What Works Clearinghouse

ies INSTITUTE OF EDUCATION SCIENCES

Beginning Reading April 23, 2007

Auditory Discrimination in Depth (ADD)®/ Lindamood Phonemic Sequencing (LiPS)®

Program description

The *Auditory Discrimination in Depth (ADD) Program*® (currently called the *Lindamood Phonemic Sequencing (LiPS) Program*®) is designed to teach students skills to successfully decode words and to identify individual sounds and blends in words. Initial activities engage students in discovering the lip, tongue, and mouth actions needed to produce specific sounds. After students are able to produce, label, and organize the sounds with their mouths, subsequent activities in sequencing, reading, and spelling use the oral aspects of sounds to identify and order them within words. The program also offers direct instruction in letter patterns, sight words, and context clues in reading. The *Auditory Discrimination in Depth Program*® is individualized to meet students' needs and is often used with students who have learning disabilities or difficulties. The version of the program tested here involved computer-supported activities.

Research

One study of *Auditory Discrimination in Depth*® met the What Works Clearinghouse (WWC) evidence standards. The study included 150 first grade students in five elementary schools.[1]

The WWC considers the extent of evidence for *Auditory Discrimination in Depth*® to be small for alphabetics and comprehension. No studies that met WWC standards with or without reservations addressed fluency or general reading achievement.

Effectiveness

Based on one study, *Auditory Discrimination in Depth*® was found to have potentially positive effects on alphabetics and no discernible effects on comprehension. Findings on fluency and general reading achievement were not reported in the study.

	Alphabetics	*Fluency*	*Comprehension*	*General reading achievement*
Rating of effectiveness	Potentially positive	na	No discernible effect	na
Improvement index[2]	Average: +17 percentile points Range: –1 to +35 percentile points	na	Average: +6 percentile points Range: 0 to +20 percentile points	na

na = not applicable

1. The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.
2. These numbers show the average and range of improvement indices for all findings across the study.

Additional program information

Developer and contact

Developed by Patricia Lindamood and Phyllis Lindamood, *Auditory Discrimination in Depth*® is currently distributed as *Lindamood Phonemic Sequencing (LiPS) Program*®. It is published by Pro-Ed and is available through a number of professional distributors and publishers.

Scope of use

Auditory Discrimination in Depth® was developed in the late 1960s and early 1970s. It was revised and renamed *Lindamood Phonemic Sequencing (LiPS) Program*® in 1998. The program is frequently offered at centers or clinics, including program-endorsed Lindamood-Bell Learning Centers. The program is available for purchase by the public. According to the program authors, the program is used widely for remedial purposes in rural and urban sites, but exact numbers were not available.

Teaching

The program is designed for emergent readers in kindergarten through grade 3 or for struggling, dyslexic readers. Teachers work with students in whole class and small group activities or in small groups and one-on-one settings to help them become aware of the mouth actions that produce speech sounds. Instructors help students verify sounds within words and teach them to self-correct in reading, spelling, and speech. The program developer recommends that instruction last four to six months for one hour a day, or four to six weeks for four hours a day. Computer-supported activities are available for the program.

Lindamood Bell offers *LiPS* workshops to train teachers, but teachers can also learn to administer the program from the *Lindamood Phonemic Sequencing Teacher's Manual.*

Cost

A kit of materials designed for one-on-one or small-group instruction can be purchased for $298. The classroom kit costs $498. Kits include a trainer's manual and all student materials (tiles, blocks, colored felts, and picture cards). Some of these materials are also sold separately. Information is not available on the cost of training for instructors or on how much it costs for students to receive instruction at a licensed center.

Research

Twenty-five studies reviewed by the WWC investigated the effects of *Auditory Discrimination in Depth*®. One study (Torgesen, Wagner, Rashotte, & Herron, 2003) was a randomized controlled trial that met WWC evidence standards. The remaining studies did not meet WWC evidence screens.

Met evidence standards

Torgesen et al. (2003) included 150 low-achieving first grade students in five elementary schools. At two schools, students were randomly assigned to either *Auditory Discrimination in Depth*® or *Read, Write and Type*™ *(RWT)*, a reading software program. At three additional schools, students were randomly assigned to either *Auditory Discrimination in Depth*®, *Read, Write and Type*™*,* or a regular instruction control group.[3] The beginning reading review presents data relevant to comparisons of ADD with RWT and of ADD with a regular instruction control group.[4]

Extent of evidence

The WWC categorizes the extent of evidence in each domain as small or moderate 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

3. Description of the assignment procedure was based on personal communication with the first study author on September 7, 2006.
4. The WWC review of beginning reading includes all comparison groups that meet evidence standards because all schools provide some type of reading instruction and there is no typical comparison condition.

