 1). The percentage of students identified as English language learners ranged from just under 10% in Grade 2 to 12% of students in Grade 1. Across all grade levels, less than 2% of students were identified as homeless or as migrant students.

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[7] Standard deviation (*SD*) is a measure of how spread out a set of values is. Higher standard deviations indicate greater variability in data across respondents.
Mean or average value is a measure of central tendency computed by adding a set of values and dividing the sum by the total number of values.

[8] In collaboration with Imagine Learning, five-minutes was selected as a minimum usage cut-off threshold because fewer minutes was determined to not represent meaningful usage. Less than five-minutes of usage would likely not give students enough time to complete *Imagine Language & Literacy* activities.

[9] Calculated as at least 1 month elapsing between a student's first and last *Imagine Language & Literacy* session. This cut off was selected in collaboration with Imagine Learning to ensure that students in the analytic sample engaged with *Imagine Language & Literacy* for a meaningful amount of time; many students were in schools with high student mobility.

[10] *N* is the total number in a sample. *n* is the number in a subsample.

[11] The initial sample in study schools consisted of 1,756 students, the analytic sample represents 78.3% of this initial sample.

EXHIBIT 1. PERCENT OF STUDENTS BY RACE/ETHNICITY AND GENDER IN KINDERGARTEN

Race/Ethnicity

- White — 60.0%
- African American — 34.2%
- Hispanic/Latino — 13.8%
- Asian American — 3.6%
- Other — 2.2%

Gender

Female 48.4%

Male 51.6%

450

Kindergarten Students
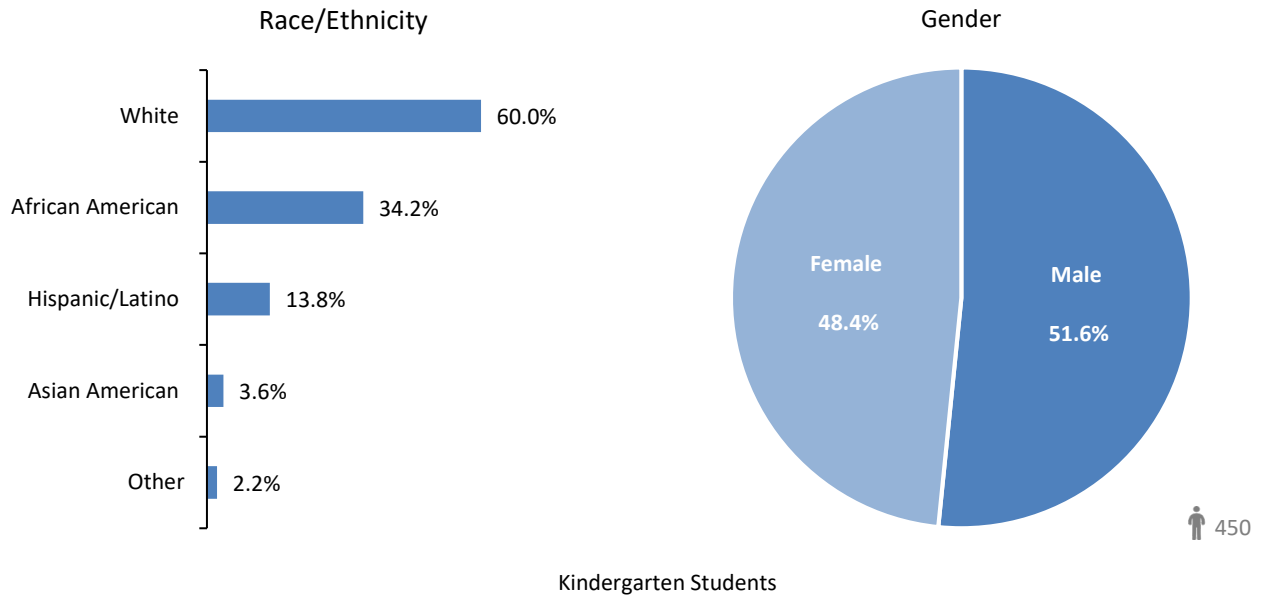
EXHIBIT 2. PERCENT OF STUDENTS BY RACE/ETHNICITY AND GENDER IN GRADE 1

Race/Ethnicity

- White — 57.2%
- African American — 35.8%
- Hispanic/Latino — 13.5%
- Asian American — 4.5%
- Other — 2.6%

Gender

Female 44.8%

Male 55.2%

467

First Grade Students
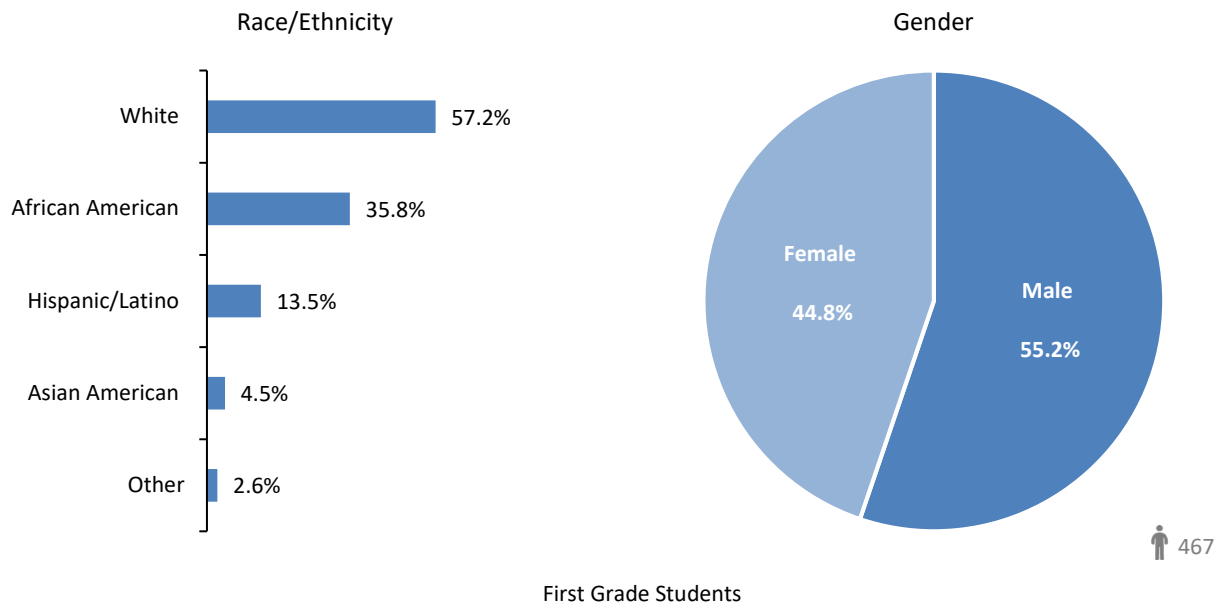
EXHIBIT 3. PERCENT OF STUDENTS BY RACE/ETHNICITY AND GENDER IN GRADE 2

Race/Ethnicity

Race/Ethnicity	Percent
White	60.3%
African American	33.2%
Hispanic/Latino	13.8%
Asian American	3.3%
Other	3.3%

Gender

Female 57.6%
Male 42.4%

458

Second Grade Students
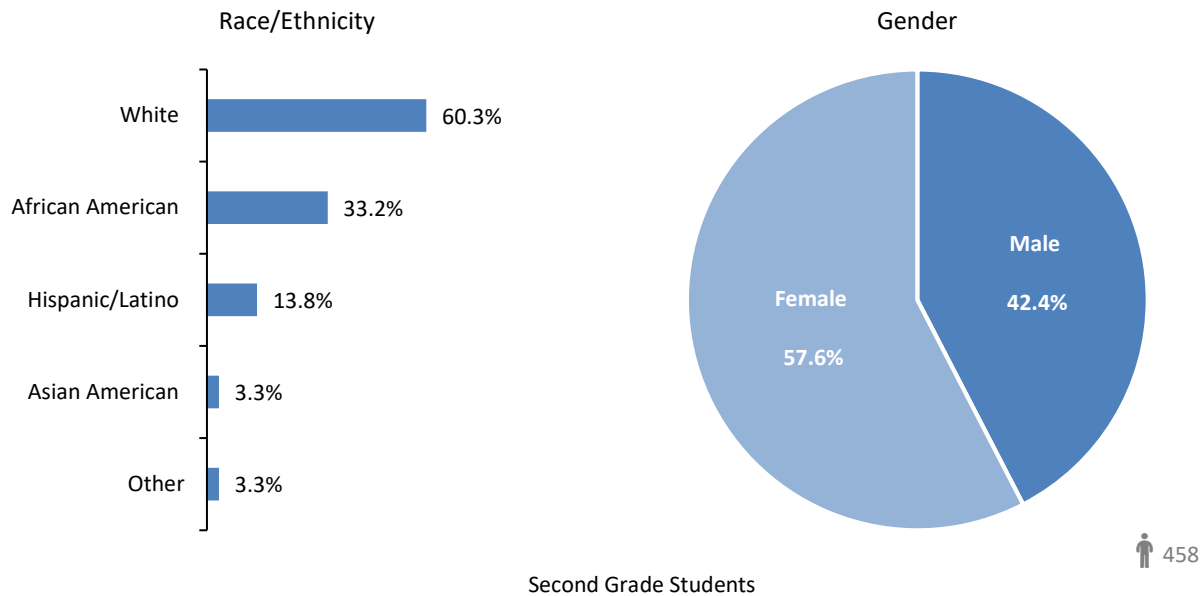
EXHIBIT 4. ADDITIONAL STUDENT CHARACTERISTICS BY GRADE LEVEL

Student-Level Characteristics	Kindergarten	Grade 1	Grade 2
Number (*N*)	450	467	458
English Language Learner (%)	10.7	12.0	9.6
Eligible for Free or Reduced-Price Lunch (%)	67.2	62.3	55.7
Homeless Students (%)	1.1	0.4	0.2
Migrant Students (%)	0.8	1.5	0.0
Students Identified for Special Education Services (%)	8.2	11.3	10.3

ANALYSES

Focus group and interview data were coded and analyzed using an approach that closely follows methods explicated by Miles, Huberman, and Saldaña (2014). This approach emphasizes well-defined study variables so that the common themes can be identified. Qualitative data were analyzed to identify trends in responses to each question.

Descriptive analyses were conducted to identify the nature and extent of variation in implementation across study sites. These findings were reported using ranges, frequencies, percentages, means, and standard deviations. Linear regression was used to determine the relationship of dosage to student outcomes using DIBELS Next scores. The approach for this correlational analysis involved building a model that explained variance in student achievement scores with fall DIBELS Next scores and student-level covariates. Measures of dosage were tested for their contribution to explaining student DIBELS Next literacy scores.

Linear regression analyses[12] were conducted using SPSS Version 24.0 to assess the relationship of variations in dosage to student outcomes measured using DIBELS Next scores. Regression analyses were conducted for each grade level and each dosage indicator independently. Dosage was measured using the total number of minutes, total number of activity minutes, average minutes per week, average activity minutes per week, the total number of weeks students engaged with *Imagine Language & Literacy*, and meeting the optimal dosage threshold. Several student-level variables, including pretest achievement (fall 2018 DIBELS Next scores) and student demographic data elements (special education status; race/ethnicity [White or nonWhite]; English language learner status) were used as covariates in the correlational analyses to identify the relationship between program dosage and student outcomes above and beyond the influence of other factors. For these analyses, achievement scores are presented in their original raw score format for DIBELS Next. All other variables are dichotomous or "dummy" variables that have values of either zero or one.[13]

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[12] Regression analysis is a statistical procedure that examines the relationship among two or more variables. This type of analysis allows for examination of the relative contribution of multiple independent variables to outcomes of interest.
[13] For example, students who were not identified as English language learners have a value of zero on this variable; those who were identified as English language learners have a value of one on this variable.

