Improving Phonemic Awareness in Children With Learning Disabilities

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Structured Abstract

Clinical Question: What phonemic awareness interventions are effective for students who have language/learning disabilities?

Method: Systematic Review and Meta-Analysis

Study Sources**:** ERIC, PsycINFO, Academic Search Premiere, & Proquest (Dissertations and Theses)

Search Terms: dyslexia, reading, phoneme sequencing, phonemic awareness, literacy, language, children, specific learning disability and meta-analysis, LiPS®, Lindamood®, Lindamood Bell®, and Auditory Discrimination in Depth

Number of Included Studies: 3

Number of Participants: 124

Primary Results:

1) Limited scientific research examining effectiveness of the LiPS program in the areas of phonological awareness, language, spelling, or reading.
2) Only one study located that found the LiPS Program to be effective in the areas of phonological awareness, spelling, and reading.

Conclusions: More high quality research is needed to draw a firm conclusion regarding the effectiveness of any one intervention, including the LiPS program, for students with language/learning disabilities. Cautious recommendation for implementation is offered.

Scenario

The Elementary and Secondary Education Act as reauthorized by the No Child Left Behind (NCLB) Act of 2001 calls for scientifically based instruction for all students and holds schools accountable for students' academic gains via adequate yearly progress (AYP) reports. Schools not meeting AYP must focus instructional efforts and resources on areas of weakness. A local school district noted deficiencies in the AYP in literacy, especially for elementary students with diagnosed learning disabilities. These students demonstrated weaknesses in decoding skills that affected their overall reading ability. District administrators have charged veteran school psychologists, speech-language pathologists (SLPs), and reading specialists to examine what research-validated programs might best address the literacy needs of the students with a variety of learning disabilities, including language impairment and dyslexia.

Discussions among the specialists focused on the underlying phonemic awareness deficits that contribute to difficulties with decoding and, therefore, overall literacy development. Several programs were considered (e.g., Earobics®, Fast ForWord®, *Lindamood Phoneme Sequencing®* [LiPS®], and Wilson Reading System®). It was agreed that the LiPS program might be a viable approach for district-wide adoption. Before recommending the program for district-wide use and providing the necessary professional development for district SLPs to administer the program, district administrators asked the staff for a summary of the research base that supports use of the program.

Background

The federal Department of Education (2006) reported that public schools in the US currently serve more than 2.8 million students identified with learning disablities (LD). Though students with LD may have difficulties across all academic areas, reading is the major academic problem of concern. Deficits in phonemic or phonological awareness may be central to their reading difficulties (Colón, 2005; Kamhi, Allen, & Catts, 2001; National Reading Panel, 2000; Torgesen, 2002). Phonological awareness (i.e., awareness of the sound structure of spoken words) and phonemic awareness[1] (i.e., awareness of individual sounds in words) are recognized as primary skills needed for reading (Felton, 1993; Fox, 2000; Speece, Mills, & Ritchey, 2003; Torgesen et al., 2001). Direct instruction in literacy-based skills is essential to ameliorate the reading abilities of these students.

One approach used to remediate reading deficits through phonemic awareness training is the LiPS program. The program is designed to build a child's phonemic awareness, knowledge, and skills through five hierarchical levels of sequenced instruction:

1. Setting the Climate for Learning: Educate the child on what he or she will be learning and how it will be presented. Students learn to apply sensory information (i.e., feeling, hearing, and seeing) to become explicitly aware of how sounds are produced.
2. Identifying and Classifying Speech Sounds: Introduce, identify, and classify sounds based on similarities and differences between them. The orthographic symbol for the sound also may be introduced at this level at the discretion of the SLP.
3. Tracking Speech Sounds: Use a tactile-kinesthetic approach to teach the child to identify and manipulate sounds within syllables and words. Blocks and colored pieces of felt are used to represent sounds and syllables and are moved according to the sounds represented within words.
4. Associating Sounds and Symbols: Introduce orthographic symbols (if not previously done so) to promote letter-sound and sound-letter correspondences.
5. Spelling and Reading: The child applies his or her phonemic awareness knowledge and skills to contextual activities in spelling and reading.

