

# What Works Clearinghouse



## Lexia Reading

### Program Description<sup>1</sup>

*Lexia Reading* is a computerized reading program that provides phonics instruction and gives students independent practice in basic reading skills. *Lexia Reading* is designed to supplement

regular classroom instruction. It is designed to support skill development in the five areas of reading instruction identified by the National Reading Panel.

### Research<sup>2</sup>

Two studies of *Lexia Reading* meet What Works Clearinghouse (WWC) evidence standards and one study meets WWC evidence standards with reservations. The three studies included 314 students in kindergarten and first grade in two states.<sup>3</sup>

Based on these three studies, the WWC considers the extent of evidence for *Lexia Reading* to be small for alphabetics, fluency, comprehension, and general reading achievement.

### Effectiveness

*Lexia Reading* was found to have potentially positive effects on alphabetics, no discernible effects on fluency, potentially positive effects on comprehension, and no discernible effects on general reading achievement.

	Alphabetics	Fluency	Comprehension	General reading achievement
<b>Rating of effectiveness</b>	Potentially positive	No discernible effects	Potentially positive	No discernible effects
<b>Improvement index<sup>4</sup></b>	Average: +11 percentile points Range: -31 to +50 percentile points	+9 percentile points  Range: -15 to +30 percentile points	+11 percentile points	+9 percentile points

1. The descriptive information for this program was obtained from a publicly available source: the program’s website ([www.lexialearning.com](http://www.lexialearning.com), downloaded September 2008). The WWC requests developers to review the program description sections for accuracy from their perspective. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review.
2. The studies in this report were reviewed using WWC Evidence Standards, Version 1.0 (see the WWC Standards).
3. The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.
4. These numbers show the average and range of student-level improvement indices for all findings across the study (studies).

## Additional program information

### Developer and contact

*Lexia Learning* was developed by Lexia Learning Systems, Inc. Address: 200 Baker Ave. Extension, Concord, MA 01742. Email: info@lexialearning.com. Web: www.lexialearning.com. Telephone: (800) 435-3942; Outside USA: (978) 405-6200. Fax: (978) 287-0062.

### Scope of use

Lexia Learning Systems has been developing reading skills software since 1984. In October 2007, Lexia released its newest version of reading skills software: *Lexia Reading*, which combines the three core Lexia skills programs: *Early Reading*, *Primary Reading*, and *Strategies for Older Students* (which are intended for pre-K through adult users) under a single management system with Internet-based reporting and data-hosting features that make installation and maintenance easier for schools.

### Teaching

*Lexia Reading* is a computerized, supplementary reading software program designed for regular use, consisting of two to five weekly sessions of 20 to 30 minutes each, in a lab or classroom setting. *Lexia Reading* is compatible with a tiered model of instruction and is designed to be used for 20 to 30 minutes per session. The program is intended for use twice

per week for students reading on grade level or above, three to four times per week for students who are at-risk or are English as Second Language/English Language Learners (ESL/ELL) students, and five times per week for special education, Title I, and ESL/ELL students with serious reading deficiencies. Students work independently, and the software tracks student responses and automatically provides additional practice when needed. The Internet-based reports from the developer allow educators to assess and monitor progress at the individual, class, school, or district level. Reports provide ongoing assessments of reading skills and progress to assist educators with choices about differentiated reading instruction. The Internet-enabled version provides on-demand access to *Lexia Reading* in homes, libraries, after-school programs, and community centers.

### Cost

*Lexia Reading* offers customized pricing based on the individual needs of each school or district. For example, operating *Lexia Reading* (including all three reading programs—*Early Reading*, *Primary Reading*, and *Strategies for Older Students*) in one school with a computer lab of 25 stations would cost \$12,500 to purchase licenses and \$1,350 for one year of hosting and maintenance (including data storage and technical support). The 25 concurrent licenses would support daily program use for 125 students.

## Research

Eleven studies reviewed by the WWC investigated the effects of *Lexia Reading*. Two studies (Gale, 2006; Macaruso, Hook, & McCabe, 2006) are randomized controlled trials that meet WWC evidence standards. One study (Macaruso & Walker, 2008) uses a quasi-experimental design that meets WWC evidence standards with reservations. The remaining eight studies do not meet either WWC evidence standards or eligibility screens.

### Meets evidence standards

Macaruso, Hook, and McCabe (2006) randomly assigned 10 classrooms in five schools to either a treatment group that was exposed to *Lexia Reading Phonics Based Reading*<sup>5</sup> and *Strategies for Older Students* components or to a control group that did not. Eighty-three students in the five treatment group classrooms participated in *Lexia Reading* for two to four weekly sessions of 20 to 30 minutes each, and 84 students in the five

5. *Lexia Phonics Based Reading* was an earlier version that was later replaced with *Lexia Primary Reading*.

## Research (continued)

comparison group classrooms received regular classroom instruction during that time.

Gale (2006) identified kindergarten and first-grade students whose fall Dynamic Indicators of Basic Early Literacy Skills (DIBELS) test scores indicated that they needed substantial intensive intervention. Among those students, 41 kindergarten students and 38 first-grade students were randomly assigned to one of three groups, with 39 kindergarten and 37 first-grade students remaining after attrition: (1) *Lexia Early Reading*, (2) Earobics® Step 1, or (3) control. Students in groups 1 and 2 received the supplemental interventions during the five-week study period in addition to their regular instruction; students in the control group received no reading instruction beyond their regular language arts class time.

### Meets evidence standards with reservations

Macaruso and Walker (2008) randomly assigned classrooms to treatment and comparison groups; however, they excluded treatment group students from the analysis sample if they did

not complete at least 45 *Lexia Reading* sessions. Because this exclusion leads to a nonrandom sample of classroom students in the analysis sample, the WWC considers this design to be quasi-experimental. The study analyzed the effects of *Lexia Early Reading* on 26 kindergarten students in three classes who were assigned to receive *Lexia Early Reading* compared with 45 students in three classes who were not.

### Extent of evidence

The WWC categorizes the extent of evidence in each domain as small or medium to large (see the What Works Clearinghouse Extent of Evidence Categorization Scheme). The extent of evidence takes into account the number of studies and the total sample size across the studies that meet WWC evidence standards with or without reservations.<sup>6</sup>

The WWC considers the extent of evidence for *Lexia Reading* to be small for alphabetics, fluency, comprehension, and general reading achievement.

## Effectiveness Findings

The WWC review of interventions for Beginning Reading addresses student outcomes in four domains: alphabetics, reading fluency, comprehension, and general reading achievement. The studies included in this report cover all four domains. The findings below present the authors' estimates and WWC-calculated estimates of the size and the statistical significance of the effects of *Lexia Reading* on students.<sup>7</sup>

*Alphabetics.* Gale (2006) analyzed three alphabetics outcomes (DIBELS: Initial Sounds Fluency, Letter Naming Fluency, and Phoneme Segmentation Fluency subtests) for kindergarten students and three outcomes (DIBELS: Letter Naming Fluency, Phoneme Segmentation Fluency, and Nonsense Word Fluency subtests) for first-grade students. The outcomes of the *Lexia Early Reading* group were compared against those from two other groups: one receiving no supplemental instruction and one receiving Earobics®.

