

A Randomized-Controlled Trial of *Foundations for Literacy*: An Intervention for Young
Children who are Deaf or Hard-of-Hearing

Amy R. Lederberg, Susan R. Easterbrooks, Victoria Burke, & Carol Connor

Center on Literacy and Deafness

Georgia State University

Atlanta, GA

Technical Report, February 4, 2018

Abstract

The goal of the present study was to assess the effectiveness of *Foundations for Literacy* for deaf and hard-of-hearing (DHH) children. 48 teachers in 10 states were randomly assigned to either intervention or control groups. Teachers taught in rural, urban, or suburban schools. Almost half of the children were in inclusion classes with both DHH and hearing students. 70% of the teachers used only spoken language with their students, while 30% used both sign and spoken language. Teachers in the intervention group used *Foundations* for one hour a day throughout the school year. Teachers in the control group taught their typical curriculum. DHH children in the intervention group showed stronger gains on tests of spoken phonological awareness, alphabetic knowledge, and word reading than children in the control group. Effect sizes were moderate to large. All children showed accelerated gains in vocabulary learning. This study, together with previous peer-reviewed publications, supports the conclusion that the *Foundations for Literacy* is an effective intervention for DHH children. It is the only evidence-based early literacy intervention specifically developed for DHH children.

This research was supported, in part, by the Institute of Education Sciences, U.S. Department of Education, through Grant R324E060035 to the Georgia State University Research Foundation, Inc. The opinions expressed are those of the authors and do not represent views of the Institute or the U.S. Department of Education.

The authors wish to thank the teachers and administrators at the participating schools. Their enthusiasm and support was critical to the success of our research and the creation of an effective intervention for deaf and hard-of-hearing children.

Introduction

Young deaf and hard-of-hearing children are typically delayed in their language and literacy skills compared to their hearing peers. Early intervention can play an important role in ensuring DHH children enter elementary school with the foundational skills needed to learn to read. *Foundations for Literacy* was created specifically for that purpose. Learning objectives include phonological awareness, alphabetic knowledge, word reading, vocabulary and narrative. *Foundations* is more systematic and its instruction is more explicit, multi-modal, and intensive than interventions developed for hearing children. Much of the instruction is embedded in language-rich activities. Finally, differentiation or individualization of instruction to the wide variation of language and phonological processing skills observed for children who are DHH is integral to the design. Our previous quasi-experimental work showed that DHH children taught with *Foundations for Literacy* made more gains on tests of phonological awareness, alphabetic knowledge, decoding, vocabulary and narrative skills compared to a matched comparison group (see references for peer-reviewed publications). For example, children taught with *Foundations*, on average, made gains of 11 standard points on standardized tests of vocabulary and phonological awareness from fall to spring in the school year. The goal of the current study was to provide stronger evidence through a randomized-controlled trial (RCT) that followed the US Department of Education guidelines for RCT educational research (i.e., met criteria for strong evidence in What Works Clearinghouse).

Method

We used a clustered (at the classroom level) randomized controlled trial design. We recruited 48 teachers of young DHH children from across the US. Teachers were from 39 schools located in 14 states. Teachers taught in preschool and/or kindergarten classes located in public elementary schools, private schools for DHH children, and state schools for the deaf. Schools were in rural, urban, and suburban locations. 42% of children were in inclusion classes with both DHH and hearing students.

Teachers were randomly assigned to either treatment (*Foundations*) or wait list control (business as usual). 228 DHH children participated in the study. Intervention and control groups did not differ in mean student age ($m = 51$ month; range 35 to 83 months), presence of an additional disability ($m = 25\%$) or language of the classroom (70% of children in listening and spoken language classrooms, the rest had teachers who used both sign and spoken language). Intervention teachers attended a 2-day professional development workshop and received coaching (remotely) during the school year. Intervention teachers taught *Foundations* one hour a day for the school year. Control teachers taught their typical curriculums. After the study was over (i.e., summer 2018), control teachers attended the 2-day professional development workshop (all expenses paid) and received the curriculum for free.

School IRB, teacher consent, and parental consent were obtained for all children. Independent assessors, blind to condition, tested the DHH children in the fall and spring of the school year.