The original population for which the program was designed is primary elementary students (K–3). However, it has been implemented in both individual and group settings for students in both regular and special education programs across all age groups (Colón, 2005; McBride, 2004). Krackowizer and Jamison (1974) reported one of the earlier efficacy studies of the *Auditory Discrimination in Depth* (ADD) and an earlier version of LiPS, in which experimental (n = 6) and control (n = 6) 9th-grade

[1] Some authors use the term *phonological awareness* generically to represent phonemic awareness. We have chosen to use the term to reflect the measured outcomes for phonemic skills.

students identified as poor readers were compared after a 3-week intervention program. Results of this study led the authors to conclude that "Their exposure to shifts in sounds within nonsense words seemed to increase their ability to represent changes in CV, VC, and CVC sets" (p. 101). Despite the absence of any test of statistical differences, their conclusions offered support for the use of the ADD program for students identified as poor readers.

More recently, Kennedy and Blackman (1993) assessed reading achievement of 11- to 17-year-old students and reported significant gains on phonemic awareness performance and spelling for the ADD group over the control group. Kennedy and Blackman concluded that the ADD program "…was a successful addition to a comprehensive remedial program in terms of improved ability to sequence speech sounds and phonetic accuracy in spelling real and non-words within this sample of students with severe LDs" (p. 258). However, many of the studies investigating the efficacy of the LiPS or ADD in the past 35 years have not provided a strong scientific basis upon which to draw firm conclusions of program effectiveness. Many of the studies utilized descriptive or correlation designs and analyses (e.g., Gifford, 2004), focused only on outcomes that yielded apparent or observed positive results (e.g., McIntyre, Protz, & McQuarrie, 2008), or tested the efficacy of the programs across a range of age levels (e.g., Sadoski & Wilson, 2006).

What Works Clearinghouse (2007, 2010) conducted the two recent summary and reviews specifically focused on the efficacy of the LiPS program for students with LD, in which only randomized controlled trial-designed (RCT) studies were accepted for summary and analysis. Only one study in each review met inclusion criteria (Torgesen, Wagner, Rashotte, & Herron, 2003; and Torgesen, Alexander, Wagner, Rashotte, Voeller, & Conway, 2001, respectively), resulting in positive statements of support for use of the LiPS program for improving alphabetics (i.e., phonemic awareness, word attack, letter-word identification), reading fluency, and math. Because only a single study could be identified as high quality, a non-support recommendation for improving reading comprehension and a possible negative effect for writing also were noted. The issue for both reviews was simply that a single, high-quality study did not provide a sufficient number of scientifically controlled conditions to offer a supporting recommendation. More high-quality studies that produced similar levels of student performance are required to support implementation.

The question might be raised regarding the use of such a restricted standard of research design for inclusion in the reviews. Would these conclusions be supported if the inclusion criteria were expanded to allow for quasi-experimental (QED) group-designed studies to be included in the efficacy analysis? Thus, the purpose of this Brief is to conduct a systematic review of research evidence that includes both RCT and QED studies that measure the efficacy of the LiPS program for students identified with language and/or learning disabilities.

Searching for Evidence

Study Inclusion Criteria

Decisions regarding which studies would be considered as an evidence base for assessing the intervention impact of the LiPS® program met the following criteria:

1. The study used a Randomized Control Trial (RCT) or a Quasi-Experimental Design (QED).
2. The intervention was identified as either the ADD or LiPS program.
3. The participants were classified as having a primary diagnosis of Learning Disabled (LD), Specific Learning Disabled (SLD), Language Learning Disabled (LLD), Language Impaired (LI), Specific Language Impairment (SLI) or Language Delayed (LDy).
4. The participants were students 5–18 years old and/or in grades K–12.

Study Retrieval Strategy

Studies included in this Brief were identified in searches of the databases Education Resources Information Center (ERIC), PsycINFO, Proquest (Dissertations and Theses) and Academic Search Premier. Combinations and variations of the following descriptors were used: *Lindamood, Lindamood Bell, Auditory Discrimination in Depth, dyslexia, reading, phoneme sequencing, phonemic awareness, literacy, language, children, specific learning disability* and *meta-analysis*. To include the most current research, the timeframe searched was limited to 1990–2010.

Study Coding

A data extraction system was developed for coding categories of *Participant, Treatment, Outcome,* and *Design Characteristics* for each study meeting all inclusion criteria. The features associated with each coding category are presented in Table 1. Each study was independently coded by two coders. Any discrepancies between the coders were resolved by discussion until consensus was reached.

Evaluating the Evidence

Study Retrieval Results

Initial searches of the selected databases, incorporating the previously mentioned search terms, yielded a total of 884 articles at the abstract or citation level. Of these, 871 were excluded as duplicates or for not meeting inclusion criteria, leaving 13 articles for full-text retrieval. Of these final 13 full-text studies, 10 were excluded for not meeting all of the inclusion criteria identified earlier. Reasons for exclusion included design type (e.g., single group, pre–post-test) and participant qualification methodology (e.g., students selected by lower test scores rather than by diagnoses). Table 2 presents a summary of the excluded studies and reasons for exclusion.