6. The extent of evidence categorization was developed to tell readers how much evidence was used to determine the intervention rating, focusing on the number and size of studies. Additional factors associated with a related concept—external validity, such as the students' demographics and the types of settings in which studies took place—are not taken into account for the categorization. Information about how the extent of evidence rating was determined for *Lexia Reading* is in Appendix A6.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate the statistical significance, see Technical Details of WWC-Conducted Computations. In the cases of Gale (2006) and Macaruso and Walker (2008), a correction for multiple comparisons was needed, and in the cases of Macaruso, Hook, and McCabe (2006) and Macaruso and Walker (2008), a correction for clustering was needed, so the significance levels may differ from those reported in the original studies.

## Effectiveness *(continued)*

The first comparison was *Lexia Early Reading* versus no supplemental instruction. The author reported, and the WWC confirmed, positive and statistically significant effects of *Lexia Early Reading* for two DIBELS subtests: Initial Sounds Fluency (kindergarten) and Phoneme Segmentation Fluency (kindergarten). The author reported statistically significant effects of *Lexia Early Reading* versus no supplemental instruction in first grade for three DIBELS subtests (Phoneme Segmentation Fluency, Letter Naming Fluency, and Nonsense Word Fluency). In WWC calculations, none of these effects were statistically significant, however, the WWC determined that the effects for all of the subtests were positive and large enough to be considered substantively important (that is, an effect size of at least 0.25)

The second comparison was *Lexia Early Reading* versus Earobics®. The author found no statistically significant effect on three of the four DIBELS subtests for either of the two grades. For first-grade students, the author reported a statistically significant difference on the Phoneme Segmentation Fluency subtest. The WWC found that this effect was not statistically significant, however, the WWC determined that three of the negative effects were large enough to be considered substantively important: Initial Sounds Fluency (kindergarten), Phoneme Segmentation Fluency (grade 1), and Nonsense Words Fluency (grade 1).

The WWC found that the combined effect for alphabets across both comparison groups was not statistically significant, but was positive and large enough to be considered substantively important.

Macaruso and Walker (2008) reported positive but not statistically significant effects of *Lexia Early Reading* when compared to the no intervention group on four alphabets outcomes, and a positive and statistically significant effect on one outcome (Oral Language Concepts). The WWC found that this effect was not statistically significant. However, the effects of the Gates-MacGintie subtests for Oral Language Concepts and Literacy Concepts were positive and large enough to be

considered substantively important. The WWC found that the combined effect for alphabets across all measures was not statistically significant nor was it large enough to be considered substantively important.

*Fluency.* Gale (2006) found positive but not statistically significant effects of *Lexia Early Reading* when compared to the no intervention group, and negative but not statistically significant effects of *Lexia Early Reading* when compared to Earobics® on the DIBELS: Oral Reading Fluency subtest. The WWC determined that both the positive and negative effects were large enough to be substantively important.

The WWC found that the combined effect for fluency across both comparison groups was neither statistically significant nor substantively important.

*Comprehension.* Macaruso and Walker (2008) found a positive but not statistically significant effect of *Lexia Early Reading* when compared to the no intervention group on the Gates-MacGintie Reading Test, Level PR: Listening Comprehension subtest. The WWC determined that the positive effect was large enough to be substantively important.

*General Reading Achievement.* Macaruso, Hook, and McCabe (2006) found no statistically significant effect of *Lexia Reading* on the Gates-MacGintie Reading Test, Level Beginning Reading (BR): Form S, nor was the effect large enough to be considered substantively important by the WWC.

### Rating of effectiveness

The WWC rates the effects of an intervention in a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative. The rating of effectiveness takes into account four factors: the quality of the research design, the statistical significance of the findings, the size of the difference between participants in the intervention and the comparison conditions, and the consistency in findings across studies (see the WWC Intervention Rating Scheme).

**The WWC found *Lexia Reading* to have potentially positive effects for alphabets, no discernible effects on fluency, potentially positive effects on comprehension, and no discernible effects on general reading achievement**

### Improvement index

The WWC computes an improvement index for each individual finding. In addition, within each outcome domain, the WWC computes an average improvement index for each study and an average improvement index across studies (see Technical Details of WWC-Conducted Computations). The improvement index represents the difference between the percentile rank of the average student in the intervention condition versus the percentile rank of the average student in the comparison condition. Unlike the rating of effectiveness, the improvement index is entirely based on the size of the effect, regardless of the statistical significance of the effect, the study design, or the analysis. The improvement index can take on values between -50 and +50, with positive numbers denoting results favorable to the intervention group.

The average improvement index for alphabets is +11 percentile points across the two studies, with a range of

-31 to +50 percentile points across findings. The improvement index for fluency is +9 percentile points, with a range of -15 to +30. The improvement index for comprehension is +11 percentile points, reflecting only one outcome. The improvement index for general reading achievement is +9 percentile points, reflecting only one outcome.

### Summary

The WWC reviewed 11 studies on *Lexia Reading*. Two of these studies meet WWC evidence standards. One study meets WWC evidence standards with reservations. The remaining eight studies do not meet either WWC evidence standards or eligibility screens. Based on the three studies, the WWC found potentially positive effects of *Lexia Reading* on alphabets and comprehension and no discernible effects on fluency and general reading achievement. The conclusions presented in this report may change as new research emerges.

## References

### Meets WWC evidence standards

Macaruso, P., Hook, P. E., & McCabe, R. (2006). The efficacy of computer-based supplementary phonics programs for advancing reading skills in at-risk elementary students. *Journal of Research in Reading, 29*(2), 162–172.

#### **Additional source:**

Macaruso, P., Hook, P., & McCabe, R. (2003). *The efficacy of Lexia skills-based software for improving reading comprehension*. Retrieved February 4, 2009 from Lexia Learning website: [http://www.lexialearning.com.au/library/source/research/revere\\_030912.pdf](http://www.lexialearning.com.au/library/source/research/revere_030912.pdf).

Gale, D. (2006). *The effect of computer-delivered phonological awareness training on the early literacy skills of students identified as at-risk for reading failure*. Retrieved May, 2008 from the University of South Florida website: <http://purl.fcla.edu/usf/dc/et/SFE0001531>.

### Meets WWC evidence standards with reservations

Macaruso, P., & Walker, A. (2008). The efficacy of computer-assisted instruction for advancing literacy skills in kindergarten children. *Reading Psychology, 29*(3), 266–287.

### Studies that fall outside the Beginning Reading protocol or do not meet WWC evidence standards

Lankutis, T. (2001). Reaching the struggling reader. *Technology & Learning, 21*(10), 24–31. This study is ineligible for review because it does not include a student outcome.

Macaruso, P., & Hook, P. (2007). Computer assisted instruction: Successful only with proper implementation. *Perspectives on Language and Literacy*, Summer, 43–46. This study is ineligible for review because it does not examine the effectiveness of an intervention.