Results

Child gains. Hierarchical linear analyses (HLM) showed significant intervention effects for phonological awareness, alphabetic knowledge, and word reading (all significant at the $p < .01$). See Figure 1. DHH children taught with *Foundations* made larger gains in letter-sound knowledge (Cohen's $d = .615$), phonological awareness (Cohen's $d = .591$), and word reading (Cohen's $d = 1.25$), compared to control children. Intervention children made larger gains than control children on all four phonological awareness skills assessed: rhyming, syllable segmentation, phoneme blending, and phoneme isolation. Effect sizes are considered moderate to large. There were no differences between intervention and control children on language outcomes. Both intervention and control children made significant gains in standard scores on vocabulary tests.

Survey. At the end of the school year, we gave the intervention teachers a survey; there was an 84% return rate. 95% of teachers said they enjoyed teaching *Foundations*, felt their children benefitted, would recommend it to other teachers, and planned to continue using next year (if they have an appropriate class). 62% ($n = 13$) of teachers taught classes with both DHH and hearing children (some typically developing, others with disabilities). 100% agreed that their hearing children benefitted from the program as well.

Conclusions: This study provides strong evidence that *Foundations for Literacy* promotes the language and literacy skills of DHH children. Teachers also enjoyed teaching *Foundations*. These results indicate that early literacy skills, including phonological awareness, letter-sound knowledge, and early decoding, are malleable skills in DHH children, despite their decreased access to sound. *Foundations for Literacy* is the only evidence-based intervention designed for DHH children. Teachers also indicated it is appropriate for hearing children.

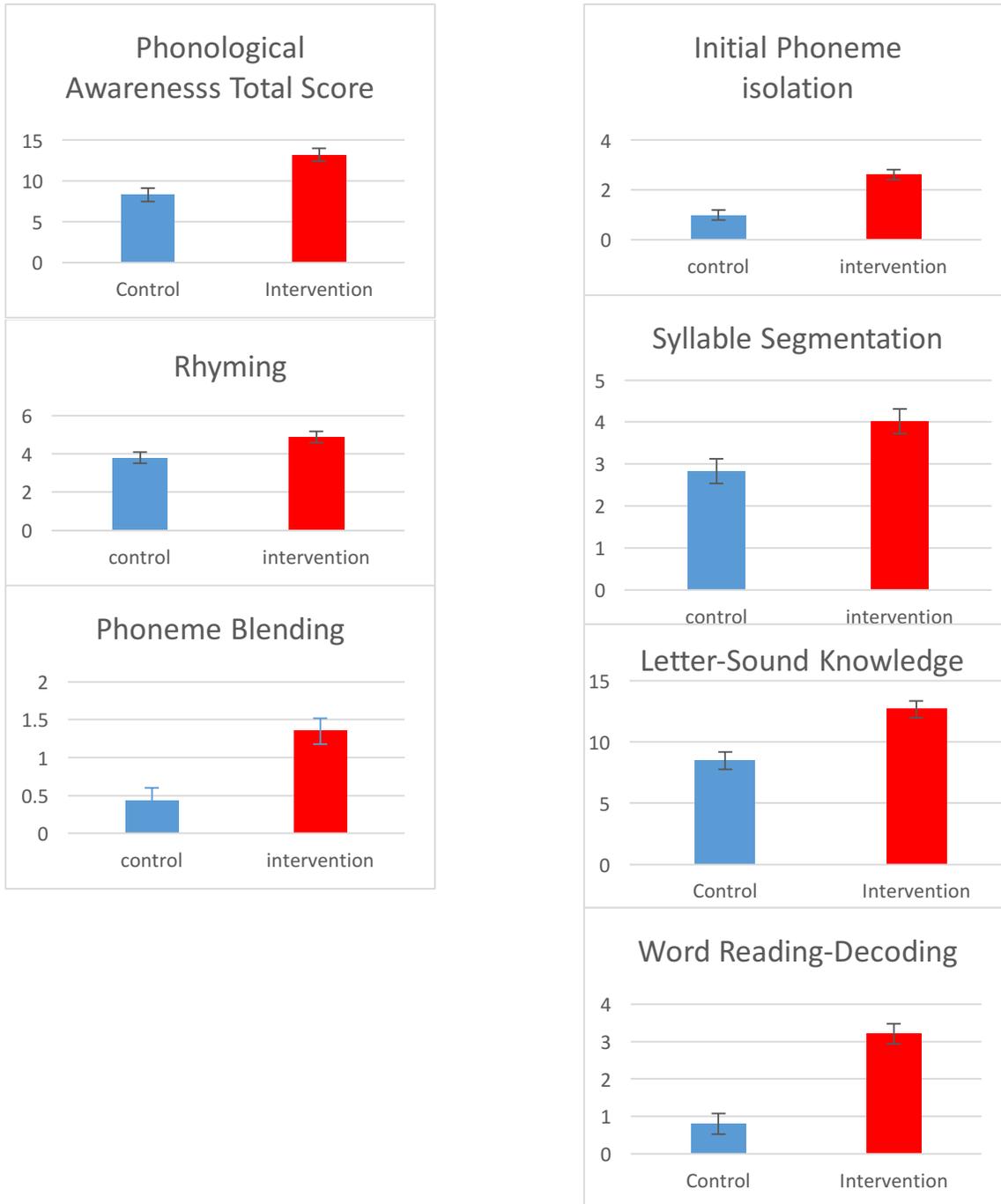
We released the *Foundation for Literacy* curriculum for sale in summer 2017 (selling it at cost). Over 150 teachers from across the country have attended professional development workshops both in Atlanta and at state-wide conferences.

