

# Appendix

## Appendix A1.1 Study characteristics: Foster, Erickson, Foster, Brinkman, & Torgesen, 1994 (randomized controlled trial)<sup>1</sup>

Characteristic	Description
<b>Study citation</b>	Foster, K. C., Erickson, G. C., Foster, D. F., Brinkman, D., & Torgesen, J. K. (1994). Computer administered instruction in phonological awareness: Evaluation of the Daisy-Quest program. <i>The Journal of Research and Development in Education</i> , 27(2), 126–137.
<b>Participants</b>	The participants in this study were 27 four- to six-year-old low- to middle-income children selected from a pool of more than 100 children based on their scores on two pretests. Children with scores less than 75 on the Peabody Picture Vocabulary Test-Revised (PPVT-R) and scores greater than 20 on the Phonological Awareness Test (PAT) were excluded from the study. Thirty-seven percent of the children were female. The mean age of the children in the intervention condition was 65.1 months and the mean age of the children in the comparison condition was 63.4 months. The children were randomly assigned to the intervention and comparison conditions.
<b>Setting</b>	The study took place at the Kinderland Center in Orem, Utah.
<b>Intervention</b>	The intervention group participated in <i>DaisyQuest</i> , a computer-based phonological awareness training program, for 20 sessions that lasted approximately 20–25 minutes each.
<b>Comparison</b>	Children in the no-treatment comparison group participated in their regular preschool program.
<b>Primary outcomes and measurement</b>	The primary outcome domain was phonological processing as measured with two nonstandardized measures: the Phonological Awareness Test (PAT) and the Screening Test of Phonological Awareness-Experimental Version (STOPA-E). (See Appendix A2 for more detailed descriptions of outcome measures.)
<b>Teacher training</b>	No information on teacher training was provided because teachers did not deliver the intervention.

1. Foster et al. (1994) also conducted a study with kindergarten children, but the kindergarten study is not included in the report because the children are outside of the eligible age range for the WWC ECE topic. The Beginning Reading team reviewed the kindergarten study. After the study authors completed the preschool phase of the study, *DaisyQuest* was modified.

## Appendix A1.2 Study characteristics: Lonigan, Driscoll, Phillips, Cantor, Anthony, & Goldstein, 2003 (randomized controlled trial)

Characteristic	Description
<b>Study citation</b>	Lonigan, C. J., Driscoll, K., Phillips, B. M., Cantor, B. G., Anthony, J. L., & Goldstein, H. (2003). A computer-assisted instruction phonological sensitivity program for preschool children at-risk for reading problems. <i>Journal of Early Intervention, 25</i> (4), 248–262.
<b>Participants</b>	The study began with 45 low-income English-speaking children; four children withdrew during the course of the study, leaving a sample of 41 children. Eighty-five percent of the children were African-American, 10% were Caucasian, and 5% were Hispanic. Sixty-six percent of the participants were female. The average age of participants in the intervention group was 56.4 months and 53.9 months in the comparison group. The children were randomly assigned to the intervention and comparison conditions.
<b>Setting</b>	The study took place in a Head Start program in Tallahassee, Florida.
<b>Intervention</b>	The intervention group children worked individually on portable computers using two instructional programs, <i>DaisyQuest</i> and <i>Daisy's Castle</i> , to master phonological sensitivity tasks. Children participated in <i>Daisy's Castle</i> only after they had completed the <i>DaisyQuest</i> modules twice. Children participated in the intervention over an eight-week period, four to five days a week for 15–20 minutes a session.
<b>Comparison</b>	Children in the no-treatment comparison group participated in their regular Head Start curriculum.
<b>Primary outcomes and measurement</b>	The primary outcome domains assessed were oral language, print knowledge, phonological processing, and early reading/writing. Children's oral language use was measured by a standardized measure: the Expressive One Word Picture Vocabulary Test-Revised (EOWPVT-R). Print knowledge was measured by two nonstandardized measures: a letter-name knowledge task and a letter-sound knowledge task. Phonological processing was measured by eight nonstandardized measures: rhyme oddity, rhyme matching, word blending, syllable/phoneme blending, multiple-choice blending, word elision, syllable/phoneme elision, and multiple-choice elision. Early reading/writing was assessed with a nonstandardized word decoding task and a standardized measure: the Word Identification subtest of the Woodcock Reading Mastery Test-Revised—WRMT-R. The EOWPVT-R, letter knowledge tasks, and the WRMT-R are not included in this report because posttest means and standard deviations were unavailable. (See Appendix A2 for more detailed descriptions of outcome measures.)
<b>Teacher training</b>	Research assistants were trained by researchers to provide one-on-one instruction and support to children throughout the eight-week intervention period.