## References *(continued)*

- Macaruso, P., Hook, P., McCabe, R., Rodman, A., & Walker, A. (2007, September). *Closing the reading achievement gap*. Concord, MA: Lexia Learning Systems, Inc. This study is ineligible for review because it does not examine the effectiveness of an intervention.
- Macaruso, P., & Rodman, A. (2008). *Benefits of computer-assisted instruction on early literacy skills in young children*. Manuscript submitted for publication in *Reading and Writing Quarterly*. (**Preschool study**). This study is ineligible for review because it does not use a sample within the age or grade range specified in the protocol.
- Macaruso, P., & Rodman, A. (2008). *Benefits of computer-assisted instruction on early literacy skills in young children*. Manuscript submitted for publication in *Reading and Writing Quarterly*. (**Kindergarten study**). This study does not meet WWC evidence standards because the measures of effectiveness cannot be attributed solely to the intervention—there was only one unit assigned to one or both conditions.
- MacLaughlin, A. I. (2003). *Will a computer based phonics practice program result in higher reading and writing skills for kindergarten children?* Unpublished master's thesis, Salem State College, Salem, MA. This study is ineligible for review because it does not use a comparison group.
- Ruth, R. (1997). *Remedial reading instruction using the Accelerated Learning Program*. Retrieved February 27, 2009 from Lexia Learning website: [http://www.lexialearning.com.au/library/source/research/robert\\_ruth\\_1997.pdf](http://www.lexialearning.com.au/library/source/research/robert_ruth_1997.pdf). This study is ineligible for review because it does not use a sample within the age or grade range specified in the protocol.
- Stevens, D. A. (2000, March) *Leveraging technology to improve test scores: A case study of low-income Hispanic students*. Paper presented at the meeting of the International Conference on Learning with Technology, Cambridge, MA. This study is ineligible for review because it does not use a sample within the age or grade range specified in the protocol.

# Appendix

## Appendix A1.1 Study Characteristics: Macaruso, Hook, & McCabe, 2006

Characteristic	Description
<b>Study citation</b>	Macaruso, P., Hook, P. E., & McCabe, R. (2006). The efficacy of computer-based supplementary phonics programs for advancing reading skills in at-risk elementary students. <i>Journal of Research in Reading, 29</i> (2), 162–172.
<b>Participants</b>	Study participants were first-graders in 10 classrooms spread across five schools, with two classrooms in each school (one treatment classroom and one comparison classroom) participating in the study. The study initially included 92 intervention and 87 comparison students. Twelve students (9 intervention, 3 comparison) left the study when it was determined that they were eligible for special education services. The analysis sample contained 15 Title I students in each of the intervention and comparison groups (Title I students received an additional 30 minutes of academic instruction per day from a Title I staff member).
<b>Setting</b>	First-grade classrooms in a Massachusetts public school district.
<b>Intervention</b>	<i>Lexia Reading</i> is a computerized, supplementary reading software program designed for regular use, consisting of two to four weekly sessions of 20 to 30 minutes each, in a lab or classroom setting. In the study, intervention students were exposed to two <i>Lexia Reading</i> components: <i>Phonics Based Reading (PBR)</i> and <i>Strategies for Older Students (SOS)</i> . The <i>PBR</i> component has 3 levels, 17 skill activities, and 174 units covering basic phonics skills usually taught in grades 1 through 3. After finishing <i>PBR</i> activities, children were introduced to <i>SOS</i> activities, which consist of 5 levels, 24 skill activities, and 369 discrete units. Intervention classes used <i>Lexia Reading</i> software for approximately six months, with children completing an average of 64 sessions and 140 skill units. Most students worked on <i>PBR</i> activities only; 14 students (17%) in the intervention programs moved on to <i>SOS</i> activities, working mainly on early levels.
<b>Comparison</b>	Students in the comparison group classrooms received regular classroom instruction while intervention group classrooms were participating in the <i>Lexia Reading</i> program.
<b>Primary outcomes and measurement</b>	For both pre- and posttest, the authors used the Gates-MacGintie Reading Test, Level BR to assess reading performance. For a more detailed description of this outcome measure and its subtests, see Appendices A2.1, A2.3, and A2.4.
<b>Staff/teacher training</b>	Teachers in intervention classrooms had an average of 19 years of teaching experience, and teachers in comparison classrooms had an average of 18 years of teaching experience. Teachers in the intervention classrooms and computer lab staff received orientation and training sessions for implementing <i>Lexia Reading</i> software use.

## Appendix A1.2 Study Characteristics: Gale, 2006

Characteristic	Description
<b>Study citation</b>	Gale, D. (2006). <i>The effect of computer-delivered phonological awareness training on the early literacy skills of students identified as at-risk for reading failure</i> . Retrieved from the University of South Florida website: <a href="http://purl.fcla.edu/usf/dc/et/SFE0001531">http://purl.fcla.edu/usf/dc/et/SFE0001531</a> .
<b>Participants</b>	Kindergarten and first-grade students who were identified in the fall assessment period as needing intensive substantial intervention based on their performance on the Dynamic Indicators of Basic Early Literacy Skills (DIBELS) were recruited for this study. Forty-one kindergarten students and 38 first-grade students were randomly assigned to one of three groups: (1) <i>Lexia Early Reading</i> , (2) Earobics® Step 1, or (3) control. After attrition, the analysis sample contained 39 kindergarten and 37 first-grade students.
<b>Setting</b>	The elementary school in which this study occurred is located in a large school district in the southwest region of Florida serving approximately 114,500 pre-K to twelfth-grade students. The elementary school had a total kindergarten through fifth-grade student enrollment of 722. Students in the school represented the following ethnic groups: 60% Caucasian, 19% Hispanic, 8% Asian/Pacific Islander, 7% African-American, 5% multiracial, <1% American Indian/Alaskan Native. Approximately three-quarters of the students in this school were eligible for free or reduced-priced lunch.
<b>Intervention</b>	A rotation schedule was developed by the researcher based on teacher input. The two phonological awareness software programs were loaded on 14 numbered computers with headphones in the computer lab at the elementary school. Each student was assigned to a computer to use throughout the intervention period. Before the intervention period began, the researcher trained the participants in small groups of five on the relevant intervention software ( <i>Lexia Early Reading</i> or Earobics® Step 1) with regard to initiating and proceeding through the program and navigating the mouse. Students were required to pass at least five out of six areas on the training checklist as well as the task “use mouse to navigate activity” before beginning the intervention. The students were divided into four groups that alternated in the computer lab according to the rotation schedule. The researcher and a teacher assistant monitored the students each day during their training in the computer lab. Students used their respective computer programs in the school computer lab 20 minutes daily for 25 days, resulting in a total of 8 hours 20 minutes of exposure.
<b>Comparison</b>	The control group received no reading instruction beyond the regular language arts time. Typical reading instruction in the school was a 90-minute reading block.
<b>Primary outcomes and measurement</b>	Students were tested before and after the intervention using the DIBELS subtests for Initial Sounds Fluency (kindergarten only), Letter Naming Fluency, Phoneme Segmentation Fluency, Nonsense Word Fluency (first grade only) and Oral Reading Fluency (first grade only). For a more detailed description of these outcome measures, see Appendices A2.1 and A2.2.
<b>Staff/teacher training</b>	No information on teacher training was provided. The <i>Lexia Early Reading</i> group worked in a computer lab, with minimal teacher instruction.