Three studies (Kennedy & Backman, 1993; Pokorni, Worthington, & Jamison, 2004; Torgesen et al., 2001), all retrieved from the ERIC database, met inclusion criteria and were included in the review. All of the studies compared the LiPS® group performance with either a control group or a second intervention group. Kennedy and Backman utilized a "treatment as usual" comparison group who received the typical classroom program though the LiPS group received only the experimental treatment. The other two studies used alternative intervention programs compared to the LiPS program, thereby restricting the meta-analysis possibilities and allowing for only an individual summary and descriptive analysis of the three included studies.

Table 1. Categories and Associated Characteristics Coded for Each Included Study

Coding Categories	Characteristics
Participant	Sample Size, Age, Grade Level, Gender Distribution, Diagnostic Classification, Severity Rating, Reading Level, SES, Race/Ethnicity, Sample Source, Setting, Recruitment Status
Treatment	Length of Treatment Program (days), Length of Treatment Sessions (minutes), Number of Treatment Sessions/Dosage, Type of Treatment Program, Treatment Grouping, Treatment Administrator
Outcome	Outcome Variable, Outcome Measures, Outcome Measure Administrator, Assessor Blinding
Design	Type of Study Design, Assignment Procedure, Unit of Assignment, Method of Assignment, Blinding

Table 2. List of Excluded Studies and Reason for Exclusion

Name of Study	Reason(s) for Exclusion
Colón (2005)	Pre-experimental design
Florida Center for Reading Research (2006)	Review—no experimental study conducted
Gifford (2004)	Data reported are nonparametric
McIntyre, Protz, & McQuarrie (2008)	Participants with no formal diagnoses
Paul (2002)	Participants with no formal diagnoses
Sadoski & Wilson (2006)	Pre-experimental design
Torgesen, Wagner, Rashotte, Rose, Lindamood, Conway, & Garvan (1999)	Participants with no formal diagnoses
Torgesen, Wagner, Rashotte, & Herron (2003)	Participants with no formal diagnoses
What Works Clearinghouse (2007)	Review—no experimental study conducted
What Works Clearinghouse (2010)	Review—no experimental study conducted

Included Studies Results

In the first study, Kennedy and Backman (1993) examined the efficacy of the LiPS program towards improving students' phonemic awareness, spelling, and reading skills over the course of a school year. A total of 20 participants were recruited from a private school serving students ages 11–17 years with diagnoses of severe learning disabilities. Ten students (9 male, 1 female) were selected for the LiPS group and matched for age (mean = 13 years), cognitive abilities, and test scores to a control group of 10 students (8 male, 2 female). The LiPS group received a total of 75 hours of instruction (three 50-minute sessions every school day for six weeks consisting of two group sessions composed of 4–6 students and one individual session) while the control group received the typical classroom instruction. Both groups received the same total number of hours of classroom instruction over the six week period making the LiPS training an additional program to the regular classroom instruction.

Pre-test measurements were taken in September, with post-treatment measurements taken in December, and follow-up measures taken in May on both groups of the following outcome categories:

a) Phonemic Awareness: *The Lindamood Auditory Conceptualization Test* (LAC)

b) Reading: *Slosson Oral Reading Test* (SORT) (Slosson, 1963), *Gray Oral Reading Test* (GORT) (Gray, 1955), Phonetic Reading–Nonwords

c) Spelling: *Stanford Achievement Test* (SAT-Sp, 1940), Phonetic Spelling–Stanford, Phonetic Spelling–Nonwords

Analysis of post-treatment performance presented in Table 3 suggests that the treated group performed significantly better than the control group immediately following treatment for the measured outcomes of phonological awareness, spelling, and reading. At one year post treatment, the experimental group demonstrated a significant advantage in phonemic awareness and spelling but not in reading.

In the second study, Torgesen et al. (2001) employed a comparative efficacy design of the LiPS program versus the Embedded Phonics (EP) program. Sixty students over the course of 3 years (20 each year) were selected to participate in this study. Participants ages 8–10 years were diagnosed as having a learning disability, exhibited a verbal intelligence quotient (IQ) of 75 or higher, vision and hearing within normal limits or corrected to within normal limits, and presented with no maladaptive behaviors. Participants were randomly assigned to either the LiPS group or the EP group. Both groups received two 50-minute intervention group sessions every day of the week over the course of 8–9 weeks. The total treatment time was 67.5 hours for both groups.

