

# What Works Clearinghouse



## Earobics<sup>®</sup>

### Program description<sup>2</sup>

*Earobics*<sup>®</sup> is interactive software that provides students in pre-K through third grade with individual, systematic instruction in early literacy skills as students interact with animated characters. *Earobics*<sup>®</sup> *Foundations* is the version for prekindergarten, kindergarten, and first grade. *Earobics*<sup>®</sup> *Connections* is for second and third graders and older struggling readers. The program builds children’s skills in phonemic awareness, auditory processing, and

phonics, as well as the cognitive and language skills required for comprehension. Each level of instruction addresses recognizing and blending sounds, rhyming, and discriminating phonemes within words, adjusting to each student’s ability level. The software is supported by music, audiocassettes, and videotapes and includes picture/word cards, letter-sound decks, big books, little books, and leveled readers for reading independently or in groups.

### Research

Two studies of *Earobics*<sup>®</sup> meet What Works Clearinghouse (WWC) evidence standards and two studies meet WWC evidence standards with reservations. The four studies included 246 students from grades K through 3 in Los Angeles, California; southwest Florida; Anchorage, Alaska; and Chicago, Illinois.<sup>3</sup>

Based on these four studies, the WWC considers the extent of evidence for *Earobics*<sup>®</sup> to be small for alphabets and reading fluency. No studies that meet WWC evidence standards with or without reservations examined the effectiveness of *Earobics*<sup>®</sup> in the comprehension or general reading achievement domains.

### Effectiveness

*Earobics*<sup>®</sup> was found to have positive effects on alphabets and potentially positive effects on reading fluency.

	Alphabets	Reading fluency	Comprehension	General reading achievement
Rating of effectiveness	Positive effects	Potentially positive effects	na	na
Improvement index <sup>4</sup>	Average: +25 percentile points Range: 0 to +49 percentile points	Average: +15 percentile points Range: +3 to +33 percentile points	na na	na na

na = not applicable

1. This report has been updated to include reviews of 10 studies released in 2005 and later. A complete list and disposition of all studies reviewed is provided in the references.
2. The descriptive information for this program was obtained in 2007 from a publicly available source: the program’s website (<http://www.earobics.com>). The WWC requests developers to review the program description sections for accuracy from their perspective. Neither the authors nor the website provided any additional information for this update. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review.
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 studies.

## Additional program information

### Developer and contact

Developed in 1995, *Earobics*® is distributed by Houghton Mifflin Harcourt Learning Technology. Address: Earobics | Houghton Mifflin Harcourt Learning Technology, 222 Berkeley Street, Boston, MA 02116. Email: HMLTcustomerservice@hmco.com. Web: www.earobics.com. Telephone: (888) 242-6747.

### Scope of use

According to the distributors, *Earobics*® has been used nationally in more than 10,000 schools. The program has been used with at-risk students, general and special education students, and English language learners.

### Teaching

The software is a supplemental program that can be used in conjunction with existing language arts programs. The *Earobics*® Teacher's Guides help teachers plan students' use of the software and supporting materials, using a teach, practice,

## Research

Twenty-eight studies reviewed by the WWC investigated the effects of *Earobics*®. Two studies (Cognitive Concepts, 2003, and Gale, 2006) are randomized controlled trials that meet WWC evidence standards. Two studies (Rehmann, 2005, and Valliath, 2002) are randomized controlled trials or quasi-experimental designs that meet WWC evidence standards with reservations. The remaining 24 studies do not meet either WWC evidence standards or eligibility screens.

### Meets evidence standards

Cognitive Concepts (2003) conducted a randomized controlled trial of elementary school students in Los Angeles, California. Nineteen teachers identified students in kindergarten through third grade with reading difficulties. Students were pretested, matched, and then randomly divided into two groups. In all, 39 students used *Earobics*® in addition to *Open Court* (their regular reading curriculum) during the study period that lasted from

and apply approach. As students work with the software, the program automatically adjusts based on each student's performance. Reports on student performance can be printed or accessed online. Teachers may also customize the program for students, including selecting one of 10 languages for the directions. Teachers also have access to CD-ROMs with reproducible materials tied to specific lessons for students. Professional development for using *Earobics*® is available and focuses on instructional strategies to incorporate *Earobics*® into the curricula.

### Cost<sup>5</sup>

*Earobics*® *Foundations* and *Earobics*® *Connections* are available for home use for \$59 per user or in a "clinic" version that accommodates up to 12 users for \$299. *Foundations* is targeted for ages 4 to 7 and includes six interactive games with more than 300 levels of play. *Connections* is targeted for ages 7 to 10 and includes five interactive games with nearly 600 levels of play.

October to December, and 35 students in the comparison group used only *Open Court*.