## Appendix A1.3 Study Characteristics: Macaruso & Walker, 2008

Characteristic	Description
<b>Study citation</b>	Macaruso, P., & Walker, A. (2008). The efficacy of computer-assisted instruction for advancing literacy skills in kindergarten children. <i>Reading Psychology, 29</i> (3), 266–287.
<b>Participants</b>	Six kindergarten classes from two elementary schools participated in the study. The six classes included morning and afternoon classes for each of three teachers. The authors randomly assigned the six classes to treatment ( <i>Lexia Early Reading</i> ) or comparison (extra time spent in language-related classroom activities), blocked by teacher. These six classes included a total of 94 students. After randomly assigning classrooms, the authors dropped from the analysis 11 students (9 intervention, 2 comparison) who were designated as English Language Learners or special education. At the end of the study, the authors excluded another 12 students from the treatment group who had not completed their minimum criterion of more than 45 sessions with <i>Lexia Early Reading</i> . The final analysis sample consisted of 26 students in the <i>Lexia Early Reading</i> group and 45 students in the comparison group. The authors demonstrated that there were no statistically significant pre-intervention differences between the two analysis groups on the baseline measures (DIBELS: Initial Sounds Fluency and DIBELS: Letter Naming Fluency).
<b>Setting</b>	The participating schools were two urban elementary schools near Boston, Massachusetts. Twenty-nine percent of families in the school system spoke a language other than English at home, and the median household income in the school district was \$37,000 (compared to a state median of \$50,000). More than half of the students in the district qualified for free or reduced-price lunch.
<b>Intervention</b>	Classes in the intervention condition began using <i>Lexia Early Reading</i> in November and continued for approximately six months. Students used the software in two to three weekly sessions of 15 to 20 minutes each. On average, students in the analysis sample completed 52 sessions with the software. <i>Lexia Early Reading</i> contains nine activities involving sound identification, rhyming, segmenting and blending of sounds, and application of letter-sound correspondences for subsets of consonants and vowels. Each activity consists of several units; students progress to the next activity only after mastering skills in the prior activity.
<b>Comparison</b>	Students in the comparison condition spent extra time engaged in language-related classroom activities.
<b>Primary outcomes and measurement</b>	At the end of the study period, the students were tested using the DIBELS subtests for Letter Naming Fluency and Phoneme Segmentation Fluency, as well as both subtest and overall composite scores for the Gates-MacGintie Reading Test, Level PR. Because the composite score for the Gates-MacGintie measure spans the alphabetic and comprehension domains, the subtests results for alphabetic and comprehension are presented as the main findings in Appendices A3.1 and A3.3 and the composite score results are presented as supplemental findings in Appendix A4.3. For a more detailed description of these outcome measures, see Appendices A2.1 and A2.3.
<b>Staff/teacher training</b>	Kindergarten teachers and computer lab staff participated in an orientation and training session for <i>Lexia Early Reading</i> software implementation.

## Appendix A2.1 Outcome measures for the alphabetic domain

Characteristic	Description
<i>Phonological Awareness</i>	
<b>Gates-MacGintie Reading Test, Level BR: Letter-Sound Correspondences subtest</b>	Students are required to match letters with their appropriate sounds. It is one of four subtests on the Gates-MacGintie Reading Test, Level BR (as cited in Macaruso, Hook, & McCabe, 2006).
<b>Dynamic Indicators of Basic Early Literacy Skills (DIBELS): Initial Sounds Fluency subtest</b>	Students are presented with four pictures that are named by the examiner. The examiner then asks the student to identify the picture that begins with a sound presented orally by the examiner. The student is also asked to orally provide the initial sound in a word presented orally by the examiner. The score is calculated by totaling the amount of time that it takes the student to identify or produce the correct sounds and converting that time into the number of correct onsets in a minute (as cited in Gale, 2006).
<b>Dynamic Indicators of Basic Early Literacy Skills (DIBELS): Phoneme Segmentation Fluency subtest</b>	In this task, the student is given a word and asked to provide the individual phonemes that make up the word. Words are continuously presented for one minute. The score is calculated by how many phonemes the student correctly segments in one minute (as cited in Gale, 2006).
<b>Gates-MacGintie Reading Test, Level PR: Oral Language Concepts subtest</b>	This subtest requires children to identify pictures with names that begin or end with the same sound or identify pictures that have rhyming names (as cited in Macaruso & Walker, 2008).
<i>Letter Knowledge</i>	
<b>Dynamic Indicators of Basic Early Literacy Skills (DIBELS): Letter Naming Fluency subtest</b>	This task requires the student to orally identify upper- and lowercase letters presented in random order on a piece of paper. The student names as many letters (out of 120) as he or she can in one minute with the examiner providing the name if the student hesitates for three seconds. The score is calculated by the number of correctly named letters in one minute (as cited in Gale, 2006).
<b>Gates-MacGintie Reading Test, Level PR: Letters and Letter-Sound Correspondences subtest</b>	Children identify when two letters match and match letters with pictures that begin with sounds corresponding to the letters (as cited in Macaruso & Walker, 2008).
<i>Phonics</i>	
<b>Dynamic Indicators of Basic Early Literacy Skills (DIBELS): Nonsense Words Fluency subtest</b>	In this measure, the student is presented with randomly ordered vowel-consonant and consonant-vowel-consonant nonsense words on a sheet of paper and asked to produce either the individual sounds or the whole nonsense word. The child has one minute to produce as many letter sounds or words as he or she can (as cited in Gale, 2006).
<i>Print Awareness</i>	
<b>Gates-MacGintie Reading Test, Level PR: Literacy Concepts subtest</b>	This subtest assesses students' basic knowledge of printed text, such as finding the first letter in a word (as cited in Macaruso & Walker, 2008).

## Appendix A2.2 Outcome measures for the fluency domain

Outcome measure	Description
<b>Dynamic Indicators of Basic Early Literacy Skills (DIBELS): Oral Reading Fluency</b>	Oral Reading Fluency is a measure of accuracy and fluency with connected text. Students are presented with a passage calibrated at their grade level and asked to read aloud for one minute. Scoring is based on mispronunciations, omissions, substitutions, and hesitations (as cited in Gale, 2006).

## Appendix A2.3 Outcome measures for the comprehension domain

Outcome measure	Description
<i>Vocabulary Development</i>	
<b>Gates-MacGintie Reading Test, Level BR: Basic Story Words subtest</b>	Children are tested on their ability to recognize words that appear most commonly in written text and do not require decoding. It is one of four subtests on the Gates-MacGintie Reading Test, Level BR (as cited in Macaruso, Hook, & McCabe, 2006).
<i>Reading Comprehension</i>	
<b>Gates-MacGintie Reading Test, Level PR: Listening Comprehension subtest</b>	This subtest asks children to listen to a passage and select a picture that most closely reflects the meaning of the passage (as cited in Macaruso & Walker, 2008).

