Journal of Research in Reading, ISSN 0141-0423 *DOI: 10.1111/j.1467-9817.2007.00353.x*
Volume 31, Issue 2, 2008, pp 243–256

Effects of rhyming, vocabulary and phonemic awareness instruction on phoneme awareness

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Sixteen Head Start classrooms, involving 128 children, were randomly assigned to three approaches for augmenting early literacy instruction: (a) instruction in phoneme segmentation, blending, and letter–sound relationships, (b) rhyming instruction and (c) vocabulary instruction. The phoneme segmentation approach was more effective in promoting phoneme segmentation skill. Existing research suggests that phoneme segmentation skill is a better predictor of early progress in learning to read than rhyming skill or vocabulary knowledge. Thus, the results suggest that instruction emphasising phoneme segmentation is not only more likely to promote phoneme segmentation skill, but also more likely to promote future reading ability than rhyming or vocabulary activities, even for highly disadvantaged children as young as 4 years old.

Phonemic awareness is an advanced stage of phonological awareness, defined as the ability to recognise that a spoken word consists of a sequence of phonemes (for example, that 'cat' involves blending of three phonemes, /k/, /a/, /t/; Snow, Burns & Griffin, 1998). Children who lack phoneme segmentation and blending skills upon entering first grade are likely to be poor readers in fourth grade (Juel, 1988) and sixth grade (Lundberg, 1984). Numerous studies indicate that children given training in phonological sensitivity and/or alphabetic coding show superior outcomes on measures of comprehension and text reading as well as word recognition (Stanovich & Stanovich, 1995).

There is now strong evidence from experimental studies that the positive effects of teaching segmentation and blending skills generalise to reading comprehension. Training in phoneme segmentation and blending resulted in improvement in future reading ability in kindergarten children (Lundberg, Frost & Peterson, 1988), 5-year-old children (Schneider, Kuspert, Roth & Vise, 1997) and 4-year-old children in a randomised study (Hatcher, Hulme & Snowling, 2004).

Furthermore, phoneme segmentation skill is a better predictor of early progress in learning to read than rhyming skill (Hatcher & Hulme, 1999; Hatcher et al., 2004; Hulme, 2002; Hulme, Muter & Snowling, 1998; Hulme et al., 2002; Muter & Diethelm, 2001;

Muter, Hulme, Snowling & Stevenson, 2004; Muter, Hulme, Snowling & Taylor, 1998; Nation & Hulme, 1997) or vocabulary knowledge (Muter & Diethelm, 2001; Muter et al., 2004). While Goswami and Bryant (1990) found that rhyme ability predicts future reading ability, this conclusion is primarily based on studies that did not provide direct comparisons with phoneme segmentation and blending ability (e.g., Bradley & Bryant, 1983), or did not measure rhyme and phoneme skills at the same points in time (see Hulme, 2002). Phoneme skills account for unique variance in subsequent reading scores after controlling for rhyme skills, yet rhyme skills account for no unique variance after controlling for phoneme skills (Duncan, Seymour & Hill, 1997; Hulme et al., 2002; Muter et al., 1998; Stuart, 1995). The hypothesis that rhyme may be a developmental precursor of phoneme awareness (Goswami & Bryant, 1990) is not supported by research showing that reading skill is predicted by phonemic skills but not rhyme skills for young non-readers (mean age less than 5 years) as well as older children (Hatcher et al., 2004; Hulme, 2002; Muter et al., 2004).

A substantial proportion of disadvantaged prekindergarten children as young as 4 years old have the ability to segment (Caravolas & Bruck, 1993; Caravolas, Hulme & Snowling, 2001; Hatcher et al., 2004) or delete phonemes (Muter et al., 2004), and instruction of phoneme segmentation and blending skills in preschool is twice as effective as instruction in kindergarten, with a much larger effect size for reading outcomes, demonstrating transfer of phonemic awareness training to reading (National Reading Panel Subgroups, 2000, chapter 2, p. 24). Thus, there is ample evidence suggesting that phoneme segmentation can and should be taught to preschool children as young as 4 years old in order to promote future reading ability.