Research *(continued)*

total sample size across the studies that met WWC evidence standards with or without reservations.[5]

The WWC considers the extent of evidence for *Auditory Discrimination in Depth*® to be small for alphabetics and comprehension. No studies that met WWC standards with or without reservations addressed fluency or general reading achievement.

Effectiveness

Findings

The WWC review of interventions for beginning reading addresses student outcomes in four domains: alphabetics, fluency, comprehension, and general reading achievement.[6] The Torgesen et al. (2003) study addressed outcomes in the alphabetics and comprehension domains. The findings below present the authors' and the WWC-calculated estimates of the size and statistical significance of the effects of *Auditory Discrimination in Depth*® on students' performance.

Alphabetics. The Torgesen et al. (2003) study findings for alphabetics are based on the performance of *Auditory Discrimination in Depth*® students and comparison students on three measures of phonological awareness and two measures of phonics.

- When the *Auditory Discrimination in Depth*® group was compared with the *Read, Write and Type*™ group, the study authors and the WWC found that there were no statistically significant differences between the groups on any of three phonological awareness measures (phoneme blending, phoneme elision, and phoneme segmenting subtests of the Comprehensive Test of Phonological Processes) or on two phonics measures (word identification and word attack subtests of the Woodcock Reading Mastery Test).
- When the *Auditory Discrimination in Depth*® group was compared with the regular classroom instruction/support group, the authors reported and the WWC confirmed statistically significant positive effects of *Auditory Discrimination in Depth*® on the two phonics measures (word identification and word attack). The authors reported and the WWC confirmed statistically significant positive effects of ADD on two of the phonological awareness measures (phoneme elision and segmenting), but the authors did not find statistically significant effects on the third phonological awareness measure—phoneme blending.

In the alphabetics domain, one study with a strong design met WWC evidence standards and showed statistically significant positive effects for one comparison group and no effect for the other.

Comprehension. The Torgesen et al. (2003) study findings for comprehension are based on the performance of *Auditory Discrimination in Depth*® students and comparison students on the passage comprehension subtest of the Woodcock Reading Mastery Test and an estimated verbal IQ measure (based on the vocabulary subtest of the Stanford Binet Intelligence test).

- When the *Auditory Discrimination in Depth*® group was compared with the *Read, Write and Type*™ group, the authors and the WWC found that there was no statistically significant difference between the groups on the comprehension measures.
- When the *Auditory Discrimination in Depth*® group was compared with the regular classroom instruction/support group, the authors found statistically significant positive effects on the passage comprehension subtest. In WWC computations, the effect was not statistically significant. On the vocabulary subtest, the authors found that *Auditory Discrimination in Depth*® had no statistically significant effect.

In the comprehension domain, one study with a strong design met WWC evidence standards and showed indeterminate effects.

5. 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 students' demographics and the types of settings in which studies took place, are not taken into account for the categorization.
6. For definitions of the domains, see the Beginning Reading Protocol.

Effectiveness *(continued)*

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,[7] 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 *Auditory Discrimination in Depth*® to have potentially positive effects for alphabetics and no discernible effects for comprehension

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 alphabetics is +17 percentile points in one study across two comparison groups, with a range of –1 to +35 percentile points across findings.

The average improvement index for comprehension is +6 percentile points in one study across two comparison groups, with a range of 0 to +20 percentile points across findings.

Summary

The WWC reviewed 25 studies on *Auditory Discrimination in Depth*®. One of these studies met WWC evidence standards; the remaining studies did not meet WWC evidence screens. Based on the study that met WWC evidence standards, the WWC found potentially positive effects on alphabetics and no discernible effect on comprehension. The evidence presented in this report is limited and may change as new research emerges.