## Appendix A2.4 Outcome measures for the general reading achievement domain

Outcome measure	Description
<b>Gates-MacGintie Reading Test, Level BR: Form S</b>	This test contains four subtests: (1) letter-sound correspondences for initial consonants and consonant clusters, (2) letter-sound correspondences for final consonants and consonant clusters, (3) letter-sound correspondences for vowels, and (4) recognizing basic story words (as cited in Macaruso, Hook, & McCabe, 2006).

## Appendix A3.1 Summary of study findings included in the rating for the alphabets domain<sup>1</sup>

Outcome measure	Study sample	Sample size (clusters/students)	Authors' findings from the study		WWC calculations			
			Mean outcome (standard deviation) <sup>2</sup>		Mean difference <sup>3</sup> (Lexia Reading-comparison)	Effect size <sup>4</sup>	Statistical significance <sup>5</sup> (at $\alpha = 0.05$ )	Improvement index <sup>6</sup>
			Lexia Reading group	Comparison group				
<b>Gale, 2006<sup>7,8</sup></b>								
<i>Comparison #1: Lexia Early Reading vs. Control</i>								
<b>Construct: Phonological Awareness</b>								
DIBELS: Initial Sounds Fluency	Kindergarten	26	10.07 (5.01)	5.21 (3.00)	4.86	1.14	Statistically significant	+37
DIBELS: Phoneme Segmentation Fluency	Kindergarten	26	1.31 <sup>9</sup> (0.63)	0.00 <sup>10</sup> (0.00)	1.31	2.85	Statistically significant	+50
DIBELS: Phoneme Segmentation Fluency	Grade 1	24	37.66 (13.71)	31.02 (10.57)	6.64	0.52	ns	+20
<b>Construct: Letter Knowledge</b>								
DIBELS: Letter Naming Fluency	Kindergarten	26	16.92 <sup>9</sup> (12.91)	13.08 <sup>10</sup> (10.00)	3.84	0.32	ns	+13
DIBELS: Letter Naming Fluency	Grade 1	24	48.11 (14.33)	38.02 (8.97)	10.09	0.81	ns	+29
<b>Construct: Phonics</b>								
DIBELS: Nonsense Word Fluency	Grade 1	24	40.87 (15.12)	26.11 (11.44)	14.76	1.06	ns	+36
<b>Average for alphabets, Comparison #1 (Gale, 2006)<sup>11</sup></b>						<b>1.12</b>	<b>Statistically significant</b>	<b>+37</b>
<i>Comparison #2: Lexia Early Reading vs. Earobics<sup>®</sup></i>								
<b>Construct: Phonological Awareness</b>								
DIBELS: Initial Sounds Fluency	Kindergarten	26	10.07 (5.01)	13.72 (4.61)	-3.65	-0.73	ns	-27
DIBELS: Phoneme Segmentation Fluency	Kindergarten	26	1.31 <sup>9</sup> (0.63)	1.31 <sup>10</sup> (0.75)	0.00	0.00	ns	0
DIBELS: Phoneme Segmentation Fluency	Grade 1	25	37.66 (13.71)	47.75 (8.08)	-10.09	-0.88	ns	-31

(continued)

**Appendix A3.1 Summary of study findings included in the rating for the alphabets domain<sup>1</sup> (continued)**

Outcome measure	Study sample	Sample size (clusters/students)	Authors' findings from the study					
			Mean outcome (standard deviation) <sup>2</sup>		Mean difference <sup>3</sup> (Lexia Reading–comparison)	WWC calculations		
			Lexia Reading group	Comparison group		Effect size <sup>4</sup>	Statistical significance <sup>5</sup> (at $\alpha = 0.05$ )	Improvement index <sup>6</sup>
<b>Construct: Letter Knowledge</b>								
DIBELS: Letter Naming Fluency	Kindergarten	26	18.31 <sup>9</sup> (12.91)	21.08 <sup>10</sup> (11.74)	-2.77	-0.22	ns	-9
DIBELS: Letter Naming Fluency	Grade 1	25	48.11 (14.33)	50.26 (13.83)	-2.15	-0.15	ns	-6
<b>Construct: Phonics</b>								
DIBELS: Nonsense Word Fluency	Grade 1	25	40.87 (15.12)	47.72 (19.65)	-6.85	-0.38	ns	-15
<b>Average for alphabets, Comparison #2 (Gale, 2006)<sup>11</sup></b>						<b>-0.39</b>	<b>ns</b>	<b>-15</b>
<b>Average for alphabets, Entire study (Gale, 2006)<sup>11</sup></b>						<b>0.36</b>	<b>ns</b>	<b>+14</b>
<b>Macaruso &amp; Walker, 2008<sup>7,12</sup></b>								
<b>Construct: Phonological Awareness</b>								
DIBELS: Phoneme Segmentation Fluency	Kindergarten	6/71	28.00 (13.30)	30.90 (19.10)	-2.90	-0.17	ns	-7
Gates-MacGintie: Oral Language Concepts	Kindergarten	6/71	14.80 (4.00)	12.80 (3.50)	2.00	0.54	ns	+20
<b>Construct: Letter Knowledge</b>								
DIBELS: Letter Naming Fluency	Kindergarten	6/71	38.30 (16.90)	38.50 (17.00)	-0.20	-0.01	ns	0
Gates-MacGintie: Letters and Letter-Sound Correspondences	Kindergarten	6/71	24.70 (4.50)	23.70 (5.40)	1.00	0.19	ns	+8
<b>Construct: Print Awareness</b>								
Gates-MacGintie: Literacy Concepts	Kindergarten	6/71	16.80 (2.80)	15.70 (3.00)	1.10	0.37	ns	+14
<b>Average for alphabets (Macaruso &amp; Walker, 2008)<sup>11</sup></b>						<b>0.18<sup>9</sup></b>	<b>ns</b>	<b>+7<sup>9</sup></b>
<b>Domain average for alphabets across all studies<sup>11</sup></b>						<b>0.27</b>	<b>na</b>	<b>+11</b>

ns = not statistically significant

na = not applicable

(continued)

## Appendix A3.1 Summary of study findings included in the rating for the alphabetics domain<sup>1</sup> (continued)

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the alphabetics domain. Subtest and subgroup findings from Macaruso and Walker (2008) are not included in these ratings but are reported in Appendix A4.1.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
4. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between -50 and +50, with positive numbers denoting results favorable to the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate statistical significance, see Technical Details of WWC-Conducted Computations. In the case of Gale (2006), corrections for multiple comparisons were needed, and in the case of Macaruso & Walker (2008), corrections for clustering and multiple comparisons were needed, so the significance levels may differ from those reported in the original studies.
8. Unless otherwise noted, means from this study are posttest means, ANCOVA-adjusted for pretest differences, as reported in Gale (2006).
9. The *Lexia Reading* group mean equals the comparison group mean plus the mean difference. The study author did not provide adjusted means for this outcome, so the WWC calculated the mean difference in outcomes, taking into account the pretest difference between the study groups. For further details, please see Technical Details of WWC-Conducted Computations.
10. Unadjusted posttest mean as reported in Gale (2006).
11. The WWC-computed average effect sizes for each study and for the domain across studies are simple averages rounded to two decimal places. The average improvement indices are calculated from the average effect sizes.
12. In this study, the authors did an ANCOVA-adjustment for pretest scores when calculating statistical significance but presented raw means and standard deviations.