FINDINGS

This section summarizes findings of analyses to address the research question. Findings from the case study are presented first, followed by descriptive analyses of implementation and correlational analyses relating program dosage to student outcomes.

HOW DOES IMPLEMENTATION OF *IMAGINE LANGUAGE & LITERACY* VARY?

CLASSROOM OBSERVATIONS

Across the two districts and six schools, three different implementation models for *Imagine Language & Literacy* were observed. In these models, students engaged with *Imagine Language & Literacy*:

- In whole **classrooms** with a 1:1 student-to-device ratio and the classroom teacher present;
- In a **computer lab** with a 1:1 student-to-computer ratio and either a lab monitor or classroom teacher present. In some cases, this model was implemented with small groups of students because the computer lab or classroom could not accommodate the entire class at once; and
- In **stations in classrooms** with fewer devices than students and the classroom teacher present.

In all cases, students were told when it was time to work with *Imagine Language & Literacy* and did so independently at their own device. Devices observed being used during the site visits included desktop computers, laptops, chrome books, and iPads. Almost all students stayed in the computer lab or classroom for the duration of their *Imagine Language & Literacy* time; however, a few students were pulled for small group instruction or testing during this time. During implementation, teachers engaged in various activities, including grading student work, pulling students for small group instruction or testing, and monitoring for technology issues. Teachers were not observed helping students complete the instructional programming.

The amount of time students needed to log in and begin engaging in *Imagine Language & Literacy* activities varied. For example, in some cases, if a student did not remember their username and/or password they needed to wait for a teacher or lab monitor to help them. In other cases, students came into the lab and referred to a card with their username and password which allowed them to log in quickly.

Most students attended to the program and actively engaged with the tasks presented. When the program prompted students to record themselves, some students barely whispered into the microphone and had to be prompted to speak louder while others shouted into the microphones. A few students were observed speaking gibberish or saying "blah blah blah" repeatedly when prompted to record, but most spoke along with the program and were heard sounding out words that were difficult for them. Some teachers and lab monitors prompted students to listen to their recordings prior to submitting them to ensure they could be understood. Students were audibly excited when they advanced in the program. As they advanced in the program, they earned coins and were able to spend them on games and personalizing their character. In most cases, the teacher or lab monitor roamed the room offering technical help when needed and encouragement to students. A few students did not

engage with the program. For these students, a "timeout" screen appeared after a few minutes, generally prompting the teacher or lab monitor to attempt to get the student to engage with the program.

A number of technology issues were observed including: students being unable to log in, students being logged out in the middle of a task, and problems with microphones, headphones, and Internet access. In many cases, these problems resulted in students being unable to log onto *Imagine Language & Literacy* or being unable to record themselves. In one lab session, either the Internet or *Imagine Language & Literacy* experienced a problem and a whole class was unable to log onto the program. The lab monitor attempted to get students into the program and called Imagine Learning technical support; however, the lab monitor was unable to resolve the issue. Students seemed most frustrated when they were suddenly logged out of the program in the middle of an activity. Some students logged right back in, with many losing the progress they made during that session. Other students complained to their teacher or lab monitor and were either sent back to class or told to work on another activity until their time ended. Another common issue was that session times were shorter than the class period resulting in sessions ending prior to the end of the scheduled *Imagine Language & Literacy* time. In these instances, some students logged back in and others began another activity or returned to class.

Almost all teachers had their students use *Imagine Language & Literacy* during a scheduled period each day. Only one teacher was not using the program at the designated time during the site visits. Several classes or labs had substitutes during observations; students tended to have challenges logging in to the program when these individuals were present.

TEACHER FOCUS GROUPS AND SCHOOL ADMINISTRATOR INTERVIEWS

Teachers and school administrators responded to questions about a range of topics including professional development, implementation, support, monitoring, student engagement, student results, and recommendations for improvement. Teachers involved in the focus groups had varied experience ranging from a first-year computer lab monitor to a teacher with more than 20 years of experience. In addition, a number of teachers used *Imagine Language & Literacy* in the past. Administrators interviewed during the case studies had varying amounts of experience ranging from a first-year administrator to an administrator with more than 20 years of experience.

The majority of the administrators agreed for their schools to participate in the study because they had previous positive experience with *Imagine Language & Literacy*. Those who lacked prior experience with *Imagine Language & Literacy* generally agreed to participate out of a desire to improve student learning. All of the administrators interviewed served as the main point of contact for Imagine Learning at their schools. In this role, administrators answered teacher questions, handled technical issues, and troubleshot other issues as they arose. For example, one administrator entered all teacher and student information into the program, assigned usernames and passwords, and personally outfitted lab and computers with microphones for students to use.

Professional Development. Teachers reported the timing of the training varied with teachers receiving training either in the summer, at the beginning of the school year, or after the academic year began. Training sessions occurred online or through video conferencing. Most teachers indicated that the training was very informative and provided sufficient information to start implementation. However, a few teachers felt the trainings were rushed and did not spend enough time on how to interpret reports. Some teachers also reported that the trainings did not afford them the opportunity to explore the

system, that no manual was provided, and information about the program was often relayed by teachers who used it in previous years. A number of teachers indicated they had learned much of what they knew about working with *Imagine Language & Literacy* during past experiences with the program. All teachers expressed a desire for more training with a focus on how to pull and interpret student data reports. One teacher suggested the training could be improved through the use of small group instruction. Another recommendation was that a manual or "Frequently Asked Questions (FAQ" document be provided to help teachers navigate the platform and access additional resources. Below are some representative quotes from teachers about the training:

> *The training was a basic review and introduction to [Imagine Language & Literacy]. It wasn't really a training on how to use it. We could have used training on how to pull data, look data up by class, and move students between classes.* – Teacher

> *The training was rushed, but it helped us to get started.* – Teacher

> *The training was good for what was available, but we really needed to be able to log in during the training to be able to [experience the system] and look for data.* – Teacher

> *We figured [the program out] as we went along, it would have been useful to [learn how] to listen to students' recordings.* – Teacher

> *We could have used training on how and when [students] redo lessons and explanations of the parts of the tests and assessments and the dashboard. We can see student growth, but we can't explain it, I don't know how to pull that information.* – Teacher

In general, administrators experienced the same professional development presented to teachers that provided a general overview how to get started. Administrators also learned how to set up the program by entering student and teacher information into the program. Administrator ratings of the overall quality of training varied across sites. Most administrators agreed the training provided sufficient information to support implementation. They stated that the training staff was professional and provided exceptional customer service when needed. Administrators also had a few recommendations for improvement. They felt the training could have been improved if more time was provided to review program components and included more hands-on activities. All the of administrators felt that an additional training component after the intervention started would have been beneficial to provide more hands-on information and technical support. Below are some representative quotes from administrators about the training:

> *The training was good, but we had not set up accounts yet so we couldn't work with it. We had to follow up with more information on how to access [Imagine Language & Literacy].* – Administrator

> *[The training] was great, [there is] never enough time. . . It was definitely adequate to get us started and [Imagine Learning staff] are always available [to help us].* – Administrator

> *The training was good, I wish they had included the amount of time each grade level was supposed to [use the program]. This was shared around Christmas.* – Administrator

A second training a month [into implementation] would have been great to go over data and available resources. – Administrator

Monitoring. Teachers monitored student program implementation and growth by viewing the student dashboards through *Imagine Language & Literacy* and looking at the weekly reports sent by Imagine Learning documenting student program usage. Teachers indicated they liked that *Imagine Language & Literacy* instruction was differentiated to meet the needs of individual students. For some, monitoring student progress was difficult due to the varied levels of materials students were engaging within the system, while others indicated that monitoring progress was easy because program activities aligned with the curriculum. A few teachers indicated that when students worked on material in *Imagine Language & Literacy* that was ahead of topics covered in their classroom, they referred to this experience when the topic was introduced.

Another group of teachers indicated that the reports highlighted the need to increase grammar instruction in their grade level. Some teachers reported difficulty monitoring growth because of inaccurate information on *Imagine Language & Literacy* reports. For example, a few teachers reported that *Imagine Language & Literacy* reports sometimes indicated that a student had not started a lesson when the lesson was already completed. Others, however, indicated that the action areas noted for students on the reports were accurate.

Support for Implementation. Teachers listed several ways that implementation of *Imagine Language & Literacy* was supported by Imagine Learning and their districts. For example, when headphones with embedded microphones were not available for students to use, Imagine Learning provided them to schools. In addition, technical support was provided by Imagine Learning. Teachers and lab monitors reported difficulties helping students while they were using *Imagine Language & Literacy* due to the amount of time needed and the necessity to leave a student logged in while experiencing a problem. Some teachers reported they received support from their district when asked, while others reported receiving limited support.

Administrators varied in their assessments of the quality of support received from Imagine Learning. Many administrators appreciated the quick responses from Imagine Learning staff while others reported challenges and limited communication with Imagine Learning about implementing the program in their school. Some administrators noted they received district support by receiving Chromebooks, headphones, and iPads for students to use. Administrators indicated that having the support of their teachers, and teachers who were open and willing to try Imagine Learning facilitated effective implementation of the program.

Implementation Challenges. Teachers reported that all students used *Imagine Language & Literacy* in the classroom or in a computer lab. Technological issues were reported by all teachers who participated in the focus groups. Teachers and administrators reported that the following issues affected overall implementation of the program the ability for students to create recordings:

- Students lacking headphones;
- Headphones being incompatible with devices;
- Computers freezing;
- Students being logged off in the middle of a session; and
- Microphones breaking.

Teachers and lab monitors reported that because of how and when *Imagine Language & Literacy* saved student progress, many students had to re-complete tasks. This challenge was reported as a frequent issue that occurred when students had to log out before a lesson was completed or when they were automatically logged out of the program. For example, students frequently had to close the program and move to their next scheduled activity prior to finishing the timed lesson. To decrease the need to repeat information, students were either sent back to class early, or they logged into a different (mathematics) program activity for the remainder of their *Imagine Language & Literacy* time.

The only non-technology related implementation difficulty mentioned by teachers was that *Imagine Language & Literacy* interfered with the time needed for other instructional programs in their school. For example, one district had recently purchased a phonics program that teachers wanted to use. One school was concurrently implementing three different online programs including one targeting computer literacy and one for mathematics. Below are some representative quotes from teachers regarding implementation challenges.

> *The [technology requirements] for headphones and microphones are a disadvantage. We needed to spend our money on headphones for the classroom.* – Teacher

> *Our biggest issues are students being logged off, the number of computers available, and when the sound won't work, that's a big issue because they [students] have to be able to hear what the program is saying to them.* – Teacher

> *[Imagine Language & Literacy] does not save a student's progress mid-lesson, this is a problem when they get logged off or [don't get to finish] within a class.* – Teacher

Some administrators reported that their school had difficulties meeting the recommended minute requirements for students, with many students only engaging with *Imagine Language & Literacy* for 30 minutes per week. One reason identified for this difficulty was the lack of available computer lab time or availability of computer carts. At the time of the site visits, administrators were working with Imagine Learning to find ways for students to meet the recommended dosage. Below are some representative quotes from administrators regarding implementation challenges.