References

Met WWC evidence standards

Torgesen, J., Wagner, R., Rashotte, C., & Herron, J. (2003). *Summary of outcomes from first grade study with Read, Write and Type and Auditory Discrimination in Depth Instruction and software with at-risk children* (FCRR Tech. Rep. No. 2). Retrieved from Florida Center for Reading Research Web site: http://www.fcrr.org/TechnicalReports/RWTfullrept.pdf

Did not meet WWC evidence screens

Adair, J., Nadeau, S., Conway, T., Gonzalez-Rothi, L., Heilman, P., Green, I., et al. (2000). Alterations in the functional anatomy of reading induced by rehabilitation of an alexic patient. *Neuropsychiatry, Neuropsychology and Behavioral Neurology, 13*(4), 303–311.[8]

Alexander, A., Anderson, H., Heilman, P., Voeller, K., & Torgesen, J. (1991). Phonological awareness training and the remediation of analytic decoding deficits in a group of severe dyslexics. *Annals of Dyslexia, 41,* 193–206.[8]

7. 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. See Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate the statistical significance. In the case of *Auditory Discrimination in Depth*®, corrections for multiple comparisons were needed.
8. The sample is not appropriate to this review: the parameters for this WWC review specified that students should be in grades kindergarten through 3 during the time of the intervention; this study did not focus on the targeted grades.

References *(continued)*

Conway, T., Heilman, P., Gonzalez-Rothi, L., Alexander, A., Adair, J., Crosson, B., & Heilman, K. (1998). Treatment of a case of phonological alexia with agraphia using the Auditory Discrimination in Depth (ADD) program. *Journal of the International Neuropsychological Society, 4,* 608–620.[8]

Howard, M. P. (1986). Effects of pre-reading training in auditory conceptualization on subsequent reading achievement. *Dissertation Abstracts International, 47*(03), 847A. (UMI No. 8612677) **(Study: Arco, Indiana first-grade longitudinal)**[9]

Howard, M. P. (1986). Effects of pre-reading training in auditory conceptualization on subsequent reading achievement. *Dissertation Abstracts International, 47*(03), 847A. (UMI No. 8612677) **(Study: Arco, Indiana kindergarten)**[9]

Howard, M. P. (1986). Effects of pre-reading training in auditory conceptualization on subsequent reading achievement. *Dissertation Abstracts International, 47*(03), 847A. (UMI No. 8612677) **(Study: Arco, Indiana and Santa Maria, California)**[9]

Kennedy, K., & Backman, J. (1993). Effectiveness of the Lindamood Auditory Discrimination in Depth Program with students with learning disabilities. *Learning Disabilities Research and Practice, 8*(4), 253–259.[8]

Lindamood-Bell Learning Processes. (2003). *Lindamood-Bell Learning Processes: Beginning reading submissions.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: Intervention in kindergarten through 2nd grade)**[10]

Lindamood-Bell Learning Processes. (2003). *Lindamood-Bell Learning Processes: Beginning reading submissions.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: Kindergarten results from school project in Oregon)**[11]

Lindamood-Bell Learning Processes. (2003). *Lindamood-Bell Learning Processes: Beginning reading submissions.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: Kindergarten through 3rd grade results from learning centers across the United States)**[11]

Lindamood-Bell Learning Processes. (2003). *Lindamood-Bell Learning Processes: Beginning reading submissions.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: Kindergarten through 3rd grade results from school project in Colorado)**[11]

Lindamood-Bell Learning Processes. (2004). Lindamood-Bell Learning Processes: *Interventions for beginning reading evidence report–Report 1, Book I of II.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: K-3 Lindamood Bell focus students 2002 summary)**[10]

Lindamood-Bell Learning Processes. (2004). *Lindamood-Bell Learning Processes: Interventions for beginning reading evidence report–Report 1, Book I of II.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: Kindergarten students in Oregon 2001–02)**[10]

Lindamood-Bell Learning Processes. (2004). *Lindamood-Bell Learning Processes: Interventions for beginning reading evidence report–Report 1, Book I of II.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: Pueblo, Colorado 2001–02 summary)**[10]

9. Does not use a strong causal design: there was only one intervention and/or one comparison unit, so the analysis could not separate the effects of the intervention from other factors.
10. Complete data were not reported: the WWC could not evaluate the design or data because complete study details were not reported.
11. Does not use a strong causal design: this study did not use a comparison group.