## Appendix A3.2 Summary of study findings included in the rating for the fluency domain<sup>1</sup>

Outcome measure	Study sample	Sample size (students)	Authors' findings from the study		WWC calculations			
			Mean outcome <sup>2</sup> (standard deviation) <sup>3</sup>		Mean difference <sup>4</sup> (Lexia Reading–comparison)	Effect size <sup>5</sup>	Statistical significance <sup>6</sup> (at $\alpha = 0.05$ )	Improvement index <sup>7</sup>
			Lexia Reading group	Comparison group				
<b>Gale, 2006<sup>8</sup></b>								
<i>Comparison #1: Lexia Early Reading vs. Control</i>								
DIBELS: Oral Reading Fluency	Grade 1	24	21.31 (9.65)	13.81 (7.83)	7.50	0.82	ns	+30
<i>Comparison #2: Lexia Early Reading vs. Earobics<sup>®</sup></i>								
DIBELS: Oral Reading Fluency	Grade 1	25	21.31 (9.65)	27.35 (18.53)	–6.04	–0.39	ns	–15
<b>Domain average for fluency<sup>9</sup></b>						<b>0.22</b>	<b>ns</b>	<b>+9</b>

ns = not statistically significant

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the fluency domain.
2. Means are posttest means, ANCOVA-adjusted for pretest differences, as reported in Gale (2006).
3. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
4. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
5. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations.
6. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
7. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting results favorable to the intervention group.
8. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate statistical significance, see Technical Details of WWC-Conducted Computations. In the case of Gale (2006), a correction for multiple comparisons was needed, so the significance levels may differ from those reported in the original study.
9. This row provides the study average, which in this instance, is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

### Appendix A3.3 Summary of study findings included in the rating for the comprehension domain<sup>1</sup>

Outcome measure	Study sample	Sample size (clusters/students)	Authors' findings from the study					
			Mean outcome (standard deviation) <sup>2</sup>		Mean difference <sup>3</sup> (Lexia Reading-comparison)	WWC calculations		
			Lexia Reading group	Comparison group		Effect size <sup>4</sup>	Statistical significance <sup>5</sup> (at $\alpha = 0.05$ )	Improvement index <sup>6</sup>
<b>Macaruso &amp; Walker, 2008<sup>7,8</sup></b>								
<b>Construct: Reading Comprehension</b>								
Gates-MacGintie: Listening Comprehension	Kindergarten	6/71	13.60 (3.80)	12.60 (3.50)	1.00	0.27	ns	+11
<b>Domain average for comprehension<sup>9</sup></b>						<b>0.27</b>	<b>ns</b>	<b>+11</b>

ns = not statistically significant

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the comprehension domain. Subtest and subgroup findings from Macaruso and Walker (2008) are not included in these ratings, but are reported in Appendix A4.2.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
4. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations.
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between -50 and +50, with positive numbers denoting results favorable to the intervention group.
7. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate statistical significance, see Technical Details of WWC-Conducted Computations. In the case of Macaruso and Walker (2008), corrections for clustering and multiple comparisons were needed, so the significance level may differ from that reported in the original study.
8. In this study, the authors did an ANCOVA-adjustment for pretest scores when calculating statistical significance but presented raw means and standard deviations.
9. This row provides the study average, which in this instance, is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

## Appendix A3.4 Summary of study findings included in the rating for the general reading achievement domain<sup>1</sup>

Outcome measure	Study sample	Sample size (clusters/ students)	Authors' findings from the study		WWC calculations			
			Mean outcome <sup>2</sup> (standard deviation) <sup>3</sup>		Mean difference <sup>4</sup> (Lexia Reading– comparison)	Effect size <sup>5</sup>	Statistical significance <sup>6</sup> (at $\alpha = 0.05$ )	Improvement index <sup>7</sup>
			Lexia Reading group	Comparison group				
<b>Macaruso, Hook, &amp; McCabe, 2006<sup>8</sup></b>								
Gates-MacGintie Reading Test, Level BR: Form S	Grade 1	10/167	63.70 (14.10)	60.40 (14.10)	3.30	0.23	ns	+9
<b>Domain average for general reading achievement<sup>9</sup></b>						<b>0.23</b>	<b>ns</b>	<b>+9</b>

ns = not statistically significant

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices for the general reading achievement domain. Subtest and subgroup findings from Macaruso, Hook, and McCabe (2006) are not included in these ratings, but are reported in Appendix A4.3.
2. Means and standard deviations are ANCOVA-adjusted for pretest differences, as reported in communication with the author.
3. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
4. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
5. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations.
6. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
7. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between -50 and +50, with positive numbers denoting results favorable to the intervention group.
8. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate statistical significance, see Technical Details of WWC-Conducted Computations. In the case of Macaruso, Hook, and McCabe (2006), a correction for clustering was needed, so the significance levels may differ from those reported in the original study.
9. This row provides the study average, which in this instance, is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

## Appendix A4.1 Summary of subscale and subgroup findings for the alphabetics domain<sup>1</sup>

Outcome measure	Study sample	Sample size (clusters/students)	Authors' findings from the study					
			Mean outcome (standard deviation) <sup>2</sup>		Mean difference <sup>3</sup> (Lexia Reading–comparison)	WWC calculations		
			Lexia Reading group	Comparison group		Effect size <sup>4</sup>	Statistical significance <sup>5</sup> (at $\alpha = 0.05$ )	Improvement index <sup>6</sup>
<b>Macaruso, Hook, &amp; McCabe, 2006<sup>7,8,9</sup></b>								
Gates-MacGintie Reading Test: Letter-Sound Correspondences	Grade 1: Title I Students	10/30	39.80 (5.50)	34.80 (5.50)	5.00	0.88	Statistically significant	+31
<b>Macaruso &amp; Walker, 2008<sup>8,10</sup></b>								
<b>Construct: Phonological Awareness</b>								
DIBELS: Phoneme Segmentation Fluency	Kindergarten: Low Performers	6/24	29.00 (11.00)	28.00 (21.20)	1.00	0.06	ns	+2
Gates-MacGintie: Oral Language Concepts	Kindergarten: Low Performers	6/24	16.00 (2.20)	12.40 (3.60)	3.60	1.17	Statistically significant	+38
<b>Construct: Letter Knowledge</b>								
DIBELS: Letter Naming Fluency	Kindergarten: Low Performers	6/24	39.20 (12.40)	38.40 (12.70)	0.80	0.06	ns	+2
Gates-MacGintie: Letters and Letter-Sound Correspondences	Kindergarten: Low Performers	6/24	25.60 (2.60)	22.30 (5.40)	3.30	0.75	ns	+27
<b>Construct: Print Awareness</b>								
Gates-MacGintie: Literacy Concepts	Kindergarten: Low Performers	6/24	17.10 (2.50)	15.30 (2.90)	1.80	0.64	ns	+24

ns = not statistically significant

1. This appendix presents subscale and subgroup findings for measures that fall in alphabetics. Total group (for Macaruso & Walker, 2008) and total scale (for Macaruso, Hook, & McCabe, 2006) scores were used for rating purposes and are presented in Appendices A3.1 and A3.4, respectively.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
4. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between -50 and +50, with positive numbers denoting results favorable to the intervention group.
7. Means and standard deviations are ANCOVA-adjusted for pretest differences, as reported in communication with the author.