> *Headphones have been a big challenge for us. Not all are compatible with each computer. The recording trips us up.* – Administrator

> *Technology factors, scheduling issues, time allocations, the number of available computers and the technical requirements have [been difficult for us].* – Administrator

> *Our greatest challenge is other district requirements, we can't have all of the computer lab time we'd like, we are required to administer computerized benchmark assessments and [another digital program].* – Administrator

Student Outcomes. Teachers reported students very much enjoyed using *Imagine Language & Literacy* and they asked to use the program when using other computer-based learning software. Teachers also reported that *Imagine Language & Literacy* was easy for students to use and was very engaging for students. One teacher highlighted that the read-aloud feature helped give students more confidence. An overwhelming majority of teachers said they believed that participation in *Imagine Language & Literacy*

positively affected their students. Some said that students who participated in the program demonstrated higher vocabulary and reading scores, as well as increased computer fluency.

Teachers reported they expected to see student growth on computer-based formative assessments like DIBELS Next because *Imagine Language & Literacy* covered relevant topics and provided students with an opportunity to interact with computer-based learning systems. Overall, administrators believed that *Imagine Language & Literacy* aligned with their school curriculum. One administrator noted that Imagine Learning could be improved if there was a way to align program components with current lesson plans for the teacher.

Teachers suggested that benefits may be accelerated for English language learners and more advanced students. The ability of *Imagine Language & Literacy* to provide scaffolded instruction in a student's native language was seen as a benefit among teachers who were unable to provide this type of instruction. Teachers reported rapid growth in achievement for these students. In addition, teachers reported that *Imagine Language & Literacy* helped to prepare English language learner students for state tests. They explained that state tests require students to record themselves speaking and *Imagine Language & Literacy* provided practice with this skill. Teachers also reported benefits for advanced learners, for whom providing challenging material was sometime difficult while simultaneously meeting the needs of struggling students. Below are some representative quotes from teachers regarding student outcomes:

> *We hope to see growth in all students, and a lot of them showed gains on the interim assessment.* – Teacher

> *Imagine Language & Literacy is very interactive and engaging, as long as students are not logged out. The reading aloud component really gives them a sense of confidence. The students don't even realize they are learning.* – Teacher

> *The increased computer use has helped students to get used to using them. This will be a benefit for [other digital assessments].* – Teacher

> *Imagine Learning provides students with good exposure to reading. They do it every day.* – Teacher

> *Imagine Language & Literacy meets students where they are . . . and the oral reading is very helpful for students.* – Teacher

> *[Imagine Language & Literacy] helps [students] to establish a love of learning . . . singing rhymes. They tell me all about what they are learning. It definitely keeps them engaged.* – Teacher

> *We have seen some benefits. Some of our low performing students and English language learners [have] really benefited from [the program].* – Teacher

All teachers said they would recommend Imagine Learning to another teacher because it is motivating to students, easy for students to use, and does not represent a large additional burden for teachers, for example one teacher stated:

> *My favorite thing is that [Imagine Language & Literacy] in not a lot of teacher work . . . it sets a pathway for them. We know it is a quality program and we trust it.* – *Teacher*

Nearly all school administrators also reported that students very much enjoyed interacting with the program. Based on their observations they believed that participating in *Imagine Language & Literacy* resulted in increased phonics skills and improved student confidence in their ability to use new vocabulary outside of class. They reported similar benefits for English language learners. Administrators said they expected to see some form of growth in each student, whether it is based on state assessment scores or students reaching grade-level proficiency. They stated that, compared to other programs, *Imagine Language & Literacy* was easy to use and provided support for a variety of student levels. Below are some representative quotes from administrators regarding student outcomes:

> *Students really enjoy Imagine Language & Literacy compared to the program we used last year. They ask to go and work on it.* – Administrator

> *Students love it and are excited about learning. We are developing life-long learning.* – Administrator

> *I have seen increased confidence in students as their skills develop. Some are catching on quicker to blending and segmenting and picking up new sight words beyond the class materials. I think the growth is due to the additional exposure [through Imagine Language & Literacy].* – Administrator

> *We expect to see growth in our students and an increase in student growth percentiles and the number meeting proficiency.* – Administrator

> *Imagine Language & Literacy has made a positive impact. It helps students at all levels. High performing students get to [engage with] new concepts . . . and ELL [English Language Learner] students have their needs met as well. We've seen carryover of skills into the ELL classrooms.* – Administrator

> *Imagine Language & Literacy helps [students] with digital literacy and strongly supports our instruction. We've already seen some very good growth in reading in Grade 1 on their interim assessments.* – Administrator

DOSAGE

Imagine Language & Literacy dosage was measured using total time (minutes) in the program, total activity time (minutes), number of weeks of program implementation, average total minutes per week, average activity time per week, and meeting the optimal dosage threshold.

The average total minutes spent in the *Imagine Language & Literacy* program varied by grade level and across schools (Exhibits 5 and 6). Across grade levels, school average total minutes in *Imagine Language & Literacy* ranged from 647 to just under 2,000 minutes. Overall, across schools and grade levels, students engaged with the program for between 49 and 3,182 minutes (M = 1,268, SD = 624). On average, students in Kindergarten and Grade 2 spent just under 1,200 total minutes on the program (Kindergarten M = 1,192, SD = 549; Grade 2 M = 1,174, SD = 657). Students in Grade 1 on average used

the program for over 1,400 minutes during the school year (Grade 1 M = 1,433, SD = 628). See Exhibit 6 for a detailed description.

EXHIBIT 5. AVERAGE TOTAL TIME (MINUTES) STUDENTS SPENT IN
***IMAGINE LANGUAGE & LITERACY* BY GRADE LEVEL**
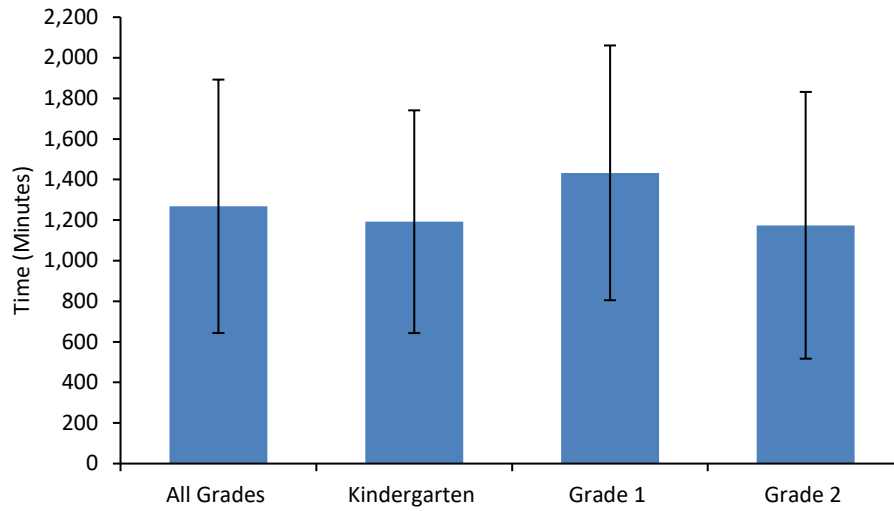
Note. The lines represent the standard deviation (SD).

EXHIBIT 6. TOTAL TIME (MINUTES) STUDENTS SPENT IN *IMAGINE LANGUAGE & LITERACY* BY SCHOOL AND GRADE LEVEL

	School								Total
	1	2	3	4	5	6	7	8	
	Across All Grade Levels								
N	78	156	185	214	154	183	176	229	1375
Min	289.0	49.4	514.0	127.4	467.0	129.8	518.5	436.0	49.4
Max	2780.2	2554.3	2795.4	3182.4	2631.0	815.7	3162.5	2645.3	3182.4
Mean	985.3	692.7	1497.0	1224.4	1532.2	647.1	1999.6	1367.4	1267.9
SD	539.1	582.7	399.0	660.1	443.7	85.5	357.4	414.2	624.4
	Kindergarten								
N	31	41	63	82	54	60	50	69	450
Min	289.0	49.4	514.0	127.4	947.4	516.8	518.5	1025.5	49.4
Max	1619.5	936.5	2795.4	1611.6	1818.6	815.7	1998.8	2137.7	2795.4
Mean	1036.7	341.2	1670.7	856.1	1391.8	676.3	1674.2	1672.1	1192.0
SD	352.4	205.6	378.9	391.9	197.7	75.0	211.0	248.4	549.0
	Grade 1								
N	29	64	62	56	58	63	63	72	467
Min	296.5	195.3	1181.1	776.7	467.0	157.9	757.3	685.2	157.9
Max	1023.0	2554.3	2207.4	3182.4	2631.0	767.0	2402.0	2645.3	3182.4
Mean	605.9	1253.3	1686.8	1980.0	1519.2	651.4	2004.6	1395.3	1432.8
SD	182.3	484.9	257.5	592.4	558.0	90.5	267.2	526.0	627.8
	Grade 2								
N	18	51	60	76	42	60	63	88	458
Min	873.5	56.8	614.6	248.0	676.7	129.8	1502.6	436.0	56.8
Max	2780.2	955.4	1588.2	2186.3	2495.9	696.5	3162.5	1530.4	3162.5
Mean	1508.1	271.9	1118.6	1065.1	1730.6	613.6	2252.7	1105.6	1174.2
SD	708.9	195.2	247.9	462.7	429.7	79.3	321.7	178.7	657.3

Average activity minutes spent in the *Imagine Language & Literacy* program also varied by grade level and school (Exhibits 7 and 8). Across grade levels, school average activity minutes in *Imagine Language & Literacy* ranged from 507 to just over 1,600 minutes. Overall, across schools and grade levels, students engaged with educational activities in the program for between 37 and 2,432 minutes (M = 973, SD = 485). On average, students in Kindergarten and Grade 2 spent approximately 900 activity minutes on the program (Kindergarten M = 900, SD = 417; Grade 2 M = 918, SD = 514). On average, students in Grade 1 used the program for almost 1,100 activity minutes during the school year (Grade 1 M = 1,098, SD = 492). See Exhibit 8 for a detailed description.

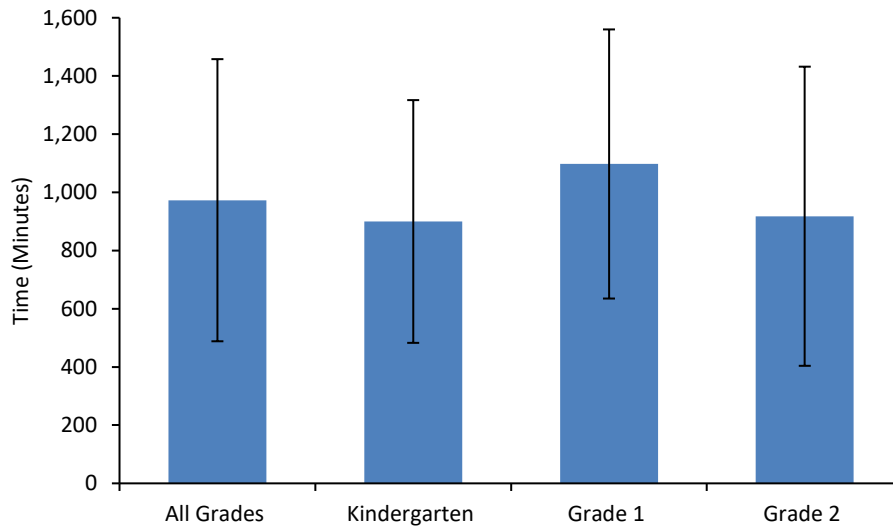## EXHIBIT 7. AVERAGE ACTIVITY TIME (MINUTES) STUDENTS SPENT IN IMAGINE LANGUAGE & LITERACY BY GRADE LEVEL

Note. The lines represent the standard deviation.

