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TRAINING IN PHONEMIC AWARENESS: GREATER ON TESTS OF PHONEMIC AWARENESS[1]

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Summary.—A review of 15 studies confirms that training in phonemic awareness has a larger effect on tests of phonemic awareness than on tests of real word reading and reading comprehension.

Phonemic awareness is being aware "that words are composed of sequences of meaningless and somewhat distinct sounds (phonemes)" (Juel, 1994). It is, in other words, the ability to divide a word into its component phonemes. Note that "phonemic awareness" refers to sounds, not letters. Thus, the word "ox" has three phonemes, even though it only has two letters: /a/, /k/, and /s/. One who knows this has phonemic awareness.

It is assumed by some policy makers that children must have direct instruction on phonemic awareness to learn to read. The State of California, for example, insists that phonemic awareness is among those skills that must be taught directly and that instruction "must be initiated in prekindergarten" (Recommendation 6, p. 9; State of California, 1995). Adequate phonemic awareness, it is assumed, is necessary for the learning of sound-spelling rules, which in turn are needed to decode and identify words. Accurate word identification is considered to be prerequisite to reading comprehension.

Training studies are considered crucial for establishing a causal relationship between phonemic awareness and reading ability. In training studies, children are taught phonemic awareness directly through activities that involve segmentation (breaking a word into its sounds), blending (assembling individual sounds into words), and similar activities. Byrne and Fielding-Barnsley (1995) have suggested that there is an ordering of the effects of phonemic awareness training, with a larger effect of training on nonwords than on real words (p. 497), an observation that leads to the hypothesis that the effect of phonemic awareness training is larger on measures with less meaning.

To test this hypothesis, all relevant published phonemic awareness training studies were analyzed. To ensure all relevant studies were included, Troia's work (1999), an exhaustive review of phonemic awareness training

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studies, was consulted. Effect sizes were calculated to estimate the influence of phonemic awareness training on different measures of reading.

Effect sizes assess the magnitude of relationships and can be used to assess the effect of training. They are calculated by subtracting the mean of the comparison group from the mean of the experimental group and dividing by the pooled standard deviation (Wolf, 1986). All effect sizes calculated here were based on posttest scores and, when possible, confirmed by using alternative means of calculation, e.g., using formulae converting test statistics such as t and F to effect sizes (Rosenthal, 1984; Wolf, 1986). In no case were pretest scores of experimental and comparison groups obviously different. Calculations were also weighted for sample size (see Wolf, 1986, pp. 39-40).

The prediction tested here is that within each study the influence of phonemic awareness training will be larger on tests of phonemic awareness, a test involving no meaning, than on tests of reading real words aloud or tests of reading comprehension. Williams (1980) was included, even though the measure of word meaning included reading nonsense words. The focus was comparison of effect sizes within studies. Comparing effect sizes across studies is problematic because differences among studies in duration, age of children, and methods of teaching could affect the influence of training. In addition, effect sizes could be influenced by the performance of comparison groups, which may undergo different kinds of treatments, some engaging in literacy-related activities and some not.

Studies used a wide variety of tests of phonemic awareness. For this analysis, whenever possible, segmentation tests were used, tests in which children are asked to divide a word into its component phonemes. Segmentation test scores correlate highly with other tests of phonemic awareness and are a significant predictor of children's rate of learning to read nonsense words following explicit instruction (Yopp, 1988).

For the seven studies containing both tests of segmentation and tests of reading real words, effect sizes were larger for the former, falling just short of statistical significance (paired $t_6 = .13$, $p = .07$). Results are statistically significant when the two studies are added that combined two or more measures of phonemic awareness, including segmentation and others (Olofsson & Lundberg, 1983, 1985; Castle, Riach, & Nicholson, 1994) (paired $t_9 = 2.36$, $p = .04$).