(continued)

## Appendix A4.1 Summary of subscale and subgroup findings for the alphabetics domain<sup>1</sup> *(continued)*

8. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools (corrections for multiple comparisons were not done for findings not included in the overall intervention rating). For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate statistical significance, see Technical Details of WWC-Conducted Computations. In the cases of Macaruso, Hook, and McCabe (2006) and Macaruso and Walker (2008), a correction for clustering was needed, so the significance levels may differ from those reported in the original study.
9. The study did not include specific information on the number of clusters (classrooms) across which the sub-sample of Title I students were distributed. The WWC assumed 10 classrooms, the number of classes in the full sample. With any fewer than 10 classrooms, however, this comparison would no longer be statistically significant.
10. In this study, the authors did an ANCOVA-adjustment for pretest scores when calculating statistical significance but presented raw means and standard deviations.

## Appendix A4.2 Summary of subscale and subgroup findings for the comprehension domain<sup>1</sup>

Outcome measure	Study sample	Sample size (clusters/students)	Authors' findings from the study		WWC calculations			
			Mean outcome (standard deviation) <sup>2</sup>		Mean difference <sup>3</sup> (Lexia Reading-comparison)	Effect size <sup>4</sup>	Statistical significance <sup>5</sup> (at $\alpha = 0.05$ )	Improvement index <sup>6</sup>
			Lexia Reading group	Comparison group				
<b>Macaruso, Hook, &amp; McCabe, 2006<sup>7,8,9</sup></b>								
<b>Construct: Vocabulary Development</b>								
Gates-MacGintie: Basic Story Words Subtest	Grade 1: Title I Students	10/30	23.30 (3.50)	21.50 (3.50)	1.80	0.50	ns	+19
<b>Macaruso &amp; Walker, 2008<sup>8,10</sup></b>								
<b>Construct: Reading Comprehension</b>								
Gates-MacGintie: Listening Comprehension	Kindergarten: Low Performers	6/24	13.40 (4.10)	11.50 (3.60)	1.90	0.48	ns	+18

ns = not statistically significant

1. This appendix presents subscale and subgroup findings for measures that fall in comprehension. Total group (for Macaruso & Walker, 2008) and total scale (for Macaruso, Hook, & McCabe, 2006) scores were used for rating purposes and are presented in Appendices A3.1 and A3.4, respectively.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
4. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between -50 and +50, with positive numbers denoting results favorable to the intervention group.
7. Means and standard deviations are ANCOVA-adjusted for pretest differences, as reported in communication with the author.
8. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools (corrections for multiple comparisons were not done for findings not included in the overall intervention rating). For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate statistical significance, see Technical Details of WWC-Conducted Computations. In the cases of Macaruso, Hook, and McCabe (2006) and Macaruso and Walker (2008), a correction for clustering was needed, so the significance levels may differ from those reported in the original study.
9. The study did not include specific information on the number of clusters (classrooms) across which the sub-sample of Title I students were distributed. The WWC assumed 10 classrooms, the number of classes in the full sample. With any fewer than 10 classrooms, however, this comparison would no longer be statistically significant.
10. In this study, the authors did an ANCOVA-adjustment for pretest scores when calculating statistical significance but presented raw means and standard deviations.

## Appendix A4.3 Summary of subgroup and composite score findings for the general reading achievement domain<sup>1</sup>

Outcome measure	Study sample	Sample size (clusters/students)	Authors' findings from the study		WWC calculations			
			Mean outcome (standard deviation) <sup>2</sup>		Mean difference <sup>3</sup> (Lexia Reading-comparison)	Effect size <sup>4</sup>	Statistical significance <sup>5</sup> (at $\alpha = 0.05$ )	Improvement index <sup>6</sup>
			Lexia Reading group	Comparison group				
<b>Macaruso, Hook, &amp; McCabe, 2006<sup>7,8,9</sup></b>								
Gates-MacGintie Reading Test, Level BR: Form S	Grade 1: Title I Students	10/30	62.10 (13.70)	49.70 (13.70)	12.40	0.88	Statistically significant	+31
<b>Macaruso &amp; Walker, 2008<sup>8,10</sup></b>								
Gates-MacGintie Reading Test, Level PR	Kindergarten: Full Sample	6/71	54.20 nr	46.40 nr	7.80	0.47	ns	+18
Gates-MacGintie Reading Test, Level PR	Kindergarten: Low Performers	6/24	55.80 nr	41.60 nr	14.20	1.51	Statistically significant	+43

ns = not statistically significant

nr = not reported

1. This appendix presents subgroup and composite score findings for measures that fall in general reading achievement. In the case of Macaruso, Hook, and McCabe (2006), total group scores were used for rating purposes and are presented in Appendix A3.4. In the case of Macaruso and Walker (2008), subtest scores were used for rating purposes and are presented in Appendices A3.1 and A3.3.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes.
3. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group.
4. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations
5. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
6. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between -50 and +50, with positive numbers denoting results favorable to the intervention group.
7. Means and standard deviations are ANCOVA-adjusted for pretest differences, as reported in communication with the author.
8. The level of statistical significance was reported by the study authors or, when necessary, calculated by the WWC to correct for clustering within classrooms or schools (corrections for multiple comparisons were not done for findings not included in the overall intervention rating). For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. For the formulas the WWC used to calculate statistical significance, see Technical Details of WWC-Conducted Computations. In the cases of Macaruso, Hook, and McCabe (2006) and Macaruso and Walker (2008), a correction for clustering was needed, so the significance levels may differ from those reported in the original study.
9. The study did not include specific information on the number of clusters (classrooms) across which the sub-sample of Title I students were distributed. The WWC assumed 10 classrooms, the number of classes in the full sample. With any fewer than 10 classrooms, however, this comparison would no longer be statistically significant.
10. In this study, the authors did an ANCOVA-adjustment for pretest scores when calculating statistical significance but presented raw means and standard deviations.

## Appendix A5.1 *Lexia Reading* rating for the alphabetics domain

The WWC rates an intervention's effects for a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.<sup>1</sup>

For the outcome domain of alphabetics, the WWC rated *Lexia Reading* as potentially positive. The remaining ratings (mixed effects, no discernible effects, potentially negative effects, and negative effects) were not considered, as *Lexia Reading* was assigned the highest applicable rating.