Outcome measures were collected for phonemic awareness, spelling, reading, and language tasks at pre-, post-, one-year post-, and two years post-treatment for 50 of the original 60 participants. Treatment effect yielded significant ($p < .05$) differences between the LiPS and EP groups for phonemic awareness, reading, and spelling. A nonsignificant ($p > .05$) effect was observed for language for post-test measures. Table 3 presents a summary of individual outcome results for Torgesen et al. (2001).

Torgesen et al. (2001) conducted a follow-up assessment at 1 and 2 years post-treatment. Data revealed significant ($p < .05$) differences between the two groups

Table 3. Effect Size Associated With Post-Test Measurement for Outcome Categories for Torgesen et al. (2001) Study

Comparison	Outcome Measures		
	Phonemic Awareness	**Spelling**	**Reading**
LiPS vs. Control–Post	*g* =1.46 95% CI = 0.76 to 2.14	*g* = 0.48 95% CI = 0.12 to 0.83	*g* = 0.473, 95% CI = 0.08 to 0.88
LiPS vs. Control–1 yr. follow up	*g* = 1.49 95% CI = 0.50 to 2.47	*g* = 0.65 95% CI = 0.14 to 1.16	*g* = 0.51 95% CI = –0.12 to 1.13

for reading at both years 1 and 2, and spelling at year 1, but not at year 2. There were no significant ($p > .05$) differences between the two groups for phonemic awareness or language at years 1 or 2. A summary of these data are presented in Table 4.

In the third included study (Pokorni et al., 2004) the LiPS program was compared to both the Fast ForWord® (FFW) and the Earobics® (ER) programs during a district-wide summer enrichment program. A total of 62 students ranging in age from 7 ½ to 9 years were selected for study participation based on SLP referral. Two students opted to not participate in the study and the remaining 60 participants were randomly assigned to one of three groups. A total of 54 participants completed the intervention program, providing the data for final analysis (LiPS $n = 18$, FFW $n = 20$, ER $n = 16$). Students received 3 hours of training in a group of five to six students, 5 days a week, for 20 days. Pre- and post-measurements of phonemic awareness, language, reading, and spelling were collected for all 54 participants.

Analysis of post-treatment group differences revealed a significant effect size difference in reading outcomes ($g = 0.49$, 95% CI = 0.12 to 0.85) for the experimental students when compared to the FFW participants. All other outcome categories yielded a nonsignificant ($p > .05$) treatment effect (see Table 4).

The data from included studies should be interpreted cautiously due to 1) the absence of a true experimental condition in which the control group was not treated, 2) the presence of substantially different comparison group protocols, and 3) the absence of preliminary data indicating any of the control/comparison conditions were inherently independently efficacious.

Discussion

The focus of this review was to assess the last 20 years of evidence available on the use of the LiPS® program with children diagnosed with a learning disability and who exhibited difficulties with language and literacy related skills (e.g., phonemic awareness). There is a clear lack of evidence as demonstrated by the number of relevant studies, a finding that is consistent with the What Works Clearinghouse reports. Using a broader inclusion criterion (e.g., RCT and QED) did not substantively increase the number of studies found.

Table 4. Effect Size Associated With Outcome Measures for Pokorni et al. (2004) and Torgesen et al. (2001) studies

Study Name	Comparison	Outcome Measures			
		Phonemic Awareness	Language	Spelling	Reading
Pokorni et al. (2004)	LiPS vs FFW	$g = 0.40$ 95% CI = –0.04 to 0.85	$g = 0.36$ 95% CI = 0.00 to 0.73	$g = 0.46$ 95% CI = –0.17 to 1.09	$g = 0.49$ 95% CI = 0.12 to 0.85
	LiPS vs ER	$g = 0.33$ 95% CI = –0.14 to 0.80	$g = 0.371$ 95% CI = –0.01 to 0.76	$g = 0.42$ 95% CI = –0.24 to 1.09	$g = 0.22$ 95% CI = –0.15 to 0.60
Torgesen et al. (2001)	LiPS vs EP–Post	$g = 0.402$ 95% CI = 0.15 to 0.65	$g = 0.061$ 95% CI = –0.25 to 0.38	$g = 0.449$ 95% CI = 0.06 to 0.84	$g = 0.24$ 95% CI = 0.04 to 0.43
	LiPS vs EP–1 yr. post	$g = 0.143$ 95% CI = –0.17 to 0.46	$g = 0.212$ 95% CI = –0.03 to 0.46	$g = 0.402$ 95% CI = 0.01 to 0.79	$g = 0.29$ 95% CI = 0.09 to 0.48
	LiPS vs EP–2 yrs. post	$g = 0.195$ 95% CI = –0.05 to 0.44	$g = 0.069$ 95% CI = –0.25 to 0.39	$g = 0.107$ 95% CI = –0.28 to 0.49	$g = 0.20$ 95% CI = 0.01 to 0.39