References *(continued)*

Lindamood-Bell Learning Processes. (2004). *Lindamood-Bell Learning Processes: Interventions for beginning reading evidence report–Report 1, Book I of II.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: Second grade students in Idaho)**[10]

McGuinness, C., McGuinness, D., & Donohue, J. (1995). Phonological training and the alphabet principle: Evidence for reciprocal causality. *Reading Research Quarterly, 30*(4), 830–852.[9]

Olson, R. K., Wise, B. W., Ring, J., & Johnson, M. (1997). Computer-based remedial training in phoneme awareness and phonological decoding: Effects on the posttraining development of word recognition. *Scientific Studies of Reading, 1*(3), 235–253.[12]

Pokorni, J. L., Worthington, C. K., & Jamison, P. J. (2004). Phonological awareness intervention: Comparison of Fast ForWord, Earobics, and LiPS. *The Journal of Educational Research, 97*(3), 147–157.[12]

Sadoski, M., & Willson, V. L. (2006). Effects of a theoretically based large-scale reading intervention in a multicultural urban school district. *American Educational Research Journal, 43*(1), 137–154.[13]

Simos, P., Fletcher, J., Bergman, E., Breier, J., Foorman, B., Castillo, E., et al. (2002). Dyslexia-specific brain activation profile becomes normal following successful remedial training. *Neurology, 58,* 1203–1212.[14]

Torgesen, J. K., Alexander, P. A., Wagner, R. K., Rashotte, C. A., Voeller, K. K. S., Conway, T., & Rose, E. (2001). Intensive remedial instruction for children with severe reading disabilities: Immediate and long-term outcomes from two instructional approaches. *Journal of Learning Disabilities, 34*(1), 33–58.[12]

Additional citation for this study:

Lindamood-Bell Learning Processes. (2004). *Lindamood-Bell Learning Processes: Interventions for beginning reading evidence report–Report 1, Book I of II.* (Available from the Lindamood-Bell Learning Processes, 416 Higuera Street, San Luis Obispo, CA 93401) **(Study: Longitudinal Florida study summary)**

Torgesen, J. K., Wagner, R. K., Rashotte, C. A., Rose, E., Lindamood, P., Conway, T., et al. (1999). Preventing reading failure in young children with phonological processing disabilities: Group and individual responses to instruction. *Journal of Educational Psychology, 91*(4), 579–593.[15]

Truch, S. (1994). Stimulating basic reading processes using auditory discrimination in depth. *Annals of Dyslexia, 44,* 60–80.[8]

Wise, B. W., Ring, J., & Olson, R. K. (2000). Individual differences in gains from computer-assisted remedial reading. *Journal of Experimental Child Psychology, 77*(3), 197–235.[13]

For more information about specific studies and WWC calculations, please see the WWC *Auditory Discrimination in Depth*® Technical Appendices.

12. The sample is not appropriate to this review: this study does not disaggregate data for students in other grades from students in grades kindergarten through third grade, the focus of this WWC review.
13. Does not use a strong causal design: this study, which used a quasi-experimental design, had a confounding factor. The ADD/LiPS intervention was combined with other interventions, making it difficult to attribute study outcomes to ADD/LiPS.
14. The outcome measures are not relevant to this review: this study did not focus on one of the domains specified for this WWC review.
15. Does not use a strong causal design: this study, which used a randomized control trial design, had a confounding factor. The ADD/LiPS intervention was combined with other interventions, making it difficult to attribute study outcomes to ADD/LiPS.

Appendix

Appendix A1 Study characteristics: Torgesen, Wagner, Rashotte, & Herron, 2003 (randomized controlled trial)