### Rating received

**Potentially positive effects:** Evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.

**Met.** One study showed a statistically significant positive effect.

#### AND

- Criterion 2: No studies showing a statistically significant or substantively important *negative* effect and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.

**Met.** Neither study showed statistically significant or substantively important negative effects, and only one study showed indeterminate effects.

### Other ratings considered

**Positive effects:** Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.

**Not met.** Only one study showed a statistically significant positive effect.

#### AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

**Met.** Neither study showed negative effects.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Intervention Rating Scheme.

## Appendix A5.2 Lexia Reading rating for the fluency domain

The WWC rates an intervention's effects for a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.<sup>1</sup> For the outcome domain of fluency, the WWC rated *Lexia Reading* as having no discernible effects.

### Rating received

**No discernible effects:** No affirmative evidence of effects.

- Criterion 1: None of the studies shows a statistically significant or substantively important effect, either *positive* or *negative*.

**Met.** Only one study examined outcomes in this domain, and the effect was neither statistically significant nor substantively important.

### Other ratings considered

**Positive effects:** Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.

**Not met.** Only one study examined outcomes in this domain.

### AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

**Met.** No study showed a statistically significant or substantively important negative effect.

**Potentially positive effects:** Evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.

**Not met.** Only one study examined outcomes in this domain, and that study did not show a statistically significant or substantively important positive effect.

### AND

- Criterion 2: No studies showing a statistically significant or substantively important *negative* effect and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.

**Met.** No study showed a statistically significant or substantively important effect, either positive or negative.

**Mixed effects:** Evidence of inconsistent effects as demonstrated through either of the following criteria.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect, and at least one study showing a statistically significant or substantively important *negative* effect, but no more such studies than the number showing a statistically significant or substantively important *positive* effect.

**Not met.** No study showed a statistically significant or substantively important effect, either positive or negative.

### OR

- Criterion 2: At least one study showing a statistically significant or substantively important effect, and more studies showing an *indeterminate* effect than showing a statistically significant or substantively important effect.

**Not met.** No study showed a statistically significant or substantively important effect.

(continued)

## Appendix A5.2 Lexia Reading rating for the fluency domain (continued)

**Potentially negative effects:** Evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *negative* effect.

**Not met.** No study showed a statistically significant or substantively important negative effect.

**AND**

- Criterion 2: No studies showing a statistically significant or substantively important *positive* effect, or more studies showing statistically significant or substantively important *negative* effects than showing statistically significant or substantively important *positive* effects.

**Met.** No study showed a statistically significant or substantively important positive effect.

**Negative effects:** Strong evidence of a negative effect with no overriding contrary evidence.

- Criterion 1. Two or more studies showing statistically significant *negative* effects, at least one of which met WWC evidence standards for a *strong* design.

**Not met.** No study showed a statistically significant negative effect.

**AND**

- Criterion 2: No studies showing statistically significant or substantively important *positive* effects.

**Met.** No study showed a statistically significant or substantively important positive effect.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Intervention Rating Scheme.

### Appendix A5.3 Lexia Reading rating for the comprehension domain

The WWC rates an intervention's effects for a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.<sup>1</sup>

For the outcome domain of comprehension, the WWC rated *Lexia Reading* as potentially positive. The remaining ratings (mixed effects, no discernible effects, potentially negative effects, and negative effects) were not considered, as *Lexia Reading* was assigned the highest applicable rating.

#### Rating received

**Potentially positive effects:** Evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.

**Met.** Only one study examined outcomes in this domain, and that study showed a substantively important positive effect.

#### AND

- Criterion 2: No studies showing a statistically significant or substantively important *negative* effect and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.

**Met.** Only one study examined outcomes in this domain, and that study showed a substantively important positive effect.

#### Other ratings considered

**Positive effects:** Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.

**Not met.** Only one study examined outcomes in this domain.

#### AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

**Met.** Only one study examined outcomes in this domain, and that study showed a substantively important positive effect.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Intervention Rating Scheme.

## Appendix A5.4 Lexia Reading rating for the general reading achievement domain

The WWC rates an intervention's effects in a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.<sup>1</sup> For the outcome domain of general reading achievement, the WWC rated *Lexia Reading* as having no discernible effects.

### Rating received

**No discernible effects:** No affirmative evidence of effects.

- Criterion 1: None of the studies shows a statistically significant or substantively important effect, either *positive* or *negative*.

**Met.** Only one study examined outcomes in this domain, and the effect was neither statistically significant nor substantively important.

### Other ratings considered

**Positive effects:** Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a *strong* design.

**Not met.** Only one study examined outcomes in this domain.

### AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

**Met.** No study showed a statistically significant or substantively important negative effect.

**Potentially positive effects:** Evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect.

**Not met.** Only one study examined outcomes in this domain, and that study did not show a statistically significant or substantively important positive effect.

### AND

- Criterion 2: No studies showing a statistically significant or substantively important *negative* effect and fewer or the same number of studies showing *indeterminate* effects than showing statistically significant or substantively important *positive* effects.

**Met.** Only one study examined outcomes in this domain, and that study showed an indeterminate effect.

**Mixed effects:** Evidence of inconsistent effects as demonstrated through either of the following criteria.

- Criterion 1: At least one study showing a statistically significant or substantively important *positive* effect, and at least one study showing a statistically significant or substantively important *negative* effect, but no more such studies than the number showing a statistically significant or substantively important *positive* effect.

**Not met.** No studies showed a statistically significant or substantively important effect, either positive or negative.

### OR

- Criterion 2: At least one study showing a statistically significant or substantively important effect, and more studies showing an *indeterminate* effect than showing a statistically significant or substantively important effect.

**Not met.** No studies showed a statistically significant or substantially important effect.

(continued)

## Appendix A5.4 Lexia Reading rating for the general reading achievement domain (continued)

**Potentially negative effects:** Evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: At least one study showing a statistically significant or substantively important *negative* effect.

**Not met.** No study showed a statistically significant or substantively important negative effect.

**AND**

- Criterion 2: No studies showing a statistically significant or substantively important *positive* effect, or more studies showing statistically significant or substantively important *negative* effects than showing statistically significant or substantively important *positive* effects.

**Met.** No study showed a statistically significant or substantively important positive effect.

**Negative effects:** Strong evidence of a negative effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *negative* effects, at least one of which met WWC evidence standards for a *strong* design.

**Not met.** No study showed a statistically significant negative effect.

**AND**

- Criterion 2: No studies showing statistically significant or substantively important *positive* effects.

**Met.** No study showed a statistically significant or substantively important positive effect.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. For a complete description, see the WWC Intervention Rating Scheme.

## Appendix A6 Extent of evidence by domain

Outcome domain	Number of studies	Sample size		Extent of evidence <sup>1</sup>
		Schools	Students	
Alphabetics	2	3	147	Small
Reading fluency	1	1	37	Small
Comprehension	1	2	71	Small
General reading achievement	1	5	167	Small

1. A rating of “medium to large” requires at least two studies and two schools across studies in one domain, and a total sample size across studies of at least 350 students or 14 classrooms. Otherwise, the rating is “small.”