We have appended some quotes from teachers and administrators (see page 5).

Our website has information about professional development opportunities and publications.

<http://clad.education.gsu.edu/foundations-literacy-home/>

Figure 1. Average learning gains made by DHH children in the intervention and control groups. All graphs represent Residualized Change Scores and depict the amount children learned during the year. These are spring scores, controlling for fall score and classroom level variance. All outcomes showed significant differences between intervention and control children.



What teachers and administrators are saying

The entire school has adopted the curriculum and it's been amazing! The teachers are team teaching and the children's progress is staggering! Both signers and our voice children are **READING** and it's December! Oh, and how fun the curriculum is to implement! We've had school tea parties and ice cream parties and fun with boats! We have listened to popcorn popping and made pies! The children and teachers are having the time of their lives! This curriculum has definitely aligned our literacy goals throughout the school and benefited both student and teacher!

-Debra Woods, Education Director, Heuser Hearing & Language Academy, Louisville, KY

It is going well! Many of my higher language students are really starting to get the hang of blending words, while my lower language students have gained a ton of vocabulary. I've seen more growth in my students this year than I have ever seen. I have 5 DHH students and 2 typical peers going to kindergarten, next year. I feel more than comfortable letting go of them, as they are the most prepared of any students I've had. The primary DHH teacher has used some of the materials to supplement her k-2 lessons, and those students have made growth, also. Thank you, so much, for your hard work on the program. Our students are going to have more of chance to work on grade level and become proficient learners.

-Kelly Chenin, A.D. Guy Elementary School Las Vegas, NV

I LOVED the program and recommended to my department that it's purchased for the self-contained kindergarten class. For some of the students that have trouble discriminating sounds, I was able to write it for the kids to read. Their overall speech has improved remarkably, parents are pleased as well as fellow DHH teachers and SLPs. My two PreK students that transitioned to kindergarten the next year were able to read at a DRA 4. It is expected that a kindergartener read at a DRA 4 or 6 by the END of the year and they started that high, all thanks to the program.

-Jessica Jordan-Hogan, Doby Elementary School, FL

I have been fortunate to work with 5 students from age 3-7 with a variety of communication modes and abilities and I have impressive results from all so thanks to you and your team for the countless hours developing these materials. I wished I had this program back when I taught a center-based program for D/HH preschoolers but I have proven it is still effective for children served by an itinerant teacher with some modifications and parent-school communication!

-Jennifer Proctor, Johnston, IA

I was unsure how Foundations would work in my classroom because the majority of my students were 3 at the beginning of the school year. I was blown away by how quickly and successfully they took to this program. They have such a strong literacy "foundation" and I am excited to see what they can do next year! One of my students is transitioning to kindergarten and when I shared the results of her progress monitoring with the team at her IEP I felt confident that she would be prepared to succeed in her full inclusion kindergarten classroom. Anonymous teacher

My students rely heavily on sign language to communicate. Using Visual Phonics in conjunction with the Foundations Curriculum really made a difference in helping those with less hearing access succeed. I was so impressed to see my limited hearing students be able to identify rhyming words and learn how to blend to read words. I have not seen a curriculum before that really helps our DHH kids get the foundations for reading skills as this curriculum offers. I have seen such improvement in not only reading ability but in speech production and spelling skills as well. I would recommend this curriculum to any DHH teacher!

-Jessica Wamsley Cannella Elementary School, Tampa FL

My students LOVED the Ms. Giggle stories and all the hands on special activities.

-Rochel Nussbaum, Strivright Auditory Oral School of New York

References

Publications are available on our website.