EXHIBIT 8. ACTIVITY TIME (MINUTES) STUDENTS SPENT IN IMAGINE LANGUAGE & LITERACY BY SCHOOL AND GRADE LEVEL

	School								Total
	1	2	3	4	5	6	7	8	
	Across All Grade Levels								
N	78	156	185	214	154	183	176	229	1375
Min	211.2	36.8	420.9	61.1	274.4	90.4	401.8	330.2	36.8
Max	2081.0	1819.4	1835.5	2432.4	1964.2	693.3	2405.5	1962.8	2432.4
Mean	731.7	507.1	1102.7	926.4	1165.5	528.6	1604.2	1052.1	973.0
SD	401.6	414.1	286.2	503.4	367.9	72.9	290.2	317.9	484.8
	Kindergarten								
N	31	41	63	82	54	60	50	69	450
Min	211.2	36.8	420.9	61.1	274.4	382.4	401.8	778.0	36.8
Max	1305.5	768.2	1835.5	1250.9	1403.8	693.3	1637.8	1684.9	1835.5
Mean	768.8	262.3	1172.7	637.5	1031.5	545.9	1334.6	1290.1	899.9
SD	283.3	161.2	267.6	299.9	196.4	66.1	186.5	209.7	417.1
	Grade 1								
N	29	64	62	56	58	63	63	72	467
Min	226.5	125.3	918.9	562.9	334.1	90.4	609.9	412.6	90.4
Max	822.1	1819.4	1747.7	2432.4	1964.2	649.6	2001.5	1962.8	2432.4
Mean	474.1	898.3	1276.6	1487.0	1161.0	523.3	1653.8	1033.2	1097.5
SD	143.4	350.6	203.1	449.9	438.2	79.4	228.2	400.0	492.4
	Grade 2								
N	18	51	60	76	42	60	63	88	458
Min	574.9	41.4	421.2	213.8	560.0	116.9	1175.1	330.2	41.4
Max	2081.0	673.2	1234.5	1696.3	1950.1	610.1	2405.5	1178.4	2405.5
Mean	1082.6	212.9	849.5	825.0	1344.0	516.8	1768.6	881.0	917.9
SD	555.7	150.1	187.9	371.0	363.5	70.1	263.8	158.4	514.1

The average weeks spent in the *Imagine Language & Literacy* program varied slightly across grade levels and schools (Exhibits 9 and 10). Across grade levels, the school average for number of weeks of participation in *Imagine Language & Literacy* ranged from 15 to 30 weeks. Overall, across schools and grade levels, students engaged with the program for between 3 and 34 weeks (M = 24.1, SD = 6.6). Average weeks did not vary much by grade level, with Grade 2 students receiving instruction for 23.0 weeks, Kindergarten students receiving instruction for 24.3 weeks, and Grade 1 students receiving instruction for 24.9 weeks, on average. See Exhibit 10 for a detailed description.

EXHIBIT 9. AVERAGE NUMBER OF WEEKS STUDENTS RECEIVED INSTRUCTION IN *IMAGINE LANGUAGE & LITERACY* BY GRADE LEVEL

Note. The lines represent the standard deviation.

EXHIBIT 10. WEEKS STUDENTS RECEIVED INSTRUCTION IN IMAGINE LANGUAGE & LITERACY BY SCHOOL AND GRADE LEVEL

	School								Total
	1	2	3	4	5	6	7	8	
	Across All Grade Levels								
N	78	156	185	214	154	183	176	229	1375
Min	7.0	3.0	16.0	7.0	10.0	5.0	10.0	18.0	3.0
Max	32.0	30.0	30.0	31.0	30.0	21.0	32.0	34.0	34.0
Mean	23.1	14.6	26.3	23.6	25.2	18.7	30.3	28.3	24.1
SD	5.7	8.5	2.2	5.0	4.7	1.8	2.8	3.3	6.6
	Kindergarten								
N	31	41	63	82	54	60	50	69	450
Min	7.0	4.0	16.0	7.0	21.0	14.0	10.0	25.0	4.0
Max	32.0	23.0	30.0	30.0	28.0	21.0	32.0	34.0	34.0
Mean	24.6	10.6	26.7	22.0	26.2	19.2	30.1	31.9	24.3
SD	6.3	4.5	2.1	4.9	1.3	1.4	3.0	1.6	6.8
	Grade 1								
N	29	64	62	56	58	63	63	72	467
Min	9.0	7.0	24.0	17.0	13.0	6.0	11.0	20.0	6.0
Max	25.0	30.0	29.0	31.0	30.0	20.0	32.0	32.0	32.0
Mean	19.1	22.7	26.8	28.2	23.6	18.5	30.0	27.1	24.9
SD	3.5	5.9	1.0	2.9	5.9	1.8	3.7	2.8	5.4
	Grade 2								
N	18	51	60	76	42	60	63	88	458
Min	21.0	3.0	19.0	9.0	10.0	5.0	26.0	18.0	3.0
Max	31.0	22.0	30.0	29.0	30.0	20.0	32.0	30.0	32.0
Mean	26.9	7.5	25.4	22.1	26.2	18.4	30.8	26.6	23.0
SD	3.3	3.7	2.9	4.3	5.0	2.1	1.3	2.4	7.3

Average total minutes per week spent in the *Imagine Language & Literacy* program also varied by grade level and school (Exhibits 11 and 12). Across grade levels, school average total minutes per week in *Imagine Language & Literacy* ranged from 41 to just under 66 minutes. Across schools and grade levels, average total minutes per week spent in *Imagine Language & Literacy* ranged from 12 to 110 minutes per week (*M* = 49.9, *SD* = 16.2). Students in Kindergarten and Grade 2 spent on average between 46 and 48 minutes per week on the program (Kindergarten *M* = 46.4, *SD* = 13.3; Grade 2 *M* = 47.9, *SD* = 16.8). Students in Grade 1 used the program, on average, for the most minutes per week (Grade 1 *M* = 55.4, *SD* = 16.6). See Exhibit 12 for a detailed description.

EXHIBIT 11. AVERAGE TOTAL MINUTES PER WEEK STUDENTS SPENT IN *IMAGINE LANGUAGE & LITERACY* BY GRADE LEVEL
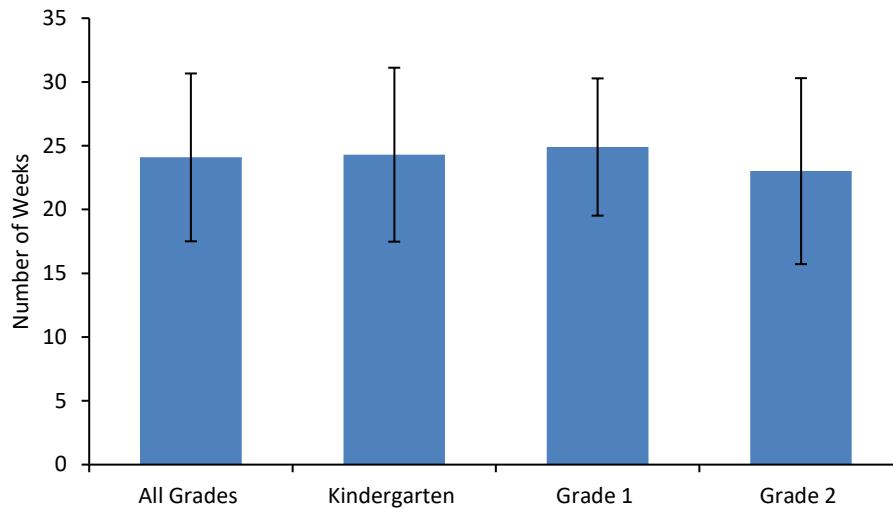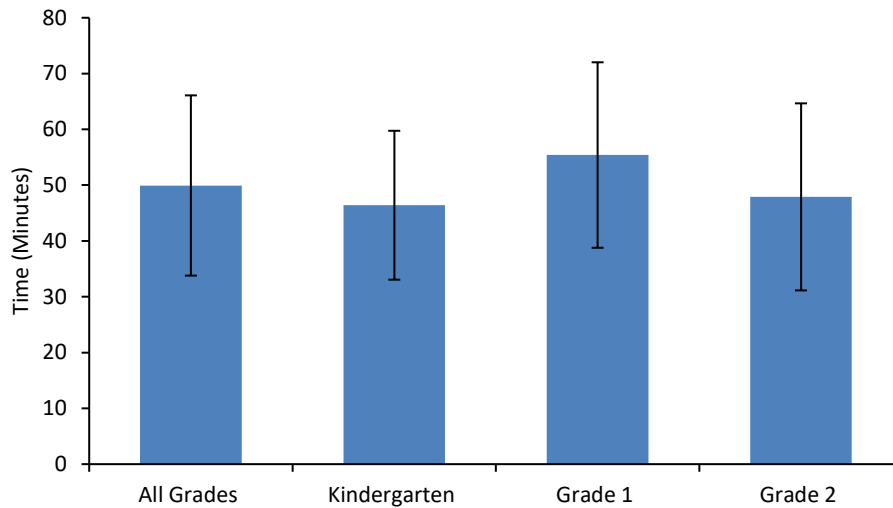

Note. The lines represent the standard deviation.

EXHIBIT 12. TOTAL NUMBER OF MINUTES PER WEEK STUDENTS RECEIVED INSTRUCTION IN *IMAGINE LANGUAGE & LITERACY* BY SCHOOL AND GRADE LEVEL

	School								Total
	1	2	3	4	5	6	7	8	
	Across All Grade Levels								
N	78	156	185	214	154	183	176	229	1375
Min	22.8	12.4	32.1	18.2	29.2	26.0	47.5	24.2	12.4
Max	89.7	85.1	96.4	109.7	99.0	41.2	99.3	87.7	109.7
Mean	40.6	41.5	56.4	49.0	60.3	34.6	65.9	47.6	49.9
SD	13.5	16.2	12.5	19.0	12.0	3.1	9.6	10.8	16.2
	Kindergarten								
N	31	41	63	82	54	60	50	69	450
Min	27.6	12.4	32.1	18.2	36.4	27.2	47.5	38.4	12.4
Max	52.2	49.7	96.4	59.7	67.4	41.1	64.5	66.5	96.4
Mean	41.6	30.7	62.1	37.2	53.1	35.2	55.5	52.3	46.4
SD	6.0	9.8	11.4	11.3	7.2	3.2	3.7	6.5	13.3
	Grade 1								
N	29	64	62	56	58	63	63	72	467
Min	22.8	27.9	48.8	30.3	29.2	26.3	59.2	29.8	22.8
Max	44.5	85.1	81.8	109.7	94.0	41.2	75.1	87.7	109.7
Mean	31.2	54.2	62.8	69.4	62.6	35.2	66.7	50.6	55.4
SD	4.8	13.0	8.6	17.6	12.1	3.2	3.2	15.1	16.6
	Grade 2								
N	18	51	60	76	42	60	63	88	458
Min	34.9	16.7	32.4	22.6	45.6	26.0	50.1	24.2	16.7
Max	89.7	62.6	58.1	80.2	99.0	39.4	99.3	52.8	99.3
Mean	54.3	34.3	43.7	46.5	66.5	33.3	73.2	41.5	47.9
SD	19.2	12.8	6.0	14.0	12.3	2.4	9.9	50.1	16.8

Average activity minutes per week spent in the *Imagine Language & Literacy* program varied by grade level and school (Exhibits 13 and 14). As expected, the number of activity minutes per week was lower than the average total time per week. Across grade levels, school average activity minutes per week in *Imagine Language & Literacy* ranged from 28 to just under 53 minutes per week. Across schools and grade levels, average activity minutes per week spent in *Imagine Language & Literacy* ranged from 9 to 84 minutes per week ($M = 38.4$, $SD = 12.6$). Students in Kindergarten spent about 35 activity minutes per week ($M = 35.1$, $SD = 10.1$); Grade 2 students spent about 38 activity minutes ($M = 37.5$, $SD = 13.1$), and Grade 1 students spent about 42 activity minutes per week ($M = 42.4$, $SD = 13.1$). See Exhibit 14 for a detailed description.