## Appendix A2 Outcome measures in the phonological processing domain

Outcome measure	Description
<b>Phonological Awareness Test (PAT)</b>	A researcher-developed measure that assesses the following skills: recognizing whether two words rhyme, recognizing whether a given word can be formed from a given sequence of separately pronounced phonemes, recognizing whether two words begin with the same sound, recognizing whether two words have the same middle sound, recognizing whether two words end in the same sound, and recognizing whether a word contains a given number of different sounds (as cited in Foster et al., 1994).
<b>Screening Test of Phonological Awareness-Experimental Version (STOPA-E)</b>	A measure of children's phonological processing that requires children to mark which of three pictured words begin with the same first sound as another pictured word, mark which of four pictured words begin with a different first sound from the other three, or count the phonemes in words that have from one to three phonemes (as cited in Foster et al., 1994).
<b>Rhyme oddity</b>	A researcher-developed measure that requires children to identify the nonrhyming word from three pictured words to assess children's sensitivity to rhyme (as cited in Lonigan et al., 2003).
<b>Rhyme matching</b>	A researcher-developed measure that requires children to look at a picture representing a word and identify rhyming words from other pictured words to assess children's sensitivity to rhyme (as cited in Lonigan et al., 2003).
<b>Word blending</b>	A researcher-developed measure that requires children to blend single syllable words into a compound word (such as, "cow" and "boy") to assess children's ability to blend sounds into a new word (as cited in Lonigan et al., 2003).
<b>Syllable/phoneme blending</b>	A researcher-developed measure that requires children to tell the researcher what results when isolated segments are put together (such as, "sis" and "ter") to assess their ability to blend sounds into a new word (as cited in Lonigan et al., 2003).
<b>Multiple-choice blending</b>	A researcher-developed measure that requires children to look at three pictures that the researcher names and then to identify the picture that represents the blended word to assess children's ability to blend sounds into a new word (as cited in Lonigan et al., 2003).
<b>Word elision</b>	A researcher-developed measure that requires children to say single syllable word components of compound words (such as, "batman" is "bat" and "man") to assess children's ability to delete parts of a word to form a new word (as cited in Lonigan et al., 2003).
<b>Syllable/phoneme elision</b>	A researcher-developed measure in which children are asked to say words without certain sounds (such as, say "candy" without the "dee" or say "heat" without "/h/") to assess children's ability to delete parts of a word to form a new word (as cited in Lonigan et al., 2003).
<b>Multiple-choice elision</b>	A researcher-developed measure that requires children to say words without certain sounds but they respond by pointing to pictures that represent those words (as cited in Lonigan et al., 2003).