Unfortunately, phoneme segmentation and blending activities have not been integrated into mainstream preschool curricula for economically disadvantaged children. For example, these activities have not been integrated into two of the most widely used curricula: *The Creative Curriculum* (Dodge, Colker & Heroman, 2002) and *High Scope*, which are standard curricula in many federally funded Head Start preschool programmes in the United States. The reason, according to key early childhood educators, educational researchers and the Chief of the Education Services Branch of the Head Start Bureau, is that many 4–5-year-old children in Head Start are not developmentally ready for phoneme segmentation and blending.[1] These educators and researchers recommend instead that highly disadvantaged young children receive instruction in activities such as rhyming or vocabulary, instead of more difficult phoneme manipulation activities. They argue that rhyming and vocabulary activities are more developmentally appropriate for children in Head Start, and phoneme segmentation and blending instruction should be delayed until kindergarten or first grade.

These views are codified in current Head Start curricula. For example, the most widely used curriculum (*The Creative Curriculum* [Dodge et al., 2002], used by 39.1% of Head Start teachers in a national sample [McKey, Pai-Samant & Sorongon, 2002]), does not include instruction in phoneme manipulation. *The Creative Curriculum® for Preschool Implementation Checklist* (Teaching Strategies Inc., 2003), which 'is designed to assess how well the Curriculum is being implemented as intended', does not mention phoneme manipulation activities. Instead, the implementation checklist asks: 'Do teachers draw children's attention to the sounds of language through playful songs, stories, rhymes and chants to help develop phonological awareness?' (Teaching Strategies Inc., 2003). In essence, the Curriculum is deemed – by its authors – to be well implemented if teachers 'draw attention to the sounds of language through playful songs, stories, rhymes and

chants' rather than phoneme manipulation and systematic instruction in letter–sound relationships. Similarly, the second most widely used curriculum (*High/Scope*, used by 20% of Head Start teachers in a national sample), avoids teaching letter–sound relationships explicitly: 'Rather than have young children rote memorize letter names and sounds, teachers in *High/Scope* programs build phonemic awareness through everyday play and games as children sing songs, hear and tell stories, make up nonsense words, invent and repeat rhymes, or move to rhythmic chants' (Epstein, Hohmann & Hohmann, 2002).

Data from a nationally representative sample of Head Start classrooms indicate that lack of attention to letter–sound relationships is indeed a problem: nearly half (47%) of Head Start graduates are unable to associate letters with beginning sounds (Zill, Resnick & O'Donnell, 2001), suggesting that inhibitions about the developmental appropriateness of teaching letter–sound relationships translate into lack of effective instruction in this area. Furthermore, letter identification skill declines (relative to children not in Head Start) and the decline is larger for children who are in the programme for 2 years, compared with 1 year (Zill et al., 2001). Zill, Resnick and McKey (1999) concluded:

> A probable reason why Head Start children are not learning early reading skills like letter recognition and print awareness is that many Head Start teachers are not teaching them. Interviews with lead teachers revealed that most do not give children's acquisition of these skills a particularly high priority in their curricular goals or daily activity plans (p. 5).

The current study

While the research reviewed above strongly suggests that phoneme segmentation and blending can and should be taught to 4- and 5-year-old children, it was not conducted with children in Head Start and there remains a persistent belief among Head Start administrators, codified in Head Start curricula, that instruction in rhyming or vocabulary are adequate to develop phonemic awareness and are developmentally more appropriate than segmentation and blending activities for the highly disadvantaged Head Start population. These beliefs find support in research suggesting that rhyming activities may promote phonemic awareness (Bradley & Bryant, 1991; Bryant, Maclean & Bradley, 1990) and literature suggesting that vocabulary development may assist in the development of phonemic awareness as children learn to discriminate between words that differ by a single phoneme (Walley, 1993). Whether or not phoneme awareness is facilitated by prior training in rhyme awareness or vocabulary development remains an unexplored issue (Stuart, 2005). The current study was designed to evaluate these hypotheses by evaluating the extent to which 4- and 5-year-old children in Head Start were more likely to develop phonemic awareness through: (a) direct instruction in phoneme segmentation and blending, (b) rhyming activities or (c) vocabulary activities. The outcome measure in this study was segmentation and blending ability because existing research (Hatcher et al., 2004; Lundberg et al., 1988; Schneider et al., 1997) demonstrates a strong causal linkage between those proximal outcomes and future reading ability. It is beyond the scope of the present study, however, to replicate that research.