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 eligible to participate in the study returned parental consent forms. These students were randomly assigned to one of three groups: (1) *Earobics*® Step 1, (2) Lexia Early Reading 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, while the control group received no instruction beyond their regular language arts class time.

### Meets evidence standards with reservations

Rehmann (2005) was a randomized controlled trial with severe differential attrition. At a Title I school with 140 kindergarten

5. Distributor's prices as of August 2007.

## Research (continued)

and first-grade students (70 at each grade level), the researcher blocked the students by gender and grade, randomly selected 20 students from each block to participate in the study, and then randomly assigned the 80 students from all four blocks to receive the 10-week intervention (40 students) or to a comparison group (40 students).<sup>6</sup> Among this sample, 14 were discontinued during the study (10 in the intervention group and 4 in the comparison group), leaving a final analysis sample of 66 students.

Valliath (2002) conducted a quasi-experimental study of first-grade students from three elementary public schools in a high-achieving school district in Chicago, Illinois. Ten teachers identified three children with the lowest reading ability within their respective classrooms. Students were pretested, matched, and divided into two similar groups. In the analysis sample, 15 students used six exercises of the *Earobics*<sup>®</sup>

software for ten weeks, while 15 students in the comparison group used math software.

## 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>7</sup>

The WWC considers the extent of evidence for *Earobics*<sup>®</sup> to be small for alphabets and reading fluency. No studies that meet WWC evidence standards with or without reservations examined the effectiveness of *Earobics*<sup>®</sup> in the comprehension or general reading achievement domains.

## Effectiveness Findings

The WWC review of interventions for Beginning Reading addresses student outcomes in four domains: alphabets, reading fluency, comprehension, and general reading achievement. The studies included in this report cover two domains: alphabets and reading fluency. The findings below present the authors' estimates and WWC-calculated estimates of the size and the statistical significance of the effects of *Earobics*<sup>®</sup> on students.<sup>8</sup>

*Alphabets.* Four studies presented findings in the alphabets domain. Cognitive Concepts (2003) found statistically significant positive effects on three phonological awareness

measures (ORAL-J: Blending into Words, Segmenting into Sounds, and Rhyming Words subtests).<sup>9</sup> The study authors did not find statistically significant effects of *Earobics*<sup>®</sup> on the letter knowledge measure (ORAL-J: Letter Naming subtest) or the phonics measure (ORAL-J: Sound of Letters subtest). The average effect size across the five outcomes was large enough to be considered substantively important according to WWC criteria (that is, an effect size of at least 0.25).

Gale (2006) analyzed three alphabets outcomes (DIBELS: Initial Sounds Fluency, Letter Naming Fluency, and Phoneme Segmentation Fluency subtests) for kindergarten students and

6. Students in the control group received the intervention in a second phase of the study, and the students in the original intervention group served as the comparison for that phase. The WWC focuses on the first phase, because by the second phase, the comparison group had just received the intervention.
7. 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 *Earobics*<sup>®</sup> is in Appendix A5.
8. The level of statistical significance was reported by the study authors or, where 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 case of Cognitive Concepts (2003), Rehmann (2005), and Valliath (2002), no corrections for clustering or multiple comparisons were needed. 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. Data for these three phonological awareness measures were received through communication with the study author.

## Effectiveness *(continued)*

three outcomes (DIBELS: Letter Naming Fluency, Phoneme Segmentation Fluency, and Nonsense Word Fluency subtests) for first-grade students. In examining *Earobics*<sup>®</sup> versus the group that received no supplemental instruction, the author found, and the WWC confirmed, positive and statistically significant effects of *Earobics*<sup>®</sup> for three DIBELS subtests: Initial Sounds Fluency (kindergarten), Phoneme Segmentation Fluency (kindergarten and grade 1) and Nonsense Words Fluency (kindergarten and grade 1). There were no statistically significant effects on the DIBELS: Letter Naming Fluency subtest in kindergarten or grade 1. However, the WWC determined that the effects for both grades were large enough to be considered substantively important. The study also compared *Earobics*<sup>®</sup> to Lexia, and the author found no statistically significant effect on any of the four DIBELS subtests for either of the two grades. However, the WWC determined that three of the positive 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. However, the WWC determined that the combined effect was large enough to be considered substantively important.

Rehmann (2005) found that the overall *Earobics*<sup>®</sup> effect across the three of four alphabets measures of beginning reading (DIBELS: Initial Sound Fluency, Letter Naming Fluency, and Phoneme Segmentation Fluency) was not statistically significant. For one subtest (Nonsense Words Fluency), the WWC determined that the negative effect was substantively important (that is, an effect size with an absolute value of at least 0.25).