Characteristic	Description
Study citation	Torgesen, J., Wagner, R., Rashotte, C., & Herron, J. (2003). *Summary of outcomes from first grade study with Read, Write and Type and Auditory Discrimination in Depth Instruction and software with at-risk children* (FCRR Tech. Rep. No. 2). Retrieved from Florida Center for Reading Research Web site: http://www.fcrr.org/TechnicalReports/RWTfullrept.pdf
Participants	The study included 150 first grade students in five elementary schools. All students scored in the lowest 35% on a letter-sound knowledge measure. At two of the schools, 16 students were randomly assigned to *Auditory Discrimination in Depth*® (ADD) and 16 to *Read, Write and Type!*™ (RWT). At three schools, 38 students were randomly assigned to ADD, 38 to RWT, and 42 to a control group (J.K. Torgesen, personal communication, September 7, 2006). Two students left the ADD and RWT groups, and 1 student left the control group. The final sample for the analysis comparing ADD to RWT included 52 ADD students and 53 RWT students across five schools. The final sample for the analysis comparing ADD to control students included 36 ADD students and 41 control students across three schools. Approximately 34% of the sample were minority children (primarily African-American). Approximately 35% of the sample received free/reduced lunch, but students ranged in their socio-economic status.
Setting	Five elementary schools (locations unknown).
Intervention	Students assigned to the ADD program were divided into groups of three children and received four 50-minute sessions a week from October through May. A trained teacher devoted half of each session to direct instruction. The remainder of the time the students worked individually on the computer practicing the same skills with the teacher in a support role.
Comparison	RWT students received the same format and time of instruction as the ADD students, but the type of activities students engaged in differed. RWT teachers began their sessions with warm up activities, and students then spent the remaining time working on computers with the teachers lending support, particularly when children ran into specific difficulties. The computer program emphasizes phonological awareness, letter sound correspondence, and phonemic decoding as children express themselves in written language. The control group continued using the classroom instruction and support typically available to them (J.K. Torgesen, personal communication, September 7, 2006). Two of the three schools with regular instruction comparison groups used Open Court's *Collections for Young Scholars* as the whole-class reading curriculum.
Primary outcomes and measurement	The authors assessed students at the end of the study period using a battery of tests. All children in the sample were given the phoneme blending, phoneme elision, and phoneme segmenting subtests of the Comprehensive Test of Phonological Processes and the word attack, word identification, and passage comprehension subtests of the Woodcock Reading Mastery Test. Students in the study were also given the vocabulary subtest of the Stanford Binet Intelligence Scale, which the authors used as a proxy for verbal IQ. Other outcomes were reported in the study, but not included in this review either because they were outside the scope of the beginning reading review (developmental spelling and probability of reading disability) or because sufficient information on the measure name, description, or validity and reliability was not reported (word efficiency and non-word efficiency). (See Appendices A2.1 and A2.2 for more detailed descriptions of outcome measures.)
Teacher training	No information was provided on teacher training.

Appendix A2.1 Outcome measures in the alphabetics domain

Outcome measure	Description
Phonological awareness	
Comprehensive Test of Phonological Processes (CTOPP): Phoneme Blending Subtest	The phoneme blending subtest measures the child's ability to blend separately presented sounds together to form words. This is a standardized test (as cited in Torgesen et al., 2003).
Comprehensive Test of Phonological Processes (CTOPP): Phoneme Elision Subtest	The phoneme elision subtest measures the child's ability to manipulate sounds in words. This is a standardized test (as cited in Torgesen et al., 2003).
Comprehensive Test of Phonological Processes (CTOPP): Phoneme Segmenting Subtest	The phoneme segmenting subtest measures the child's ability to isolate and pronounce the sounds in words. This is a standardized test (as cited in Torgesen et al., 2003).
Phonics	
Woodcock Reading Mastery Test: Word Identification Subtest	The word identification subtest is a measure of word reading vocabulary in which the child reads list of words of increasing difficulty. This is a standardized test (as cited in Torgesen et al., 2003).
Woodcock Reading Mastery Test: Word Attack Subtest	The word attack subtest is a measure of phonemic reading ability in which the child reads non-words. This is a standardized test (as cited in Torgesen et al., 2003).

Appendix A2.2 Outcome measures in the comprehension domain

Outcome measure	Description
Comprehension	
Woodcock Reading Mastery Test: Passage Comprehension Subtest	The passage comprehension subtest measures the child's ability to comprehend the meaning of short passages. This is a standardized test (as cited in Torgesen et al., 2003).
Vocabulary	
Stanford Binet Intelligence Scale: Vocabulary Subtest	The measure is based on the vocabulary subtest of the Stanford Binet Intelligence Scale. The vocabulary subtest measures the child's ability to provide names of pictures and definitions of words. This is a standardized test (as cited in Torgesen et al., 2003).