Methods

Participants

One hundred and twenty-eight children participated in the study, aged 4 years, 3 months to 5 years, 2 months ($M = 4$ years, 9 months), in 16 classrooms from three Head Start centres in Boston. All but one child aged 4–5 years old in the 16 classrooms participated (some children were younger than 4 years and were excluded). The children were mostly minority: 72% Black, 18% Hispanic, 6% White and 4% Asian. All of the children were from low-income families, consistent with Head Start eligibility criteria. All of the children were non-readers, with low levels of phonemic awareness as measured at pre-test. Before the study, the Head Start curriculum programmes included shared story reading but not phonemic awareness or sound/symbol relationships. Centres were selected for inclusion in the study based on willingness to participate and to have classrooms randomly assigned to treatments. Within these centres, all classrooms participated. The centres were located in poor, mostly minority neighbourhoods.

Design

Treatments were crossed with centres so that treatments would not be confounded with centres and the characteristics unique to particular centres (or their umbrella organisations). All of the centres used *The Creative Curriculum* (Dodge et al., 2002). A total of 16 classrooms were stratified by centre and randomly assigned to three treatments: (a) Phoneme Segmentation, (b) Rhyming and (c) Vocabulary Development. The design does not include the use of a no-treatment control group that would permit estimation of the independent effect of maturation or history. When three treatment groups are compared, any maturation or history effect is lumped together with each group's treatment effect. However, any differences in outcomes among the treatment groups are attributable to the differences in treatment, rather than maturation or history, which should affect each group the same way. Thus, any differences in outcomes that are observed cannot be attributed to maturation or history.

Measures

Phonemic awareness. Previous research established the validity of using measures of oral phoneme manipulation, that is, phoneme segmentation, blending, deletion and substitution as predictors of later reading ability (Juel, 1988; Juel, Griffith & Gough, 1986; Lundberg et al., 1988; Schneider et al., 1997). Therefore, the corresponding subtests of the Phonological Awareness Test (Robertson & Salter, 1995) were used. Published KR-20 reliability coefficients ranged from .66 to .89 for the appropriate age range (Robertson & Salter, 1995, p. 93). Internal consistency, measured by average point biserial correlations, ranged from .59 to .68 for 5-year-old children on the phonemic awareness subtests.

Letter–sound knowledge. Knowledge of letter sounds was measured using the two graphemes subtests of the Phonological Awareness Test. Children were shown each letter and prompted to produce each sound corresponding to the letter, including alternatives. The published KR-20 reliability coefficient was .96 for the appropriate age range (Robertson & Salter, 1995, p. 94). Internal consistency, measured by average point biserial correlation, was .53 for the appropriate age range.

Decoding. Decoding ability was measured using the decoding subtest of the Phonological Awareness Test. Children were shown made-up words and prompted to read each word. The published KR-20 reliability coefficient was .95 for the appropriate age range (Robertson & Salter, 1995, p. 94). Internal consistency, measured by average point biserial correlation for the first 20 items, was .64 for the appropriate age range.

Word recognition. Word Identification task from the Woodcock-Johnson Psycho-Educational Battery-Revised (WJ-R). Children were presented with printed words and prompted to read each word. The concurrent validity of this test is .6–.7 when compared with other intelligence tests.

Rhyming. Rhyming was measured by the combined score of the rhyming discrimination and rhyming production subtests from the Phonological Awareness Test. The KR-20 reliability coefficient was .93 for the appropriate age range (Robertson & Salter, 1995, p. 93). Internal consistency, measured by average point biserial correlation, was .63 for the appropriate age range.

Vocabulary. Receptive vocabulary knowledge was assessed with the Peabody Picture Vocabulary Test, Third Edition (PPVT-III) (Dunn & Dunn, 1997). The test–retest correlation for this test is .92 for children ages 4–6.

Instruction

The pre-existing Head Start curriculum emphasised story reading and included experiences with print: tracing letters and 'writing' stories using invented spelling. This curriculum was modified for each of the three treatment groups.

Phoneme segmentation group. The training provided to teachers in the Segmentation Group focused on phoneme segmentation, blending and substitution in the context of spelling three-letter words using phonemes, manipulating the spelling of those words to create new words, and reading short sentences based on those words, using preplanned curriculum activities adapted from the Phono-Graphix™ programme (McGuinness & McGuinness, 1999), a commercially available programme that emphasises phonemic spelling and oral reading of real words using letter manipulatives. Thus, Segmentation Group teachers received training in delivering structured, systematic instruction in phoneme segmentation, phoneme blending, and letter–sound relationships. In comparison, teachers in the other two groups typically provided only incidental exposure to letter–sound relationships through normal Head Start story-reading and invented spelling activities. The Segmentation approach emphasised phonemic activities in the context of spelling and reading actual words. Instruction was scaffolded, with teachers supplying, modelling and exaggerating phonemes, eliciting and reinforcing correct responses and gradually withdrawing support as children learned to match sounds and graphemes and sound out short words. Details of this instructional approach were provided in an earlier study (Yeh, 2003).