Valliath (2002) found that the overall intervention effect across the eight measures of beginning reading was not statistically significant.<sup>10</sup> The WWC analyzed four phonological

awareness measures (Comprehensive Test of Phonological Processing [CTOPP]: Blending Words, Blending Non-Words, Elision, and Sound Matching subtests) and two phonics measures (Woodcock Reading Mastery Test: Word Identification and Word Attack subtests). The WWC found that the effect for one of the four phonological awareness tests (CTOPP: Sound Matching subtest) was positive and statistically significant. Effects for the other three phonological awareness subtests and the two phonics subtests were not statistically significant but the WWC determined them to be substantively important. The average effect size across the six outcomes was large enough to be considered substantively important according to the WWC criteria.

*Reading fluency.* Two studies presented findings in the reading fluency domain. In analyzing ORAL-J: Words per Minute subtest data, Cognitive Concepts (2003) did not find statistically significant effects of *Earobics*<sup>®</sup>, and the effect was not large enough to be considered substantively important according to WWC criteria. Gale (2006) found positive but not statistically significant effects of *Earobics*<sup>®</sup> when compared to Lexia and the no intervention group on the DIBELS: Oral Reading Fluency subtest. The WWC determined that both positive effects were large enough to be substantively important.

## 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).

10. The WWC did not use all eight measures in its analysis because two were outside the domain specified in the beginning reading protocol. See Appendix A1.4.

**The WWC found Earobics® to have positive effects for alphabets and potentially positive effects for reading fluency**

**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 based entirely on the size of the effect, regardless of the statistical significance of the effect, the study design, or the analyses. 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 +25 percentile points across the four studies, with a range of 0 to +49 percentile points across findings.

The average improvement index for reading fluency is +15 percentile points across two studies, with a range of +3 to +33 percentile points across findings.

**Summary**

The WWC reviewed 28 studies on Earobics®. Two of these studies meet WWC evidence standards; two studies meet WWC evidence standards with reservations; the remaining 24 studies either do not meet WWC evidence standards or do not meet eligibility screens. Based on the four studies, the WWC found positive effects for alphabets and potentially positive effects for reading fluency. The conclusions presented in this report may change as new research emerges.

**References**

**Meets WWC evidence standards**

Cognitive Concepts, Inc. (2003). *Outcomes report: Los Angeles Unified School District, California*. Retrieved from <http://www.earobics.com/results/la.php>.

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 from the University of South Florida website: <http://purl.fcla.edu/usf/dc/et/SFE0001531>.

**Meets WWC evidence standards with reservations**

Rehmann, R. (2005). *The effect of Earobics (TM) Step 1, software on student acquisition of phonological awareness skills*. Dissertation. *Dissertation Abstracts International*, 66(07A), 157-2533. (UMI No. 3181124)

Valliath, S. (2002). *An evaluation of a computer-based phonological awareness training program: Effects on phonological awareness, reading and spelling*. *Dissertation Abstracts International*, 63(04), 1291A. (UMI No. 3050601)

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

Cognitive Concepts, Inc. (2000). *Earobics Early Literacy Instruction: Chicago Public Schools pilot research report*. Retrieved from <http://www.earobics.com/results/chicago.php>. This study is ineligible for review because it does not use a comparison group.

Cognitive Concepts, Inc. (2001). *Outcomes report: Daviess County Public Schools, Kentucky*. Retrieved from [http://www.earobics.com/results/additional\\_reports.php](http://www.earobics.com/results/additional_reports.php). This study is ineligible for review because it does not use a comparison group.

Cognitive Concepts, Inc. (2001). *Outcomes report: Newport News Public Schools, Virginia*. Retrieved from <http://www.earobics.com/results/newport.php>. This study is ineligible for review because it does not use a sample within the age or grade range specified in the protocol.

Cognitive Concepts, Inc. (2001). *Outcomes report: PALS assessment, Virginia*. Retrieved from <http://www.earobics.com/>