Appendix A3.1 Alphabetics domain: Summary of findings by construct[1]

Outcome measure	Study sample	Sample size (students)	Authors' findings from the study: Mean outcome (standard deviation[2]) — *Auditory Discrimination in Depth®* group	Authors' findings from the study: Mean outcome (standard deviation[2]) — Comparison group	WWC calculations: Mean difference[3] (*ADD* – comparison)	WWC calculations: Effect size[4]	WWC calculations: Statistical significance[5] (at $\alpha = 0.05$)	WWC calculations: Improvement index[6]
Construct: Phonological awareness								
Torgesen et al., 2003 (randomized controlled trial)[7]								
Comparison #1: *Auditory Discrimination in Depth®* vs. *Read, Write and Type!™* group								
CTOPP: Phoneme Blending Subtest	Grade 1	104	18.80 (5.30)	18.90 (4.90)	–0.1	–0.02	ns	–1
CTOPP: Phoneme Elision Subtest	Grade 1	104	14.30 (4.50)	13.50 (4.50)	0.8	0.18	ns	+7
CTOPP: Phoneme Segmenting Subtest	Grade 1	104	16.20 (6.60)	15.30 (5.30)	0.9	0.15	ns	+6
Comparison #2: *Auditory Discrimination in Depth®* vs. *regular instruction/support* group								
CTOPP: Phoneme Blending Subtest	Grade 1	77	20.60 (4.50)	18.20 (5.40)	2.4	0.48	ns	+18
CTOPP: Phoneme Elision Subtest	Grade 1	77	15.30 (4.20)	12.50 (4.60)	2.8	0.63	Statistically significant	+23
CTOPP: Phoneme Segmenting Subtest	Grade 1	77	15.60 (3.70)	11.70 (4.50)	3.9	0.93	Statistically significant	+32
Construct: Phonics								
Torgesen et al., 2003 (randomized controlled trial)								
Comparison #1: *Auditory Discrimination in Depth®* vs. *Read, Write and Type!™* group								
Woodcock Reading Mastery Test: Word Attack Subtest	Grade 1	104	109.70 (14.00)	106.30 (13.60)	3.4	0.24	ns	+10
Woodcock Reading Mastery Test: Word Identification Subtest	Grade 1	104	107.10 (14.30)	105.10 (13.40)	2.0	0.14	ns	+6

(continued)

Appendix A3.1 Alphabetics domain: Summary of findings by construct *(continued)*

Outcome measure	Study sample	Sample size (students)	Authors' findings from the study: Mean outcome (standard deviation[2]) — *Auditory Discrimination in Depth®* group	Authors' findings from the study: Mean outcome (standard deviation[2]) — Comparison group	WWC calculations: Mean difference[3] (*ADD* – comparison)	WWC calculations: Effect size[4]	WWC calculations: Statistical significance[5] (at $\alpha = 0.05$)	WWC calculations: Improvement index[6]
Comparison #2: *Auditory Discrimination in Depth®* vs. *regular instruction/support* group								
Woodcock Reading Mastery Test: Word Attack Subtest	Grade 1	77	113.70 (12.20)	99.50 (14.50)	14.2	1.04	Statistically significant	+35
Woodcock Reading Mastery Test: Word Identification Subtest	Grade 1	77	110.60 (12.20)	100.10 (15.60)	10.5	0.74	Statistically significant	+27
Averages[8]								
Average for alphabetics, Comparison #1 (Torgesen et al., 2003)						0.14	ns	+6
Average for alphabetics, Comparison #2 (Torgesen et al., 2003)						0.76	Statistically significant	+28
Domain average for alphabetics domain across comparisons (Torgesen et al., 2003)						0.45	Statistically significant	+17

ns = not statistically significant

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices.
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 the 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 versus the percentile rank 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, where 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. See Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate statistical significance. In the case of Torgesen et al. (2003), corrections for multiple comparisons were needed, so the significance levels may differ from those reported in the original study.
8. The WWC-computed average effect sizes for each comparison and for the domain across comparisons are simple averages rounded to two decimal places. The average improvement indices are calculated from the average effect sizes.