Rhyming group. Children in this group were exposed to instruction in rhyming activities. Specific rhyming activities were selected from the first part of a commercially available curriculum (Adams, Foorman, Lundberg & Beeler, 1998) for teaching phonological

awareness. Teachers followed a preplanned set of curriculum activities. For example, children in the Rhyming group were asked to rhyme, 'A cat wearing a ___(hat)', or 'tell me a word that sounds like man'. Children in this group were also asked to provide words with the same initial consonant, e.g., in response to pictures of a fox, a foot, some feathers and a fish, or in response to: 'I went for a walk and I saw a /p/ as in __', where the desired response involved a word beginning with /p/.

Readers familiar with previous studies (Lundberg et al., 1988; Schneider et al., 1997) will note that those researchers used the same curriculum to teach children rhyming skills but, unlike instruction provided to children in the current study's Rhyming group, transitioned to more advanced phoneme manipulation activities. Thus, the Rhyming treatment may be conceptualised as instruction that emphasises the first half of the curriculum, compared with the Segmentation treatment, which emphasises the same types of skills as the last half of the curriculum. For the reasons given earlier, the current study aims to provide information that is needed by teachers about what to emphasise.

Vocabulary development group. Instruction in this group focused on teaching vocabulary using strategies suggested by the National Reading Panel (NRP) meta-analysis and previous research (Dickinson & Smith, 1994; Leung, 1992; Robbins & Ehri, 1994; Senechal, 1997; Senechal & Cornell, 1993), in addition to the regular Head Start curriculum, which included experiences with print – tracing letters and 'writing' stories using invented spelling. Teachers preinstructed new vocabulary, read books to children, stopping to explain the meanings of new words as necessary, emphasised repeated words and re-read stories once the vocabulary was explained. Teachers used specific question strategies to engage children and teach vocabulary, for example, 'Does a horse have four legs?' 'Does a pig have four legs?' 'What else has four legs?' 'Does a parrot fly or does it crawl?' 'What else flies like a parrot?'

Treatment fidelity

Treatment fidelity was assessed by matching teacher descriptions of their instructional practices against the intended treatments specified by the training consultants, based on teacher interviews before, during and after the 14-week period of instruction as well as a survey administered at the end of the period. Teachers and students were observed on randomly selected instructional days for 30 minutes every week, plus random non-instructional days. Fidelity was defined as the degree to which the teacher included students in the research sample in the specified instructional activities, and implemented specified small-group instructional activities for 20–25 minutes twice per week.

Procedure

Classrooms were randomly assigned to the three treatments by the researchers after teachers agreed to participate in the study. Teachers were informed of the assignments before receiving professional development in the corresponding instructional treatments. Children were individually pre-tested to assess knowledge of phoneme segmentation, blending, deletion and substitution; letter–sound relationships; decoding ability; word recognition; rhyming ability; and vocabulary. Teachers were trained in separate 2-hour workshops for each treatment, scheduled once at the beginning of instruction and once 4 weeks later. During each workshop, teachers attended presentations regarding

instructional goals, philosophy and strategies, and received modelling and coaching regarding the assigned approach.

The three instructional treatments were implemented for 14 weeks, with instruction totalling approximately 10.5 hours. The length of treatment fell within the middle of the optimal range (5–18 hours) indicated by the NRP review of research. Children were instructed in groups of 8–10 children for 20–25 minutes twice per week, with a second teacher supervising children who were younger than 4 years old and, therefore, excluded from the study. Teachers were observed once per week on instructional days to ensure treatment fidelity. In addition, random observations on non-instructional days were conducted to assess classroom management and other literacy activities conducted by the teachers that might influence the study's findings. Children were individually post-tested using the same measures administered at pre-test.