EXHIBIT 13. AVERAGE ACTIVITY MINUTES PER WEEK STUDENTS SPENT IN
***IMAGINE LANGUAGE & LITERACY* BY GRADE LEVEL**
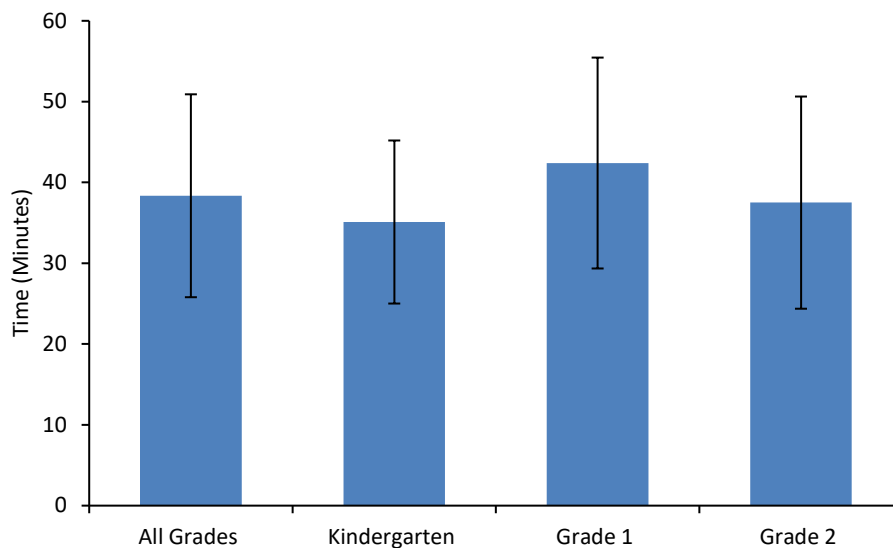

Note. The lines represent the standard deviation.

EXHIBIT 14. NUMBER OF ACTIVITY MINUTES PER WEEK STUDENTS RECEIVED INSTRUCTION IN IMAGINE LANGUAGE & LITERACY BY SCHOOL AND GRADE LEVEL

	School								Total
	1	2	3	4	5	6	7	8	
	Across All Grade Levels								
N	78	156	185	214	154	183	176	229	1375
Min	18.0	9.2	22.2	8.7	10.6	15.1	33.7	18.3	8.7
Max	67.1	60.7	67.6	83.9	76.0	35.1	77.6	67.4	83.9
Mean	30.2	31.0	41.6	37.0	45.9	28.2	52.8	36.6	38.4
SD	9.9	11.7	9.2	14.7	10.8	2.9	7.7	8.2	12.6
	Kindergarten								
N	31	41	63	82	54	60	50	69	450
Min	21.0	9.2	26.3	8.7	10.6	20.1	33.7	27.1	8.7
Max	42.1	41.6	67.6	46.3	52.0	35.1	52.8	54.4	67.6
Mean	30.7	23.6	43.7	27.7	39.4	28.4	44.2	40.4	35.1
SD	5.3	8.2	8.6	8.9	7.4	3.0	3.8	5.7	10.1
	Grade 1								
N	29	64	62	56	58	63	63	72	467
Min	18.0	17.9	36.3	22.5	20.9	15.1	47.5	20.0	15.1
Max	35.8	60.7	64.7	83.9	70.2	34.5	62.6	67.4	83.9
Mean	24.4	38.9	47.6	52.2	47.7	28.2	55.0	37.4	42.4
SD	3.9	9.7	7.1	13.6	10.0	3.2	3.1	11.5	13.1
	Grade 2								
N	18	51	60	76	42	60	63	88	458
Min	24.9	13.6	22.2	18.0	32.3	22.2	40.0	18.3	13.6
Max	67.1	56.5	44.4	64.0	76.0	34.3	77.6	42.1	77.6
Mean	38.8	27.0	33.2	35.9	51.8	28.1	57.4	33.0	37.5
SD	15.4	10.4	4.8	11.2	11.3	2.4	7.8	4.4	13.1

OPTIMAL DOSAGE

Imagine Learning recommends that students in Kindergarten engage with *Imagine Language & Literacy* for at least 45 minutes per week and that students in Grade 1 and Grade 2 engage with the program for 60 minutes per week. Across schools, more than half (56%) of Kindergarten students participated for the recommended 45 total minutes per week. Adherence to optimal dosage was lower in Grades 1 and 2 with less than half (47%) of students in Grade 1 and less than a fourth (24%) of students in Grade 2 meeting the recommended dosage of 60 minutes per week (Exhibit 15). Average minutes of participation also varied substantially across schools. Exhibits 16 through 18 present graphs with the data in Exhibit 15 compared to the recommended optimal dosage.

EXHIBIT 15. STUDENTS MEETING OPTIMAL DOSAGE BY SCHOOL AND GRADE LEVEL

| | Percent of Students Meeting Optimal Dosage | | | | | | | | |
| | School | | | | | | | | |
	1	2	3	4	5	6	7	8	Total
Kindergarten	29.0	9.8	93.7	29.3	83.3	0.0	100.0	85.5	55.6
Grade 1	0.0	34.4	62.9	69.6	69.0	0.0	98.4	25.0	47.1
Grade 2	33.3	2.0	0.0	18.4	66.7	0.0	98.4	0.0	23.6

EXHIBIT 16. MINUTES PER WEEK STUDENTS RECEIVED INSTRUCTION IN
***IMAGINE LANGUAGE & LITERACY* BY SCHOOL, KINDERGARTEN**
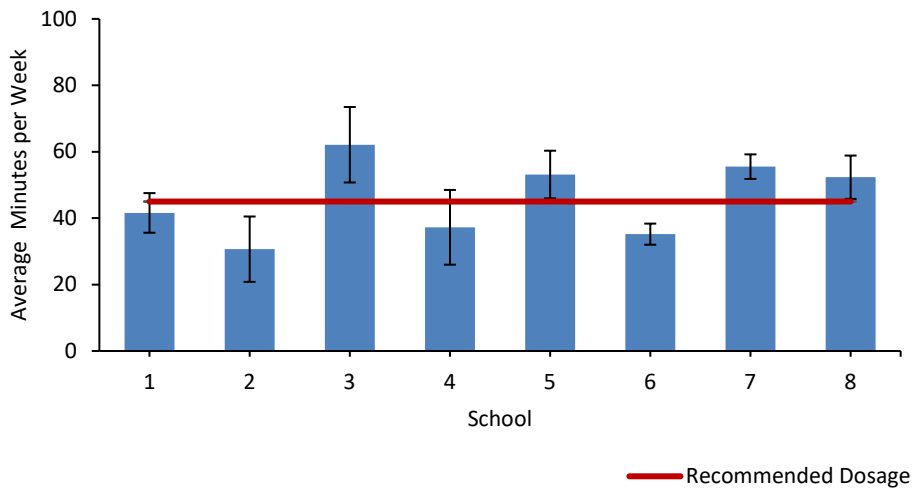
EXHIBIT 17. MINUTES PER WEEK STUDENTS RECEIVED INSTRUCTION IN
***IMAGINE LANGUAGE & LITERACY* BY SCHOOL, GRADE 1**
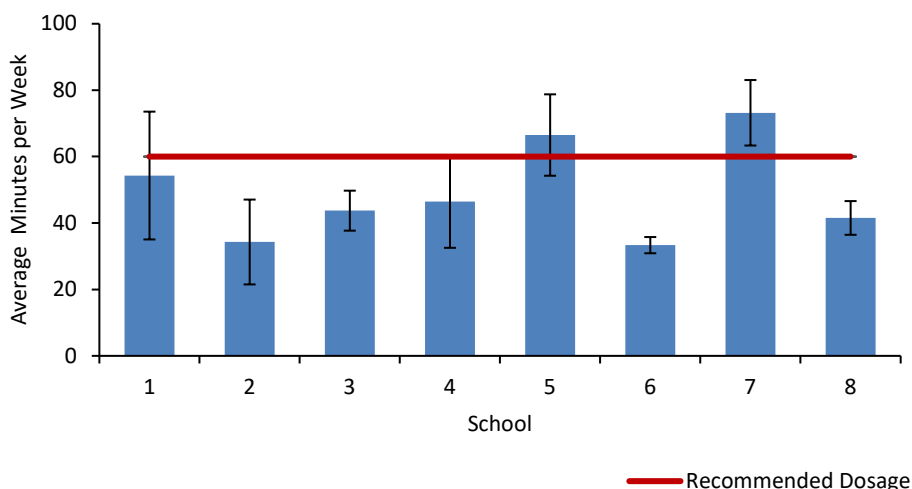
As expected, the average number of activity minutes per week was lower than the average total time per week. On average, about 77% of total time spent in *Imagine Language & Literacy* was logged as activity time, suggesting that, in this case, the optimal activity time[14] for students in Kindergarten may be approximately 35 minutes (77% of 45 minutes) per week and 46 minutes (77% of 60 minutes) per week for students in Grade 1 and Grade 2. Over half of students in Kindergarten (53%), just over 44% of Grade 1 students, and approximately 24% of Grade 2 students met these average participation times per week.

HOW DOES VARIATION IN IMPLEMENTATION RELATE TO FORMATIVE STUDENT ACHIEVEMENT OUTCOMES?

Student scores on DIBELS Next subtests by grade level are presented in Exhibit 19. In spring 2019, between 37% and 57% of students met recommended benchmarks for DIBELS Next subtests, and between 0% and 31% of students were at risk. Total time, activity time, number of weeks, average total minutes per week, average activity minutes per week, and meeting the optimal dosage threshold were the dosage indicators used in the correlational analyses to understand the relationship between dosage and student achievement on the DIBELS Next assessments. Dosage indicators were each examined in independent regression analyses due to high intercorrelation. All regression findings are presented with more detail in the Appendix.

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[14] The presented optimal activity times are estimates and may not generalize to all *Imagine Language & Literacy* users.