Appendix A3.2 Summary of study findings included in the rating for the comprehension domain[1]

Outcome measure	Study sample	Sample size (students)	Authors' findings from the study: Mean outcome (standard deviation[2]) — *Auditory Discrimination in Depth®* group	Authors' findings from the study: Mean outcome (standard deviation[2]) — Comparison group	WWC calculations: Mean difference[3] (*ADD* – comparison)	WWC calculations: Effect size[4]	WWC calculations: Statistical significance[5] (at $\alpha = 0.05$)	WWC calculations: Improvement index[6]
Construct: Reading comprehension								
Torgesen et al., 2003 (randomized controlled trial)[7]								
Comparison #1: *Auditory Discrimination in Depth®* vs. *Read, Write and Type!™* group								
Woodcock Reading Mastery Test: Passage Comprehension Subtest	Grade 1	104	99.90 (12.50)	99.30 (10.50)	0.60	0.05	ns	+2
Comparison #2: *Auditory Discrimination in Depth®* vs. *regular instruction/support* group								
Woodcock Reading Mastery Test: Passage Comprehension Subtest	Grade 1	77	102.20 (10.00)	95.40 (14.40)	6.8	0.54	ns	+20
Construct: Vocabulary								
Torgesen et al., 2003 (randomized controlled trial)								
Comparison #1: *Auditory Discrimination in Depth®* vs. *Read, Write and Type!™* group								
Stanford Binet Intelligence Scale: Vocabulary Subtest	Grade 1	104	95.50[8]	95.50[8]	0.0	0.0	ns	0
Comparison #2: *Auditory Discrimination in Depth®* vs. *regular instruction/support* group								
Stanford Binet Intelligence Scale: Vocabulary Subtest	Grade 1	77	96.10 (12.50)	95.90 (11.30)	0.2	0.02	ns	+1
Averages[9]								
Average for comprehension, Comparison #1 (Torgesen et al., 2003)						0.03	ns	+1
Average for comprehension, Comparison #2 (Torgesen et al., 2003)						0.28	ns	+11
Domain average for comprehension across comparisons (Torgesen et al., 2003)						0.15	ns	+6

ns = not statistically significant

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices.

(continued)

Appendix A3.2 Summary of study findings included in the rating for the comprehension domain *(continued)*

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 the 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 versus the percentile rank 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, where 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. See Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate statistical significance. In the case of Torgesen et al. (2003), corrections for multiple comparisons were needed, so the significance levels may differ from those reported in the original study.
8. The authors did not present standard deviations for this outcome; however, assuming that there were positive standard deviations, the zero mean difference between comparison and treatment groups generates a zero effect size.
9. The WWC-computed average effect sizes for each comparison and for the domain across comparisons are simple averages rounded to two decimal places. The average improvement indices are calculated from the average effect sizes.

Appendix A4.1 *Auditory Discrimination in Depth*® rating for the alphabetics 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.[1]

For the outcome domain of alphabetics, the WWC rated *Auditory Discrimination in Depth*® as having potentially positive effects. It did not meet the criteria for positive effects because only one study met WWC evidence standards. The remaining ratings (mixed effects, no discernible effects, potentially negative effects, negative effects) were not considered, as *Auditory Discrimination in Depth*® 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 comparison within one study showed statistically significant positive effects.

- 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 studies showed statistically significant or substantively important negative effects or 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 met WWC evidence standards for a strong design.

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

  Met. No studies showed statistically significant or substantively important 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. See the WWC Intervention Rating Scheme for a complete description.

Appendix A4.2 *Auditory Discrimination in Depth*® rating for the comprehension 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.[1]

For the outcome domain of comprehension, the WWC rated *Auditory Discrimination in Depth*® as having no discernible effects. It did not meet the criteria for other ratings (positive effects, potentially positive effects, mixed effects, potentially negative effects, and negative effects) because the one study that met WWC standards did not show statistically significant or substantively important 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. No study showed a statistically significant or substantively important effect, either positive or negative.

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 met the WWC evidence standards for a strong design.

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

  Met. No study showed statistically significant or substantively important negative effects.

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

- 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.

  Not met. No study showed a statistically significant or substantively important negative effect, but one study showed indeterminate effects.

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.

- 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, while one study showed indeterminate effects.

(continued)

Appendix A4.2 *Auditory Discrimination in Depth*® rating for the comprehension 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.

- 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 or substantively important negative effect.

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

  Met. No study showed statistically significant or substantively important positive 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. See the WWC Intervention Rating Scheme for a complete description.

Appendix A5 Extent of evidence by domain

Outcome domain	Number of studies	Sample size		Extent of evidence[1]
		Schools	Students	
Alphabetics	1	5	146	Small
Fluency	0	0	0	na
Comprehension	1	5	146	Small
General reading achievement	0	0	0	na

na = not applicable/not studied

1. A rating of "moderate 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."