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

Outcome measure	Study sample	Sample size (children)	Author's findings from the study		WWC calculations			
			Mean outcome (standard deviation <sup>2</sup> )		Mean difference <sup>4</sup> ( <i>DaisyQuest</i> – comparison)	Effect size <sup>5</sup>	Statistical significance <sup>6</sup> (at $\alpha = 0.05$ )	Improvement index <sup>7</sup>
			<i>DaisyQuest</i> group <sup>3</sup>	Comparison group				
<b>Foster et al., 1994 (randomized controlled trial)<sup>8</sup></b>								
PAT	4–6 year olds	27	22.40 (3.10)	19.20 (3.50)	3.20	0.93	Statistically significant	+32
STOPA-E	4–6 year olds	27	18.50 (7.20)	12.40 (6.50)	6.10	0.87	Statistically significant	+31
<b>Average<sup>9</sup> for phonological processing (Foster et al., 1994)</b>						0.90	Statistically significant	+32
<b>Lonigan et al., 2003 (randomized controlled trial)<sup>10</sup></b>								
Rhyme oddity	3–5 year olds	41	6.01 (2.25)	3.95 (2.91)	2.06	0.77	Statistically significant	+28
Rhyme matching	3–5 year olds	41	8.66 (2.56)	6.67 (2.39)	1.99	0.79	Statistically significant	+28
Word blending	3–5 year olds	41	5.59 (4.10)	4.24 (3.97)	1.35	0.33	ns	+13
Syllable/phoneme blending	3–5 year olds	41	1.98 (2.14)	1.95 (2.13)	0.03	0.01	ns	+1
Multiple-choice blending	3–5 year olds	41	8.48 (1.31)	8.14 (1.28)	0.34	0.26	ns	+10
Word elision	3–5 year olds	41	4.58 (4.02)	1.81 (3.17)	2.77	0.75	Statistically significant	+27
Syllable/phoneme elision	3–5 year olds	41	2.52 (2.57)	0.48 (1.25)	2.04	1.00	Statistically significant	+34
Multiple-choice elision	3–5 year olds	41	5.50 (1.47)	6.05 (1.69)	–0.55	–0.34	ns	–13
<b>Average<sup>9</sup> for phonological processing (Lonigan et al., 2003)</b>						0.45	ns	+17
<b>Domain average<sup>9</sup> for phonological processing across all studies</b>						0.68	na	+25

(continued)

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

ns = not statistically significant

na = not applicable

1. This appendix reports findings considered for the effectiveness rating and the 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. For Lonigan et al. (2003), the intervention group mean equals the comparison group mean plus the mean difference.
4. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group. For Lonigan et al. (2003), the computation of the mean differences were computed by the WWC and took into account the pretest difference between the study groups. The resulting effect sizes may overestimate the intervention's effects when the intervention group had lower pretest scores than the comparison group and underestimate the intervention's effect when the intervention group had higher pretest scores than the comparison group.
5. For an explanation of the effect size calculation, see the [Technical Details of WWC-Conducted Computations](#).
6. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
7. The improvement index represents the difference between the percentile rank of the average student in the intervention condition and that of the average student in the comparison condition. The improvement index can take on values between -50 and +50, with positive numbers denoting favorable results.
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 about the clustering correction, see the [WWC Tutorial on Mismatch](#). See the [Technical Details of WWC-Conducted Computations](#) for the formulas the WWC used to calculate statistical significance. In the case of the Foster et al. (1994) study, a correction for multiple comparisons was needed, so the significance levels may differ from those reported in the original study.
9. The WWC-computed average effect sizes for each study and for the domain across studies are simple averages rounded to two decimal places. The average improvement indices are calculated from the average effect size.
10. In the case of the Lonigan et al. (2003) study, a correction for multiple comparisons was needed, so the significance levels may differ from those reported in the original study.

*(continued)*

## Appendix A4 *DaisyQuest* rating for the phonological processing domain

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

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

### Rating received

**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.  
**Met.** Both studies met WWC evidence standards for a strong design and had statistically significant positive effects.
- Criterion 2: No studies were identified as having statistically significant *negative* effects or substantively important *negative* effects.  
**Met.** The WWC analysis found no statistically significant or substantively important negative effects in this domain.

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 effects. See the [WWC Intervention Rating Scheme](#) for a complete description.