<http://clad.education.gsu.edu/foundations-literacy-home/>

- Lederberg, A. R., Miller, E. M., Easterbrooks, S. R., Tucci, S., Burke, V. & Connor, C. M. (2017). *Foundations for Literacy: An early literacy intervention for deaf and hard-of-hearing children*, Atlanta, GA: Georgia State University.
- Lederberg, A.R. & Easterbrooks, S. E., Tucci, S., Burke, V. & Goldberg, H. (2016) *Effective intervention strategies for teaching early literacy skills to deaf children with cochlear implants*. Proceedings of the Annual Symposium of the American Cochlear Implant Alliance. *Cochlear Implants International*, 17(5), 211-237.
- Lederberg, A. R., Miller, E. M., Easterbrooks, S. R., & Connor, C. M. (2014). *Foundations for Literacy: An early literacy intervention for deaf and hard-of-hearing children*. *Journal of Deaf Studies and Deaf Education*, 19(4), 438-455. doi: 10.1093/deafed/enu022
- Miller, E. M., Lederberg, A.R., & Easterbrooks, S. R. (2013). Phonological awareness: Explicit instruction of young deaf and hard-of-hearing children. *Journal of Deaf Studies and Deaf Education*, 18, 206-227.
- Beal-Alvarez, J. S., Lederberg, A. R., & Easterbrooks, S. R. (2012). Grapheme–phoneme acquisition of deaf preschoolers. *Journal of Deaf Studies and Deaf Education*, 17(1), 39-60. doi:10.1093/deafed/enr030

Technical appendix. Results of HLM analyses

Table 1

HLM results for Foundations effect on Letter Sound Knowledge (LKS) Post-test, Controlling for LKS Pre-test

Final estimation of fixed effects

Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
β_0					
Fitted Mean LKS Post-test, γ_{00}	8.482	1.084	7.821	44	<0.001
Effect of Foundations, γ_{01}	4.200	1.512	2.778	44	0.008
β_1					
Effect of LKS Pre-test, γ_{10}	0.895	0.085	10.513	122	<0.001

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	d.f.	χ^2	p-value
Classroom level u_0	3.82924	14.66308	44	113.29318	<0.001
Student level r	5.65376	31.96495			

Deviance = 1104.621585

Model: **Level-1 Model**

$$LS_POST_{ij} = \beta_{0j} + \beta_{1j}*(LKS\ Pre-test_{ij}) + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01}*(Foundations_j) + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

Table 2

Effect of Foundations on the PAT Post-test controlling for PAT Pre-test

Final estimation of fixed effects

Fixed Effect	Coefficient	Standard error	<i>t</i> -ratio	Approx. <i>d.f.</i>	<i>p</i> -value
β_0					
Fitted Mean PAT post-test, γ_{00}	8.296	1.005	8.248	46	<0.001
Effect of Foundations, γ_{01}	4.901	1.821	2.691	46	0.010
β_1					
Effect of PAT pre-test, γ_{10}	0.862	0.085	10.034	164	<0.001

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	<i>d.f.</i>	χ^2	<i>p</i> -value
Classroom level u_0	5.708	32.590	46	224.823	<0.001
Student Level r	6.003	36.037			

Deviance = 1437.474662

Level-1 Model

$$PAT\ post\text{-}test_{ij} = \beta_{0j} + \beta_{1j} * (PAT\ Pre\text{-}test_{ij}) + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * (Foundations_j) + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$

Table 3

HLM Results for the Effect of Foundations on the Key Words Phonics (KWP) Post-test controlling for KWP Pre-test

Final estimation of fixed effects

Fixed Effect	Coefficient	Standard error	t-ratio	Approx. d.f.	p-value
β_0					
Fitted Mean KWP Post-test, γ_{00}	3.122	0.476	6.554	40	<0.001
Effect of Foundations, γ_{01}	7.310	1.111	6.574	40	<0.001
β_1					
Effect of KWP Pre-test, γ_{10}	0.993	0.081	12.170	106	<0.001

Final estimation of variance components

Random Effect	Standard Deviation	Variance Component	d.f.	χ^2	p-value
Classroom Level u_0	2.530	6.401	40	72.07896	0.002
Student Level r	5.236	27.422			

Deviance = 937.162910

Level-1 Model

$$\text{Key Word Phonics Post-test}_{ij} = \beta_{0j} + \beta_{1j} * (\text{Key Word Phonics Pre-test}_{ij}) + r_{ij}$$

Level-2 Model

$$\beta_{0j} = \gamma_{00} + \gamma_{01} * (\text{Foundations}_j) + u_{0j}$$

$$\beta_{1j} = \gamma_{10}$$