EXHIBIT 19. SPRING 2019 SCORES ON THE DIBELS NEXT SUBTESTS BY GRADE LEVEL

	Mean	SD	% Meeting Recommended DIBELS Next Benchmark	% At Risk
Letter Naming Fluency (Kindergarten)	57.3	17.2	37.1	31.3
Nonsense Word Fluency: Correct Letter Sound (Grade 1)	90.4	38.6	44.3	29.8
Nonsense Word Fluency: Whole Words Correct (Grade 1)	28.1	15.7	47.5	27.6
Oral Reading Fluency: Words Correct (Grade 2)	104.2	35.7	42.6	25.5
Oral Reading Fluency: Accuracy (Grade 2)	96.7	6.4	56.6	0.0

Increased program dosage was associated with higher student achievement for students in Kindergarten and Grade 1 after accounting for prior achievement and student characteristics. All indicators of program dosage, including total time, total activity time, total weeks of participation, average total minutes per week, average activity minutes per week, and meeting the recommended optimal dosage for total minutes per week (Exhibit 20) were significantly and positively related to higher spring scores on the subscales for DIBELS Next Letter Naming Fluency (K), and on Nonsense Word Fluency Correct Letter Sounds and Whole Words Correct (Grade 1). No indicators for Grade 2 were significantly related to spring DIBELS Next scores on the Oral Reading Fluency: Words Correct subscale or the Oral Reading Fluency: Accuracy subscale.

EXHIBIT 20. RELATIONSHIP BETWEEN DOSAGE AND STUDENT ACHIEVEMENT

DIBELS Next	Kindergarten	Grade 1	Grade 2
Letter Naming Fluency	Positive		
Nonsense Word Fluency: Correct Letter Sounds		Positive	
Nonsense Word Fluency: Whole Words Correct		Positive	
Oral Reading Fluency: Words Correct			n.s.
Oral Reading Fluency: Accuracy			n.s.

[a] n.s. = Not significant at the $p < .05$ level.[15] Shaded boxes indicate the DIBELS Next subtest was not administered to that grade.

Note. For each outcome measure and grade level, the effect of the implementation factor for *Imagine Language & Literacy* program is noted as not significant, positive, or negative. Dosage indicators include total time, total activity time, total weeks of participation, average total minutes per week, average activity minutes per week, and meeting the recommended optimal dosage threshold for total minutes per week.

More details of the strength of the relationships for students in Kindergarten are presented in Exhibits 21 through 23. As seen in Exhibit 21, when converted to hours, for students in Kindergarten, an additional hour of participation was associated with just over a third of a point higher score (0.006 x 60 minutes) on the DIBELS Next Letter Naming Fluency subtest. An additional hour of activity time within *Imagine Language & Literacy* was associated with almost a half-point increase (0.008 x 60 minutes) in

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[15] *p*-value is an indicator that represents the likelihood that observed results occurred by chance. In education research, values of $p < .05$ (i.e., values indicating that observed results had a less than 5% chance of occurring by chance) are typically used to identify results that are statistically significant. Lower *p*-values indicate a smaller likelihood that observed results occurred by chance and are therefore associated with statistically significant findings.

score on the DIBELS Next Letter Naming Frequency subtest. An additional week of participation was associated with almost a 0.4-point higher score on the DIBELS Next Letter Naming Fluency subtest. An additional 5 minutes of total time per week was associated with a 1.4-point higher score (0.287 x 5 minutes) and 5 minutes additional activity time per week was associated with an almost 1.8-point higher score (0.356 x 5 minutes) on the DIBELS Next Letter Naming Fluency subtest. Meeting the recommended optimal dosage threshold of 45 minutes per week was associated with 6.5-point higher score on the Letter Naming Fluency subtest.

EXHIBIT 21. DOSAGE AND SPRING 2019 DIBELS NEXT LETTER NAMING FLUENCY (LNF) SCORES, KINDERGARTEN

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate[16]	SE[17]	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	36.560***	2.014	36.753***	2.072	34.863***	2.953	31.095***	2.612	31.549***	2.726	40.392***	1.576
2018 Fall DIBELS Next LNF Score	.585***	.041	.592***	.041	.608***	.041	.574***	.041	.583***	.041	.610***	.041
Dosage	**.006***	**.001**	**.008***	**.002**	**.371***	**.105**	**.287***	**.049**	**.356***	**.067**	**6.506***	**1.302**

***$p < .001$.

Note. Separate models were used to examine each dosage indicator. Though the coefficients for total time and total activity time are small, this is to be expected as increases are documented in 1-minute increments.

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[16] The table contains unstandardized regression coefficients (*B*) for each of the independent variables.

[17] The standard error (SE) is a measure of the amount of sampling error associated with each regression coefficient.

In summary, an increase of 167 total minutes, 125 activity minutes, 2.7 weeks, 3.5 minutes per week, or 2.8 activity minutes per week was associated with a one-point higher score on the Kindergarten Letter Naming Fluency scores (Exhibit 22). For Kindergarten students in the analytic sample, a one-point higher score on this measure would be related to an additional 1.8% of students meeting DIBELS Next benchmark scores for progress and 2.6% fewer students being identified as at risk. The dosages associated with a one-to-five-point higher score on DIBELS Next Letter Naming Fluency can be found in Exhibit 23 with the associated relationship with the percent of students meeting DIBELS Next benchmark scores and being identified as at risk.

EXHIBIT 22. SUMMARY OF DOSAGE INDICATORS ASSOCIATED WITH ONE-POINT HIGHER DIBELS NEXT SCORE, KINDERGARTEN
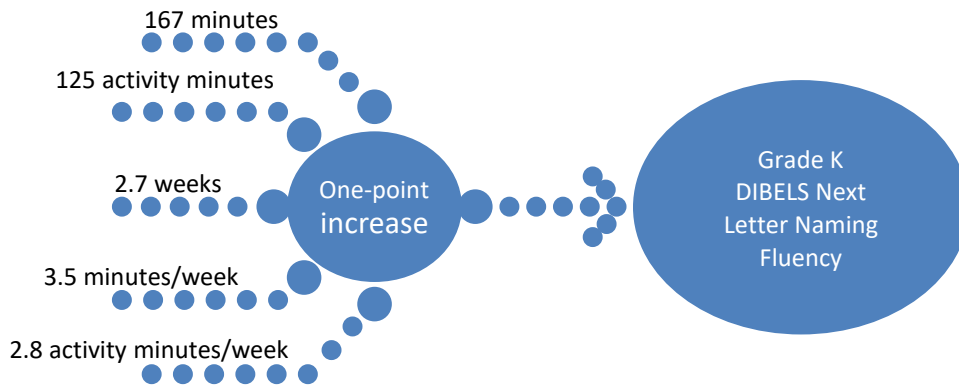
EXHIBIT 23. DOSAGE ASSOCIATED WITH HIGHER SCORES ON THE DIBELS NEXT LETTER NAMING FLUENCY (LNF), KINDERGARTEN

Change in Score	Total Time (Minutes)	Activity Time (Minutes)	Number of Weeks	Total Minutes Per Week	Activity Minutes Per Week	Additional % Meeting DIBELS Next Benchmark	Decrease in % Identified as At Risk
1	167	125	2.7	3.5	2.8	1.8	2.6
2	333	250	5.4	7.0	5.6	5.1	5.7
3	500	375	8.1	10.5	8.4	8.5	7.5
4	667	500	10.8	13.9	11.2	11.3	8.9
5	833	625	13.5	17.4	14.0	14.0	9.7

As seen in Exhibits 24 and 25, for students in Grade 1, an additional hour of participation was associated with just under a half-point higher score (0.008 x 60 minutes) on the DIBELS Next Nonsense Word Fluency: Correct Letter Sounds subtest and almost a fourth-point higher (0.004 x 60 minutes) on the DIBELS Next Nonsense Word Fluency: Whole Words Correct subtest. An additional hour of activity time was associated with just over a half point higher (0.009 x 60 minutes) on the DIBELS Next Nonsense Word Fluency: Correct Letter Sounds subtest and almost a fourth-point higher (0.004 x 60 minutes) on the DIBELS Next Nonsense Word Fluency: Whole Words Correct subtest. An additional week of participation was associated with scoring 0.7 points higher on the DIBELS Next Nonsense Word Fluency: Correct Letter Sounds subtest and a third-point higher score on the DIBELS Next Nonsense Word

Fluency: Whole Words Correct subtest. An additional 5 minutes spent interacting with *Imagine Language & Literacy* per week was associated with 1.3 point higher score (0.269 x 5 minutes) on the DIBELS Next Nonsense Word Fluency: Correct Letter Sounds subtest and a 0.7 point higher score (0.136 x 5 minutes) on the DIBELS Next Nonsense Word Fluency: Whole Words Correct subtest. An additional 5 activity minutes per week was associated with 1.6-points higher (0.316 x 5 minutes) on the DIBELS Next Nonsense Word Fluency: Correct Letter Sounds subtest and over an eighth of a point higher score (0.161 x 5 minutes) on the DIBELS Next Nonsense Word Fluency: Whole Words Correct subtest. Meeting the recommended optimal dosage threshold of 60 minutes per week was associated with almost a 5.8 points higher score on the DIBELS Next Nonsense Word Fluency: Correct Letter Sounds subtest and a 3.3 points higher score on the DIBELS Next Nonsense Word Fluency: Whole Words Correct subtest.

EXHIBIT 24. DOSAGE AND SPRING 2019 DIBELS NEXT NONSENSE WORD FLUENCY: CORRECT LETTER SOUNDS (NWF: CLS) SCORES, GRADE 1

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	47.074***	4.196	47.785***	4.184	40.027***	6.846	43.427***	5.020	44.845***	4.978	55.130***	3.353
2018 Fall DIBELS Next NWF: CLS Score	.844***	.043	.842***	.043	.852***	.043	.838***	.043	.836***	0.43	.842***	.043
Dosage	**.008***	**.002**	**.009***	**.003**	**.692**	**.241**	**.269***	**.075**	**.316***	**.096**	**5.774***	**2.503**

*p < .05, **p < .01, ***p < .001.
Note. Separate models were used to examine each dosage indicator. All models account for prior achievement (Fall DIBELS Next), gender, race, special education eligibility, and English language learner status. Though the coefficients for total time and total activity time are small, this is to be expected as increases are documented in 1-minute increments.

EXHIBIT 25. DOSAGE AND SPRING 2019 DIBELS NEXT NONSENSE WORD FLUENCY: WHOLE WORDS CORRECT SOUNDS (NWF: WRC) SCORES, GRADE 1

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	19.081***	1.563	19.389***	1.560	16.306***	2.746	16.911***	1.966	17.526***	1.957	22.628***	1.156
2018 Fall DIBELS Next NWF: WRC Score	.739***	.043	.738***	.043	.753***	.043	.734***	.043	.731***	.044	.744***	.044
Dosage	**.004***	**.001**	**.004***	**.001**	**.311**	**.102**	**.136***	**.032**	**.161***	**.041**	**3.316**	**1.065**

**p < .01, ***p < .001.
Note. Separate models were used to examine each dosage indicator. All models account for prior achievement (Fall DIBELS Next), gender, race, special education eligibility, and English language learner status. Though the coefficients for total time and total activity time are small, this is to be expected as increases are documented in 1-minute increments.