Only three studies included tests of reading comprehension. For all three, effect sizes for phonemic awareness are larger than for reading comprehension. In fact, the effect size for reading comprehension in all three studies is close to zero. The difference between effect sizes on tests of phonemic awareness and reading tests when all studies are included is statistically significant (paired $t_{11} = 2.73$, $p = .02$). Note that Hatcher, Hulme, and Ellis (1994) was counted only once.

Cunningham (1990) requires separate discussion. Four treatment groups of children, two in kindergarten and two in first grade, underwent 10 weeks of phonemic awareness training. Children experienced either "skill and drill" (pure phonemic awareness training) or "metalevel" training (included practice in using phonemic awareness while reading). Two comparison groups had no training, one of kindergarten children and one of first graders. Three tests of phonemic awareness were used, but only "phoneme oddity" is reported here, a measure in which children had to decide which of three words sounded different, e.g., rock, tack, sock, because results for other measures were similar. The measure of reading was the Metropolitan Reading Achievement Test, which includes word recognition and reading comprehension but also less meaningful components (sound-spelling correspondence, knowledge of letters). Effect sizes were larger for phonemic awareness than for scores on the Metropolitan test. Because a significant part of the Metropolitan test consists of reading real words and reading comprehension, these results are consistent with those presented in Table 1.

TABLE 1
PHONEMIC AWARENESS TRAINING ON PHONEMIC AWARENESS, WORD READING, AND READING COMPREHENSION

Study	Age	Duration	n*	Effect Size		
				Phonemic Awareness	Word Reading	Reading Comprehension
Ball & Blachman (1991)	5.7	7 wk.	29/30	1.66	.53	
Brennan & Ireson (1997)	5.4	1 yr.	12/14	5.09	1.19	
Brady, *et al.* (1994)	5.4	18 wk.	29/30	1.70	.55	
Schneider, *et al.* (1997)						
Study 1	5.7	1 yr.	205/166	.89	.21	
Study 2	5.7	5 mo.	191/155	1.00	.05	
Hatcher, Hulme, & Ellis (1994)	7.0	20 wk.	30/31	.54	.08	.08
Olofsson & Lundberg (1983, 1985)	6.1	8 wk.	61/34	.22[a]	.47	
Castle, Riach, & Nicholson (1994)	5.0	15 wk.	5/5	1.41[b]	−.09	
Williams (1980)						
Study 1	7–12[c]	26 wk.	51/36	.48	1.07[d]	
Study 2	9.5[c]	19 wk.	60/42	1.22	.95[e]	
Defior & Tudela (1994)						
Study 1	6.2	6 mo.	9/12	.75[f]		.06
Study 2	6.2	6 mo.	10/12	.74[f]		.07

*n = treatment/control. Age = age of subjects at beginning of training.
[a] Combined test of phonemic awareness (segmentation and blending). [b] Combined test of phonemic awareness (segmentation, blending, delete initial phoneme, delete final phoneme, substitute initial phoneme, substitute final phoneme). [c] Learning-disabled. [d] Test = 8 real words and 10 nonsense words, bigrams, and trigrams. [e] Real and nonsense trigrams. [f] Phoneme discrimination: subjects choose from among three pictures the one sharing the first phoneme with an orally presented word.

Phonemic awareness training has a larger effect on tests of phonemic awareness than on tests involving meaning. This result has several possible interpretations. It may take a long time for phonemic awareness to show its full effect on reading; in all studies included here, all measures were administered immediately after training. Also, factors other than phonemic awareness play a role in performance on tests of reading comprehension. A final possibility is that the influence of phonemic awareness training may be largely limited to tests that do not involve meaning.

TABLE 2
PHONEMIC AWARENESS TRAINING ON THE METROPOLITAN READING ACHIEVEMENT TEST

Training*	Effect Size	
	Phonemic Awareness	Metropolitan Test
Skill and Drill: Kindergarten	2.12	.43
Metalevel: Kindergarten	2.38	.57
Skill and Drill: First Grade	1.09	.09
Metalevel: First Grade	.83	.55

*From Cunningham (1990).

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