Data sources and analysis

Over a period of 14 weeks, weekly classroom observational data and interview data were collected and analysed to assess treatment implementation. Each classroom observation lasted 20–25 minutes, followed by a 5-minute debriefing with the teacher. Quantitative data included pre- and post-intervention measures of phoneme blending, segmentation, deletion and substitution, letter–sound knowledge, decoding, word recognition, rhyming and vocabulary. To reduce the probability of Type I errors, the four phonemic awareness measures were combined into one measure, the letter–sound and decoding measures were combined into one measure and the rhyming discrimination and production measures were combined into one measure, resulting in three combined measures plus the PPVT vocabulary measure. The effect of treatment group was analysed through analysis of variance of post-test scores minus pre-test scores. Preliminary analyses controlled for predictors including Head Start centre and classroom but in most cases these predictors were not statistically significant and were dropped from the model. Note that although the data were nested, low intra-class correlations (under .2) and the small number of second-level units (16) made HLM and multi-level modelling redundant (see Kreft, 1996).

The performance of three children resulted in large standard deviations for the rhyming and phonemic awareness measures. Therefore, two analyses were conducted to estimate the sensitivity of results to these outliers. First, Mahalanobis distances were checked and found to be less than the χ^2 critical value. Second, scores were recoded and re-analysed. For rhyming, a recoded score of 0 was assigned for children scoring 0 (58% of children at pre-test and 41% at post-test), 1 for scores in the range 1–10 (38% of children at pre-test and 39% at post-test) and 2 for scores in the range 11–20 (5% of children at pre-test and 20% at post-test). For phonemes/graphemes, a recoded score of 0 was assigned for children scoring 0 (88% of children at pre-test and 56% at post-test), 1 for scores in the range 1–10 (10% of children at pre-test and 27% at post-test) and 2 for scores in the range 11–133 (2% of children at pre-test and 16% at post-test). However, because analyses indicated that the recoding did not change the results, only the original, non-recoded results are reported.

Results

Table 1 provides descriptive statistics for each individual measure.

Table 1. Descriptive statistics for individual measures.

Measure	Segmentation group	Rhyming group	Vocabulary group
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Phoneme segmentation – pre	0.00 (0.00)	0.05 (0.30)	0.00 (0.00)
Phoneme segmentation – post	2.40 (5.42)	0.34 (1.67)	0.41 (1.34)
Phoneme blending – pre	0.18 (0.55)	0.11 (0.62)	0.09 (0.36)
Phoneme blending – post	1.00 (2.22)	0.20 (0.51)	0.27 (0.62)
Phoneme deletion – pre	0.18 (1.11)	0.02 (0.15)	0.02 (0.15)
Phoneme deletion – post	0.15 (0.95)	0.00 (0.00)	0.25 (0.99)
Phoneme substitution – pre	0.03 (0.16)	0.00 (0.00)	0.00 (0.00)
Phoneme substitution – post	0.15 (0.95)	0.00 (0.00)	0.02 (0.15)
Letter–sound knowledge – pre	0.93 (4.42)	0.27 (1.81)	0.36 (1.70)
Letter–sound knowledge – post	4.55 (8.45)	1.32 (3.93)	3.16 (5.43)
Decoding – pre	0.15 (0.80)	0.00 (0.00)	0.00 (0.00)
Decoding – post	0.98 (6.17)	0.00 (0.00)	0.00 (0.00)
Word recognition – pre	2.85 (3.21)	3.34 (3.21)	3.68 (3.44)
Word recognition – post	3.85 (3.45)	4.95 (3.35)	5.07 (3.71)
Rhyme discrimination – pre	6.20 (4.72)	5.36 (4.74)	5.32 (4.48)
Rhyme discrimination – post	8.00 (4.92)	9.50 (5.93)	8.70 (6.70)
Rhyme production – pre	0.80 (1.99)	0.73 (2.20)	1.02 (2.89)
Rhyme production – post	1.75 (3.40)	3.07 (4.14)	2.57 (3.76)
PPVT – pre	32.57 (16.73)	30.42 (15.43)	31.33 (13.10)
PPVT – post	39.08 (15.16)	36.64 (16.58)	40.41 (13.97)

Table 2. Descriptive statistics for combined measures.

Measure	Segmentation group	Rhyming group	Vocabulary group
	Mean (*SD*)	Mean (*SD*)	Mean (*SD*)
Phoneme combined – pre	0.38 (1.60)	0.18 (0.82)	0.11 (0.39)
Phoneme combined – post	3.70 (8.52)	0.55 (2.02)	0.95 (2.10)
Letter–sound combined – pre	1.08 (5.21)	0.27 (1.81)	0.36 (1.70)
Letter–sound combined – post	5.53 (13.87)	1.32 (3.93)	3.16 (5.43)
Rhyme combined – pre	7.00 (6.03)	6.09 (5.86)	6.34 (5.87)
Rhyme combined – post	9.75 (7.39)	12.57 (9.26)	11.27 (9.63)
PPVT – pre	32.57 (16.73)	30.42 (15.43)	31.33 (13.10)
PPVT – post	39.08 (15.16)	36.64 (16.58)	40.41 (13.97)

Table 2 provides descriptive statistics for the combined measures, plus the Peabody vocabulary measure.