In summary, an increase of 125 total minutes, 111 activity minutes, 1.4 weeks, an additional 3.7 minutes per week or 3.2 activity minutes per week was associated with a one-point higher score on the Grade 1 DIBELS Next Nonsense Word Fluency: Correct Letter Sounds subtest (Exhibit 26). For Grade 1 students in the analytic sample, a one-point higher score on this measure would be related to an additional half percent of students meeting DIBELS Next benchmark scores for progress and 0.2% fewer students being identified as at risk. An increase of 250 total minutes, 250 activity minutes, 3.2 weeks, 7.4 total minutes per week or 6.2 activity minutes per week was associated with a one-point higher score on the Grade 1 DIBELS Next Nonsense Word Fluency: Whole Words Correct subtest (Exhibit 26). For Grade 1 students in the analytic sample, a one-point higher score on this measure would be related to an additional 1.1% of students meeting DIBELS Next benchmark scores for progress and 2.8% fewer students being identified as at risk. The dosages associated with a one-to-five-point higher DIBELS Next Nonsense Word Fluency: Correct Letter Sounds scores can be found in Exhibit 27 and in Exhibit 28 for the DIBELS Next Nonsense Word Fluency: Whole Words Correct scores along with the associated impact on the percent of students meeting DIBELS Next benchmark scores and being identified as at risk.

EXHIBIT 26. SUMMARY OF DOSAGE INDICATORS ASSOCIATED WITH ONE-POINT INCREASE IN DIBELS NEXT SCORE, GRADE 1
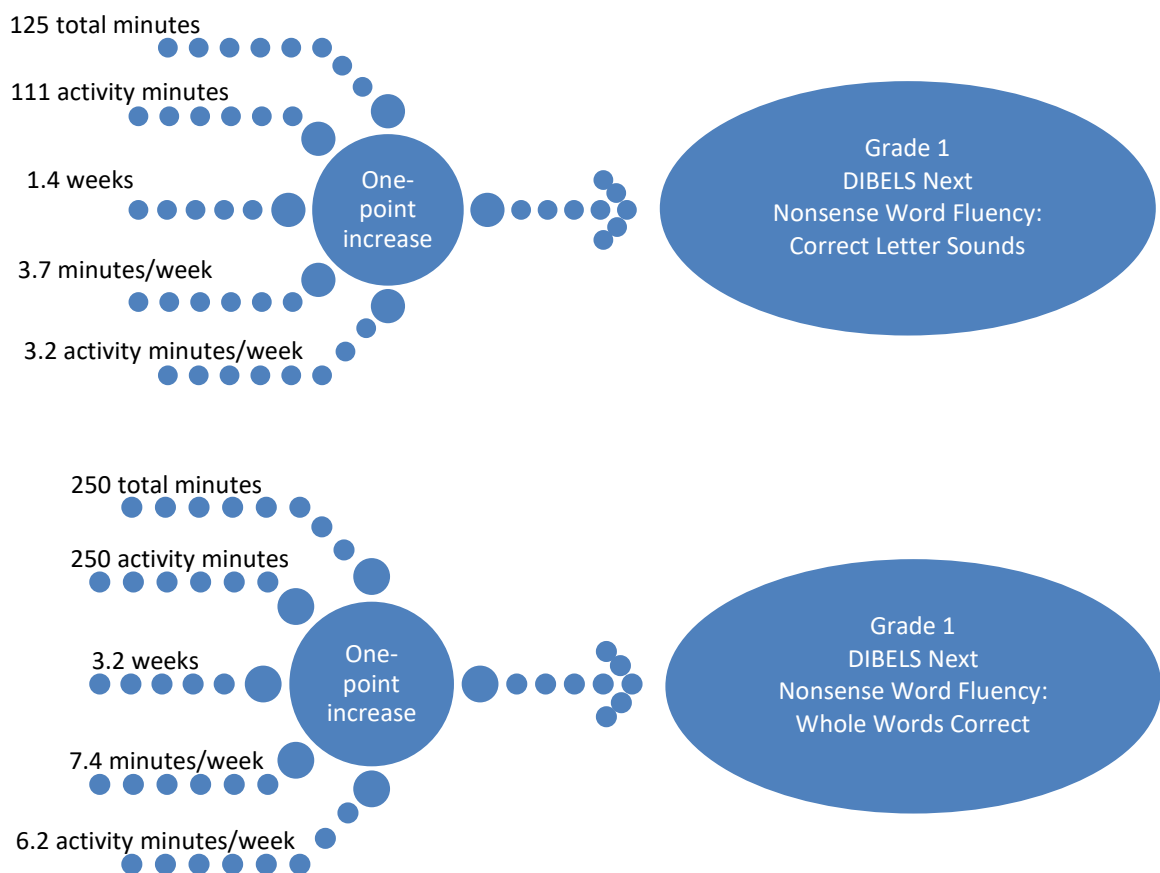
EXHIBIT 27. DOSAGE ASSOCIATED WITH HIGHER SCORES ON THE
DIBELS NEXT NONSENSE WORD FLUENCY: CORRECT LETTER SOUND, GRADE 1

	Total Time (Minutes)	Activity Time (Minutes)	Number of Weeks	Total Minutes per Week	Activity Minutes Per Week	Additional % Meeting Threshold	Decrease in % Identified as At Risk
1	125	111	1.4	3.7	3.2	0.5	0.2
2	250	222	2.9	7.4	6.3	1.3	.09
3	375	333	4.3	11.2	9.5	2.0	1.7
4	500	444	5.8	14.9	12.7	2.4	3.5
5	625	556	7.2	18.6	15.8	2.6	5.2

EXHIBIT 28. DOSAGE ASSOCIATED WITH HIGHER SCORES ON THE
DIBELS NEXT NONSENSE WORD FLUENCY: WHOLE WORD CORRECT, GRADE 1

	Total Time (Minutes)	Activity Time (Minutes)	Number of Weeks	Total Minutes per Week	Activity Minutes Per Week	Additional % Meeting Threshold	Decrease in % Identified as At Risk
1	250	250	3.2	7.4	6.2	1.1	2.8
2	500	500	6.4	14.7	12.4	2.6	4.5
3	750	750	9.6	22.1	18.6	3.7	6.6
4	1,000	1,000	12.9	29.4	24.8	5.4	7.9
5	1,250	1,250	16.1	36.8	31.1	6.7	9.6

For students in Grade 2, total time, total activity time, number of weeks of participation, average minutes per week, average activity minutes per week, and meeting the recommended optimal threshold for dosage in *Imagine Language & Literacy* were not significantly associated with spring DIBELS Next scores on the DIBELS Next Oral Reading Fluency: Whole Words Correct subtest after accounting for prior achievement (Fall DIBELS Next), gender, race, special education eligibility, and English language learner status (Exhibit 29). Similarly, for these students, total time, total activity time, number of weeks of participation, average minutes per week, average activity minutes per week, and meeting the recommended optimal threshold for dosage in *Imagine Language & Literacy* were not significantly associated with DIBELS Next scores on the DIBELS Next Oral Reading Fluency: Accuracy subtest after accounting for prior achievement (Fall DIBELS Next), gender, race, special education eligibility, and English language learner status (Exhibit 30).

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	40.797***	3.046	40.116***	3.018	37.615***	3.858	41.817***	3.548	40.568***	3.490	41.751***	2.497
2018 Fall DIBELS Next ORF: WC Score	.912***	.025	.913***	.025	.912***	.025	.911***	.025	.912***	.025	.908***	.025
Dosage	**.000**	**.001**	**.001**	**.002**	**.128**	**.118**	**-.016**	**.047**	**.009**	**.061**	**-2.041**	**1.860**

***$p < .001$.

Note. Separate models were used to examine each dosage indicator. All models account for prior achievement (Fall DIBELS Next), gender, race, special education eligibility, and English language learner status. Though the coefficients for total time and total activity time are small, this is to be expected as increases are documented in 1-minute increments.

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	56.540***	1.581	56.464***	1.572	56.093***	1.629	56.839***	1.631	56.617***	1.615	56.952***	1.555
2018 Fall DIBELS Next ORF: ACC Score	.435***	.016	.434***	.016	.434***	.016	.435***	.016	.435***	.016	.434***	.016
Dosage	**.000**	**.000**	**.000**	**.000**	**.031**	**.025**	**-.002**	**.010**	**.004**	**.013**	**-.391**	**.402**

***$p < .001$.

Note. Separate models were used to examine each dosage indicator. All models account for prior achievement (Fall DIBELS Next), gender, race, special education eligibility, and English language learner status. Though the coefficients for total time and total activity time are small, this is to be expected as increases are documented in 1-minute increments.

CONCLUSIONS AND RECOMMENDATIONS

RMC Research used a case study approach to document implementation of *Imagine Language & Literacy* and a correlational design to examine the relationship between student program usage and student academic achievement outcomes for students in Grades K-2. The study was conducted during the 2018/19 academic year at eight schools in two school districts in the Southeastern United States. The case study approach involved interviews with administrators, focus groups with teachers, and observations of *Imagine Language & Literacy* in six schools to gather detailed information about implementation. For all study schools, RMC Research and Imagine Learning collected usage data and administrative data including demographic information and scores on the formative DIBELS Next assessment for all students in Grades K-2 to examine the relationship between student program usage and student academic achievement. Findings focus on implementation factors and the impact of the amount of instruction received in *Imagine Language & Literacy* on spring DIBELS Next scores.

FINDINGS

In general, teachers and administrators found the professional development provided to be sufficient for beginning implementation of *Imagine Language & Literacy*. Teachers and administrators reported that the initial professional development they received from Imagine Learning was informative and sufficient to get them started using *Imagine Language & Literacy*.

Teachers suggested additional training or documentation on using *Imagine Language & Literacy*. Teachers indicated they would have liked additional training on how to use many of the components of *Imagine Language & Literacy* and that they would specifically like training regarding the student-level reports available in the system. Additionally, some teachers requested a "Frequently Asked Questions (FAQ)" or other documentation be available to aid them in finding information within *Imagine Language & Literacy* such as reports and additional resources.

Implementation was hindered by technology problems. All teachers and administrators reported experiencing technology problems, many of which negatively affected implementation of *Imagine Language & Literacy.*

Students enjoyed engaging with *Imagine Language & Literacy*. Teachers and administrators reported their students enjoyed working in *Imagine Language & Literacy* and the program was engaging for students*.*

Fewer than 60% of students in each grade level met the recommendation for average number of minutes per week of participation. Imagine Learning recommends that students in Kindergarten engage with *Imagine Language & Literacy* for at least 45 minutes per week and students in Grades 1 and 2 engage with the program for at least 60 minutes per week. On average, 56% of Kindergarten students, 47% of students in Grade 1, and 24% of students in Grade 2 met the recommended total minutes per week.

Average student participation varied by school. Across the schools in the study, participation in *Imagine Language & Literacy* varied. School averages for total weeks ranged from 15 to 30 weeks, averages for total minutes ranged from 647 to just under 2,000 minutes, and averages for activity minutes ranged from 507 to 1,604 minutes.

Extent of participation (dosage) was related to performance on the spring DIBELS Next assessment for students in Kindergarten. All indicators of dosage were positively related to spring scores on the DIBELS Next assessment for students in Kindergarten. For example, after accounting for prior achievement and demographic characteristics, an increase in participation of 167 total minutes, 125 activity minutes, 2.7 weeks, 3.5 minutes per week, or 2.8 activity minutes per week was associated with a one-point increase on the DIBELS Next Letter Naming Fluency test for students in Kindergarten. For students in the analytic sample, a one-point increase on this test would be related to an additional 1.8% of students meeting DIBELS Next benchmark scores for progress and 2.6% fewer students being identified as at risk.