Though some may argue that there is a larger body of literature addressing phonemic awareness training as presented in the LiPS program, the literature not included in this review did not pass the test of high quality scientific experiments. Some of the studies that presented data were excluded, but these studies were descriptive, single group pre/post, single-subject, or correlational designs. Other excluded studies were narrative summaries or reviews that provided no data analysis. None of these kinds of excluded studies enable a clinician to draw a causal conclusion for which participation in the LiPS or other programs could be viewed as a causal intervention. Though Pokorni et al. (2004) and Torgesen et al. (2001) compared the LiPS intervention to other known structured programs, any advantage shown by one intervention can only be interpreted as an advantage for that one particular intervention over another. It may be that neither of the interventions compared provide a real advantage over the absence of any intervention. Alternatively, the programs used for comparison purposes may in fact be as effective as LiPS.

Only Kennedy and Backman (1993) provide a potential statement of LiPS advantage over the "treatment as usual" classroom program; but with only a single study to draw from, conclusions have to be interpreted cautiously. Kennedy and Backman's QED-designed study was considered the highest quality design, using a control condition for treatment comparison that we identified for purposes of answering questions of LiPS treatment efficacy. Though the study design did not randomize, the experimental and control groups were matched on important characteristics, such as age and cognitive abilities. The outcomes from Kennedy and Backman show an advantage for the LiPS program immediately following the treatment program (December of the school year) in the areas of phonemic awareness, spelling, and reading as measured when compared to the typical classroom instruction. These advantages were retained for the post-testing at the end of the school year, except in the area of reading. The interpretation and application of these outcomes do not account for other unmeasured participant characteristics in the matching process, which may explain the group differences. For example, factors such as motivation, interest, home environment, parental support, or teacher characteristics were not measured. The question is, how confident can the clinician be that the observed results are not due to these unmeasured characteristics?

The results of the Pokorni et al. (2004) study indicated that the LiPS program resulted in greater gains for students than FFW, but not significantly ($p > .05$) different from the Earobics® program in any outcome area (e.g., phonemic awareness, language, spelling, or reading). Pokorni et al. (2004) also reported a random assignment of participants to one of three treatment groups. However, with a 20% attrition rate reported from selection to post-treatment measurement and the absence of information regarding the characteristics or reasons for the attrition, the study is best interpreted as a quasi-experimental design without any pre-treatment equating or matching of participants. Not only is it unknown whether or not any of the programs are effective interventions, but any differences could be attributed to the attrition of participants (e.g., the lowest performers dropped out) or to the presence of unmeasured student characteristics.

Given the absence of any measurement of the efficacy of any of these phonemic awareness-building programs when compared to a no-treatment or treatment-as-usual control condition, we do not know (1) if all the programs are equally effective, (2) if LiPS is superior to other intervention programs, or (3) if all of the programs are ineffective.

Similar to Pokorni et al. (2004), the Torgesen et al. (2001) study compared LiPS to a researcher-developed clinical approach called e*mbedded phonics* (EP). Immediate post-test findings revealed a significant improvement for the LiPS group in phonemic awareness, spelling, and reading when compared to the EP program. However, at 1-year post-test, significant differences were observed in spelling and reading, though reading maintained significance at 2-years post-testing. Again, without a measure of the effectiveness of the EP program or accounting for the loss of 16% of the sample, no inference of clinical effectiveness can be made from the interpretation of the study results.

The Evidence-Based Decision

Reflecting on these conclusions, what decision should school district administrators make regarding the efficacy of a program for improving the phonemic awareness skills needed for successful reading performance? Evidence-based practices merge the best available evidence with clinical expertise and client values. Based on this review of the evidence currently available, there appears to be limited direct causal evidence that LiPS is effective as

presented in the Kennedy and Backman (1993) study. The results of a single study do not provide sufficient evidence to warrant a district-wide programmatic adoption. District administrators may consider recommending a study within their district in which some clinicians implement the LiPS and others continue with their current intervention protocol or one of the other program approaches of interest. At the very least, this would provide a measure of local standards that could be used to support a district-wide decision.

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