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- results/newportpals.php. This study is ineligible for review because it does not use a comparison group.
- Cognitive Concepts, Inc. (2001). *Outcomes report: Spring Branch Independent School District, Texas*. Retrieved from <http://www.earobics.com/results/spring.php>. This study is ineligible for review because it does not use a comparison group.
- Cognitive Concepts, Inc. (2002). *Outcomes report: Anne Arundel County Public Schools, Maryland*. Retrieved from [http://www.earobics.com/results/additional\\_reports.php](http://www.earobics.com/results/additional_reports.php). This study is ineligible for review because it does not use a comparison group.
- Cognitive Concepts, Inc. (2002). *Outcomes report: Brevard County Public Schools, Florida*. Retrieved from [http://www.earobics.com/results/additional\\_reports.php](http://www.earobics.com/results/additional_reports.php). This study is ineligible for review because it does not use a comparison group.
- Cognitive Concepts, Inc. (2002). *Outcomes report: Cincinnati Children's Hospital Medical Center, Ohio*. Retrieved from [http://www.earobics.com/results/additional\\_reports.php](http://www.earobics.com/results/additional_reports.php). This study is ineligible for review because it does not use a comparison group.
- Cognitive Concepts, Inc. (2002). *Outcomes report: Culver City Unified School District, California*. Retrieved from [http://www.earobics.com/results/additional\\_reports.php](http://www.earobics.com/results/additional_reports.php). This study is ineligible for review because it does not use a comparison group.
- Cognitive Concepts, Inc. (2002). *Outcomes report: District of Columbia Public Schools, Washington, DC*. Retrieved from <http://www.earobics.com/results/columbia.php>. This study is ineligible for review because it does not use a comparison group.
- Cognitive Concepts, Inc. (2002). *Outcomes report: Northwestern University, Illinois*. Retrieved from [http://www.earobics.com/results/additional\\_reports.php](http://www.earobics.com/results/additional_reports.php). This study is ineligible for review because it does not use a comparison group.
- Cognitive Concepts, Inc. (2002). *Outcomes report: Polk County School District, Florida*. Retrieved from <http://www.earobics.com/results/polk.php>. This study is ineligible for review because it does not use a comparison group.
- Hargett, K. (2005). *The effects of computer-assisted therapy on phonological awareness in school-aged children*. Unpublished manuscript, Louisiana Tech University. The study is ineligible for review because it does not use a comparison group.
- Hayes, E. A., Warrier, C. M., Nicol, T. G., Zecker, S. G., & Kraus, N. (2002). Neural plasticity following auditory training in children with learning problems. *Clinical Neurophysiology*, 114, 673–684. This study is ineligible for review because it does not include a student outcome.
- Houghton Mifflin Earobics. *New Orleans education closes achievement gap with Earobics*. Retrieved March 3, 2008, from [www.earobics.com](http://www.earobics.com). The study is ineligible for review because it does not use a comparison group.
- Kamhi, A. G. (2006). Epilogue: Some final thoughts on EBP. *Language, Speech, and Hearing Services in Schools*, 37(4), 320–322. The study is ineligible for review because it does not examine the effectiveness of an intervention.
- Moore, D. R., & Amitay, S. (2007). Auditory training: Rules and applications. *Seminars in Hearing*, 28, 99–109. The study is ineligible for review because it is not a primary analysis of the effectiveness of an intervention.
- Pettis, A. M. (2000). *A study on phonological awareness: The comparison of two computer-based programs used as intervention for students with disabilities*. Unpublished master's thesis, Grand Valley State University, Allendale, MI. The study does not meet evidence standards because the overall attrition rate exceeds WWC standards for this area.
- Pobanz, M. S. (2000). *The effectiveness of an early literacy/auditory processing training program, called Earobics, with young children achieving poorly in reading*. Paper presented at the meeting of the California Association of Social Psychologists, Los Angeles, CA. This study is ineligible for review because it does not use a comparison group.
- Pokorni, J. L., Worthington, C. K., & Jamison, P. J. (2004). Phonological awareness intervention: Comparison of *Fast ForWord*,

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- Earobics*, and *LiPS*. *The Journal of Educational Research*, 97(3), 147–157. This study is ineligible for review because it does not disaggregate findings for the age or grade range specified in the protocol.
- Purpura, D. J. (2007). Can externalizing behaviors be altered by an early reading intervention. Retrieved from [http://etd.lib.fsu.edu/theses/available/etd-07092007-145531/unrestricted/Purpura\\_thesis.pdf](http://etd.lib.fsu.edu/theses/available/etd-07092007-145531/unrestricted/Purpura_thesis.pdf). The study is ineligible for review because it does not include an outcome within a domain specified in the protocol.
- Rack, C. J. (2006). *The effects of using Earobics and learning resources phonics based software as supplemental computer assisted instruction on struggling second grade readers' phonemic awareness, phonics skills, and word recognition*. Unpublished manuscript. Cardinal Stritch University: Milwaukee, WI. The study does not meet WWC evidence standards because the measures of effect cannot be attributed solely to the intervention—the intervention was combined with another intervention.
- Richard, G. J. (2005). Language-based assessment and intervention of APD. In Teralandur K. Parthasarathy (Ed.), *An introduction to auditory processing disorders in children* (pp. 95–108). Hillsdale, NJ: Erlbaum. The study is ineligible for review because it does not examine the effectiveness of an intervention.
- Sweeney, D. P., & Hoffman, C. D. (2007). Research issues in autism spectrum disorders. In Robert B. Rutherford Jr., Mary Magee Quinn, and Sarup R. Mathur (Eds.), *Handbook of research in emotional and behavioral disorders* (pp. 308–322). New York, NY: Guilford. The study is ineligible for review because it does not include an outcome within a domain specified in the protocol.
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