Analysis of variance of pre-test scores showed no significant differences across treatment conditions on the combined phonemic awareness measure, $F(2, 125) = 0.708$, $p < .494$, the combined letter–sound measure, $F(2, 125) = 0.627$, $p < .536$, the vocabulary measure, $F(2, 120) = 0.202$, $p < .817$ or the combined rhyming measure, $F(2, 125) = 0.261$, $p < .771$. This lack of pre-existing differences suggests that the differences observed at post-test are not attributable to differences at pre-test.

Each treatment group demonstrated a significant gain from pre-test to post-test on the corresponding measure(s) most closely associated with the treatment. Thus, the Segmentation group demonstrated significant gains on the combined phonemic awareness

measure, $t(1, 39) = 2.89$, $p < .006$, and the combined letter–sound measure, $t(1, 39) = 3.002$, $p < .005$. The Vocabulary group demonstrated significant gains on the vocabulary measure, $t(1, 42) = 7.11$, $p < .001$. The Rhyming group demonstrated significant gains on the rhyming measure, $t(1, 43) = 4.85$, $p < .001$. This manipulation check, in addition to classroom observations by the researchers, suggests that the treatments were implemented as designed.

The primary research question involved the effects of the three treatments on the combined measure of phonemic awareness. Analysis of variance showed a significant main effect of treatment, $F(2, 125) = 5.309$, $p < .006$, partial $\eta^2 = .078$; mean(Segmentation group) = 3.325, mean(Rhyming group) = .364, mean(Vocabulary group) = .841. Post hoc pair-wise tests indicated that the gains of the Segmentation group were significantly greater than the gains of the Rhyming ($p < .003$) as well as the Vocabulary ($p < .012$) group.

A second question involved the effect of treatment on the combined measure of letter–sound knowledge. Analysis of variance showed a significant main effect of treatment, $F(2, 125) = 3.198$, $p < .044$, partial $\eta^2 = .049$; mean(Segmentation group) = 4.45, mean (Rhyming group) = 1.045, mean(Vocabulary group) = 2.795. Post hoc pair-wise tests indicated that the gains of the Segmentation group were significantly greater than the gains of the Rhyming ($p < .013$) but not the Vocabulary group (the gain of the Segmentation group [4.45] was larger than the gain of the Vocabulary group [2.795] but this difference is obscured by the variation in student performance in the Segmentation group). There were no significant differences in gains among treatments on the measure of word recognition, $F(2, 122) = 2.52$, $p < .085$, partial $\eta^2 = .040$.

A third question involved the effect of treatment on the rhyming measure. Analysis of variance showed there were no significant differences in gains among treatments on the measure of rhyming ability, $F(2, 114) = 1.585$, $p < .210$, partial $\eta^2 = .027$. The improvement of children in the Rhyming group was not significantly greater than the gains by the other two groups.

A fourth question involved the effect of treatment on the vocabulary measure. Analysis of variance showed there were no significant differences in gains among treatments on the measure of vocabulary knowledge, $F(2, 109) = 2.381$, $p < .097$, partial $\eta^2 = .042$. The improvement of children in the Vocabulary group was not significantly greater than the gains by the other two groups.

Discussion

The results indicate that instruction emphasising phoneme segmentation and blending was more effective in developing phoneme segmentation and blending ability than instruction emphasising either rhyming or vocabulary. Given that existing research has demonstrated a causal link between phoneme segmentation and blending ability and the reduction of future reading difficulties (Hatcher et al., 2004; Lundberg et al., 1988; Schneider et al., 1997), and given that phoneme segmentation skill is a better predictor of early progress in learning to read than rhyming skill (Hatcher & Hulme, 1999; Hatcher et al., 2004; Hulme, 2002; Hulme et al., 2002, 1998; Muter & Diethelm, 2001; Muter et al., 1998; Muter et al., 2004; Nation & Hulme, 1997) or vocabulary knowledge (Muter & Diethelm, 2001; Muter et al., 2004), it is clear from existing research that development of phoneme segmentation skill is perhaps the key predictor of future reading difficulties.