Extent of participation (dosage) was related to performance on the spring DIBELS Next assessment for students Grade 1. All indicators of dosage were positively related to spring scores on the DIBELS Next assessment for students in Grade 1. For students in Grade 1, an increase of 125 total minutes, 111 activity minutes, 1.4 weeks, 3.7 minutes per week, or 3.2 activity minutes per week was associated with a one-point increase in DIBELS Next Nonsense Word Fluency: Correct Letter Sounds score and increases in participation of 250 total minutes, 250 activity minutes, 3.2 weeks, 7.4 minutes per week, or 6.2 activity minutes per week were associated with a similar increase on the DIBELS Next Nonsense Word Fluency: Whole Words Correct score. For students in the analytic sample, a one-point increase on this test would be related to an additional half percent of students meeting DIBELS Next benchmark scores for progress and 0.2% fewer students being identified as at risk on the DIBELS Next Nonsense Word Fluency: Correct Letter Sounds test and an additional 1.1% of students meeting DIBELS Next benchmark scores for progress and 2.8% fewer students being identified as at risk on the DIBELS Next Nonsense Word Fluency: Whole Word Correct test.

Extent of participation (dosage) was not significantly related to performance on the spring DIBELS Next assessment for students in Grade 2. No indicators of dosage were found to be significantly related to spring scores on the DIBELS Next assessment for students in Grade 2. Overall implementation was lowest in Grade 2, with only 24% of students meeting optimal dosage recommendations. This finding suggests that weak implementation reduces the likelihood of detecting student outcomes.

RECOMMENDATIONS

Based on findings from this study, RMC Research offers the following recommendations to guide program development and improvement, and to assess the impact of *Imagine Language & Literacy*.

1. **Provide additional hands-on experience with *Imagine Language & Literacy* programming and reports during the Getting Started training.** Recommendations from teachers and administrators included providing additional training on how to use each of the components of *Imagine Language & Literacy*, including student reports.

2. **Document technology issues and share common solutions or a manual for common issues.** Technology issues were a challenge faced by all sites. Consider collecting more systematic information about technological issues, particularly among newly implementing sites. Such

information may be used to identify the most prevalent issues and types of technical support that may be provided to facilitate successful implementation. For example, to support common challenges such as incompatibility of microphones or challenges with students logging in to the program, a manual or "Frequently Asked Questions (FAQ)" document might be developed so teachers and administrators can independently troubleshoot issues and find solutions.

3. **Continue monitoring implementation throughout the academic year.** Given variation in implementation across grade levels and schools, Imagine Learning may wish to further explore ways to regularly monitor usage statistics through the school year. For example, weekly reports of usage statistics across and within schools might be reviewed by Imagine Learning and used as a tool for communication with sites to assess factors related to low implementation. Imagine Learning may also wish to encourage school administrators to monitor implementation and take steps to address issues when target dosage thresholds are not met.

4. **Continue encouraging sites to implement programming and meet usage recommendations.** Students who met optimal dosage for time on program and those with greater overall program participation had higher spring achievement scores. Overall implementation was lowest in Grade 2 and no significant associations with outcomes were found among Grade 2 students, suggesting—not surprisingly—that weak implementation reduces the likelihood of detecting student outcomes. Encouraging sites to ensure that optimal dosage thresholds are met for all students may help improve outcomes. Examining implementation and outcomes for subgroups of students also appears to be important.

LIMITATIONS

This study includes findings based on case study and correlational evidence. While these findings suggest positive relationships between implementation of *Imagine Language & Literacy* and student achievement, no causal conclusions can be drawn. Because different subtests are used to calculate the DIBELS Next composite score depending on the grade level and time of year, composite scores are not directly comparable across administrations and grade levels (Dynamic Measurement Group, Inc., 2010). Therefore, all analyses in this report include only those subtests that were taken in both fall and spring in each grade level and do not reflect all content domains measured by DIBELS Next. In addition, approximately 1.7% of *Imagine Language & Literacy* users were excluded from these analyses due to low usage (less than 1 month); another approximately 20% were excluded due to missing demographic or DIBELS Next data or because usage data could not be matched to demographic or achievement data.

APPENDIX

This Appendix presents tables with full results from the regression analyses, including all demographic variables.

EXHIBIT A1. DOSAGE AND SPRING 2019 DIBELS NEXT LETTER NAMING FLUENCY (LNF) SCORES, KINDERGARTEN (*N* = 450)

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate[18]	*SE*[19]	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*	Estimate	*SE*
Intercept	36.560***	2.014	36.753***	2.072	34.863***	2.953	31.095***	2.612	31.549***	2.726	40.392***	1.576
2018 Fall DIBELS Next LNF Score	.585***	.041	.592***	.041	.608***	.041	.574***	.041	.583***	.041	.610***	.041
Dosage	.006***	.001	.008***	.002	.371***	.105	.287***	.049	.356***	.067	6.506***	1.302
Female	.271	1.265	.301	1.271	.007	1.284	.441	1.256	.559	1.266	-.074	1.266
Minority	.926	1.342	1.098	1.366	.666	1.387	.686	1.312	1.032	1.342	.272	1.317
Special Education	-10.145***	2.306	-10.120***	2.319	-10.500***	2.344	-10.420***	2.280	-10.321***	2.297	-11.075***	2.295
English Language Learner	-6.843***	2.110	-6.989***	2.136	-6.480**	2.173	-5.740**	2.049	-6.054**	2.073	-5.865**	2.078
R^2 [20]	.416		.411		.398		.425		.418		.414	

**p* < .01, ****p* < .001.
Note. Separate models were used to examine each dosage indicator. Though the coefficients for total activity time are small, this is to be expected as increases are documented in 1-minute increments.

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[18] The table contains unstandardized regression coefficients (*B*) for each of the independent variables.
[19] The standard error (SE) is a measure of the amount of sampling error associated with each regression coefficient.
[20] R^2 is a measure of the proportion of variance of a dependent measure that can be explained by one or more independent variables in a regression model. Values for this statistic range from 0 to 1.

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	47.074***	4.196	47.785***	4.184	40.027***	6.846	43.427***	5.020	44.845***	4.978	55.130***	3.353
2018 Fall DIBELS Next NWF: CLS Score	.844***	.043	.842***	.043	.852**	.043	.838***	.043	.836***	.043	.842***	.043
Dosage	.008***	.002	.009***	.003	.692***	.241	.269***	.075	.316***	.096	5.774*	2.503
Female	1.395	2.518	1.338	2.524	1.365	2.537	1.569	2.520	1.481	2.527	1.713	2.540
Minority	-7.307**	2.541	-7.007**	2.562	-6.931**	2.598	-8.072***	2.526	-7.618**	2.545	-8.090**	2.552
Special Education	-21.027***	4.070	-20.820***	4.074	-20.413***	4.088	21.034***	4.078	-20.787***	4.083	-19.832***	4.092
English Language Learner	-12.153**	3.973	-12.196**	3.989	-11.783**	4.010	-11.409**	3.953	-11.459**	3.970	-10.832**	3.987
R^2	.540		.538		.534		.539		.537		.531	

*$p < .05$, **$p < .01$, ***$p < .001$.

Note. Separate models were used to examine each dosage indicator. Though the coefficients for total activity time are small, this is to be expected as increases are documented in 1-minute increments.

EXHIBIT A3. DOSAGE AND SPRING 2019 DIBELS NEXT NONSENSE WORD FLUENCY:
WHOLE WORDS CORRECT SOUNDS (NWF: WRC) SCORES, GRADE 1 (N=467)

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	19.081***	1.563	19.389***	1.560	16.306***	2.746	16.911***	1.966	17.526***	1.957	22.628***	1.156
2018 Fall DIBELS Next NWF: WRC Score	.739***	.043	.738***	.043	.753***	.043	.734***	.043	.731***	.044	.744***	.044
Dosage	.004***	.001	.004***	.001	.311**	.102	.136***	.032	.161***	.041	3.316**	1.065
Female	1.060	1.069	1.031	1.072	1.079	1.081	1.137	1.068	1.090	1.072	1.216	1.077
Minority	-3.536***	1.076	-3.388**	1.085	-3.403**	1.103	-3.893***	1.068	-3.658***	1.077	-3.863***	1.080
Special Education	-10.238***	1.718	-10.139***	1.721	-9.890***	1.731	-10.258***	1.719	-10.134***	1.722	-9.623***	1.724
English Language Learner	-6.394***	1.669	-6.414***	1.677	-6.146***	1.692	-6.051***	1.657	-6.077***	1.666	-5.814***	1.672
R^2	.499		.497		.490		.499		.496		.490	

**p < .01, ***p < .001.

Note. Separate models were used to examine each dosage indicator. Though the coefficients for total activity time are small, this is to be expected as increases are documented in 1-minute increments.

EXHIBIT A4. DOSAGE AND SPRING 2019 DIBELS NEXT ORAL READING FLUENCY: WORDS CORRECT (ORF: WC) SCORES, GRADE 2 (N = 458)

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	40.797***	3.046	40.116***	3.018	37.615***	3.858	41.817***	3.548	40.568***	3.490	41.751***	2.497
2018 Fall DIBELS Next ORF: WC Score	.912***	.025	.913***	.025	.912***	.025	.911***	.025	.912***	.025	.908***	.025
Dosage	.000	.001	.001	.002	.128	.118	-.016	.047	.009	.061	-2.041	1.860
Female	.784	1.565	.833	1.566	.873	1.562	.739	1.565	.794	1.567	.769	1.559
Minority	-6.427***	1.677	-6.215***	1.684	-5.686***	1.736	-6.573***	1.616	-6.416***	1.622	-6.785***	1.609
Special Education	-16.700***	2.631	-16.700***	2.630	-16.696***	2.627	-16.670***	2.632	-16.704***	2.631	-16.462***	2.636
English Language Learner	4.213	2.690	4.069	2.695	3.819	2.692	4.308	2.677	4.198	2.682	4.529	2.678
R^2	.792		.792		.792		.792		.792		.792	

*$p < .05$, **$p < .01$, ***$p < .001$.

Note. Separate models were used to examine each dosage indicator. Though the coefficients for total activity time are small, this is to be expected as increases are documented in 1-minute increments.

**EXHIBIT A5. DOSAGE AND SPRING 2019 DIBELS NEXT ORAL READING FLUENCY:
ACCURACY (ORF: ACC) SCORES, GRADE 2 (N=445)**

	Model A: Total Time (Minutes)		Model B: Activity Time (Minutes)		Model C: Weeks of Participation		Model D: Total Minutes Per Week		Model E: Activity Minutes Per Week		Model F: Met Total Minutes Per Week Optimal Dosage Threshold	
	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept	56.540***	1.581	56.464***	1.572	56.093***	1.629	56.839***	1.631	56.617***	1.615	56.952***	1.555
2018 Fall DIBELS Next ORF: ACC Score	.435***	.016	.434***	.016	.434***	.016	.435***	.016	.435***	.016	.434***	.016
Dosage	.000	.000	.000	.000	.031	.025	-.002	.010	.004	.013	-.391	.402
Female	.305	.330	.317	.330	.313	.330	.284	.330	.297	.331	.285	.329
Minority	-.217	.349	-.178	.350	-.103	.362	-.294	.337	-2.66	.338	-.333	.335
Special Education	-2.748***	.601	-2.756***	.601	-2.760***	.600	-2.725***	.602	-2.740***	.601	-2.677***	.602
English Language Learner	.968	.576	.938	.577	.914	.577	1.023	.574	.998	.575	1.069	.574
R^2	.721		.721		.721		.720		.721		.721	

*$p < .05$, **$p < .01$, ***$p < .001$.

Note. Separate models were used to examine each dosage indicator. Though the coefficients for total activity time are small, this is to be expected as increases are documented in 1-minute increments.