Therefore, the implication of the current study, in combination with the existing research literature, is that explicit, systematic instruction emphasising phoneme segmentation and blending is more likely to promote phoneme segmentation skill – and, thus, later reading ability – than instruction emphasising either rhyming or vocabulary.

Training in phoneme segmentation and blending also produced larger gains on the combined letter–sound measure than training in rhyme or vocabulary (although the advantage over the Vocabulary group did not reach statistical significance it was in the right direction). There was no significant difference in gains across treatments on the word recognition measure. However, it would be premature to expect 4- and 5-year-old children in Head Start to demonstrate such an advanced level of skill after only 14 weeks of instruction. Thus, there is no reason to attach much significance to this result.

The primary conclusion – that instruction in phoneme segmentation and blending is more likely than instruction in rhyme or vocabulary to improve future reading ability – rests on the existing research literature demonstrating a causal link between phoneme segmentation and blending ability and the reduction of future reading difficulties (Hatcher et al., 2004; Lundberg et al., 1988; Schneider et al., 1997). The inconclusive results of the current study regarding word recognition are not inconsistent with this conclusion and should not be interpreted as weakening it, because the current study was not designed to follow the participants long enough for impacts on word recognition to be observed.

The results indicate that children as young as 4 years old who are overwhelmingly Black, Hispanic and economically disadvantaged can be taught phoneme segmentation and blending and letter–sound relationships. This finding confirms previous research (Caravolas & Bruck, 1993; Caravolas et al., 2001; Hatcher et al., 2004; Muter et al., 2004) and contradicts prevailing views among Head Start staff that it may be premature to introduce explicit, systematic instruction in phoneme segmentation and blending and letter–sound relationships to young, highly disadvantaged children in Head Start. The results
provide guidance needed by preschool educators who are unsure about whether it is developmentally appropriate to provide explicit, systematic instruction in phoneme segmentation, phoneme blending and letter–sound relationships.

The study was not designed to assess the relative importance of phoneme segmentation versus letter–sound instruction, but it is consistent with previous research suggesting that both are important. If the relative gain in performance of the Segmentation group had been significantly greater compared with the Rhyming and the Vocabulary groups on the combined letter–sound measure but not the combined phonemic awareness measure, this would have suggested the greater importance of letter–sound instruction, compared with phonemic awareness instruction. However, consistent with previous research, the Segmentation group performed better on both measures (although the advantage of the Segmentation group over the Vocabulary group on the combined letter–sound measure did not reach statistical significance).

While the study was not designed to break down the relative importance of phoneme segmentation versus letter–sound instruction, the results of this study support an important conclusion: that the combination of phoneme segmentation, phoneme blending and letter–sound instruction is more effective in promoting phoneme segmentation skill than either an approach emphasising rhyming or an approach emphasising vocabulary instruction. The results confirm previous experimental research demonstrating no effect on phoneme awareness of rhyme training (Martin & Byrne, 2002), and extend this

research by including a measure that combines rhyme production and recognition. In contrast, the findings of the earlier research study (Martin & Byrne, 2002) were limited to rhyme recognition.

Together, the findings of both studies suggest a need to change current Head Start policies and curricula which de-emphasise instruction in phoneme segmentation and blending in favour of rhyming and vocabulary instruction. The findings suggest that it is necessary to emphasise explicit, systematic instruction in phoneme segmentation and blending and letter–sound activities, rather than relying on easier rhyming and vocabulary activities to promote the type of phonemic awareness, as measured through the phoneme segmentation, blending, deletion and substitution tasks of the phonemic awareness test, which Lundberg et al. (1988), Schneider et al. (1997) and Hatcher et al. (2004) found to be causally related to the reduction of future reading difficulties. The results of this study strongly suggest that the type of rhyming and vocabulary activities currently emphasised by Head Start are *not* adequate to develop the sophisticated knowledge of phoneme segmentation and blending that previous research found to be causally related to the reduction of future reading difficulties. There was a significant difference in the ability of children in the Segmentation group to tackle the demanding phoneme segmentation and blending activities that previous research has found to be so critical to future reading ability.

Not only was the Rhyming approach less effective than the Segmentation approach in developing phoneme segmentation, phoneme blending and letter–sound knowledge, but it was not significantly more effective than the Segmentation approach with regard to the rhyming measure. So, even if ability to rhyme plays a role in developing future reading ability, it is unlikely that the Rhyming approach would benefit children more than the Segmentation approach. Statistically, both approaches were equally effective in developing rhyming ability. This finding is consistent with an earlier study suggesting that training in phonemic analysis skills may promote rhyming ability (Cary & Verhaeghe, 1994). However, because there were no significant differences in rhyming skill across all three approaches, gains may have been due to maturation instead.

What about Bradley and Bryant's (1991) hypothesis that rhyming instruction develops phonemic awareness? While children in the Rhyming group improved from pre- to post-test on the corresponding measure, the size of the gain was much smaller than the gain of children in the Segmentation group, consistent with Cary and Verhaeghe's (1994) finding that training in rhyme was less effective than training in phoneme analysis in promoting phonemic awareness. Together, these findings suggest that there is no reason to think that the Rhyming approach is more likely to promote later reading ability than the Segmentation approach.

What about the Vocabulary approach? Not only was it less effective than the Segmentation approach in regard to phoneme segmentation and phoneme blending, it was not significantly more effective than the Segmentation approach with regard to the vocabulary measure. So, even if vocabulary knowledge plays a role in developing future reading ability, there is no reason to think that the Vocabulary approach is more likely to promote later reading ability. Statistically, both approaches were about equally effective in developing vocabulary knowledge. Instruction emphasising phonemic awareness may assist children in remembering words, in the same way that details about a person's voice help in remembering an acquaintance. While recognition is not equivalent to understanding the meaning of a word, awareness of a word's sound structure may help to anchor the word in long-term memory and ease the task of recalling a word and its meaning. This hypothesis is supported by Eldredge, Quinn and

Butterfield's (1990) cross-lagged panel analysis, suggesting a causal relationship between phonics ability and improvements in children's vocabularies. Phonics instruction may be helpful in developing children's vocabularies so that children can understand what they read, as well as getting words off the page through decoding.

This hypothesis may also apply to the influence of rhyming instruction in promoting vocabulary development. Statistically, the rhyming treatment proved to be as effective as the vocabulary treatment in regard to vocabulary development. This result might be explained if rhyming activities direct children's attention to the way words sound, serving to anchor memory of the word in children's memories, easing the task of recalling the word and its meaning. Alternatively, because there were no significant differences in rhyming skill across all three approaches, gains may simply have been due to maturation.

What about Walley's (1993) hypothesis that vocabulary development influences the development of phonemic awareness? Again, the results are not inconsistent with this hypothesis – children in the Vocabulary group improved from pre- to post-test on the corresponding measure – but the results suggest that there was no statistical difference in the performance of children in the Vocabulary and Segmentation groups with regard to vocabulary, so there is no reason to think that the Vocabulary approach is more likely to promote later reading ability.

It may very well be the case that rhyming activities, vocabulary development and incidental exposure to phonological activities in the context of story reading can promote later reading ability. Many children may develop phonemic awareness naturally through such activities. But the results of this study suggest that a natural approach may be slower and less effective compared with explicit instruction in phoneme segmentation and blending activities. Therefore, it appears that explicit instruction emphasising phonemic awareness may be more likely to prevent reading difficulties, especially among disadvantaged children such as those served by Head Start, than instruction emphasising rhyming, vocabulary development or incidental exposure to phonological activities in the context of story reading.

Note

1. B. Woodbury, D. Bryant, D. Wolverton, B. Pan, A. Bryans, M. Plutro and others, Designing a Quality Enhancement Study for Head Start, meeting sponsored by ACYF/Commissioner's Office of Research and Evaluation, 15 October 1999, Bethesda, MD. This view was codified in earlier policy statements by the National Association for the Education of Young Children (NAEYC), *Developmentally Appropriate Practice for Early Childhood Programs* (Bredekamp & Copple, 1986), which decried 'overemphasis on achievement of narrowly defined academic skills' (p. 51), and *Developmentally Appropriate Practice in Early Childhood Programs Serving Children From Birth Through Age 8* (Bredekamp, 1987), which labelled as inappropriate 'isolated skill development such as recognizing single letters' (p. 55). Subsequently, NAEYC's official stance changed to state that it is appropriate that 'Children have opportunities to develop print awareness . . . while learning particular letter names and letter-sound combinations' (Bredekamp & Copple, 1997, p. 131). In practice, however, the earlier statements continue to shape recommendations regarding best practices in early childhood education (see, for example, Kostelnik, Soderman & Whiren, 2003) and many early childhood educators believe that letter–sound instruction is premature for Head Start children.

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Received 4 February 2007; revised version received 1 October 2007.