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Which children benefit from letter names in learning letter sounds? ☆

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Abstract

Typical U.S. children use their knowledge of letters' names to help learn the letters' sounds. They perform better on letter sound tests with letters that have their sounds at the beginnings of their names, such as *v*, than with letters that have their sounds at the ends of their names, such as *m*, and letters that do not have their sounds in their names, such as *h*. We found this same pattern among children with speech sound disorders, children with language impairments as well as speech sound disorders, and children who later developed serious reading problems. Even children who scored at chance on rhyming and sound matching tasks performed better on the letter sound task with letters such as *v* than with letters such as *m* and *h*. Our results suggest that a wide range of children use the names of letters to help learn the sounds and that phonological awareness, as conventionally measured, is not required in order to do so.

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1. Introduction

Knowledge about letters – their shapes, their names, and their linguistic functions – plays an important role in the development of reading and spelling ability. For example, children who are learning to read and write in English should know that the shape V is called /vi/ and that it generally represents the phoneme /v/ (see International Phonetic Association, 1999 for an explanation of the phonemic symbols). Children's knowledge about letters is often tested by providing them with one attribute of a letter and asking them to supply one or more other attributes. For example, children are shown the shape V and are asked to say its name in a letter name task or its sound in a letter sound task. Performance is typically pooled across all of the letters in each task to yield measures of children's letter name and letter sound knowledge. Some researchers additionally pool knowledge of names and sounds, for example by asking children to provide either the name or the sound of a letter and counting the number of letters for which either piece of information is known (e.g., Riley, 1996).

Supporting the idea that letter knowledge is important in learning to read and spell, young children's knowledge as pooled across letters or across names and sounds predicts their later literacy skills (e.g., McBride-Chang, 1999; Riley, 1996). However, such pooling may mask potentially important differences across letters and across tasks. Task differences are widely reported, with North American preschoolers and kindergartners generally performing better on the name task than the sound task (e.g., Evans, Bell, Shaw, Moretti, & Page, 2006; McBride-Chang, 1999; Treiman, Tincoff, Rodriguez, Mouzaki, & Francis, 1998). In the U.S. and Canada, as in a number of other countries, children are often exposed to letter names informally at home and at preschool. Letter sounds are not usually stressed until later.

Differences among letters have also been reported. Some English letters, such as *v*, have their sounds at the beginnings of their names. The name /vi/ begins with /v/, the phoneme that this letter symbolizes. Other letters, such as *m*, have the letter that they represent at the end of the name. And some phonemes are spelled by a letter whose name does not contain that phoneme. For example, the phoneme typically represented by *h*, /h/, is not in the letter's name at all. When asked about letters' sounds, North American children generally perform best on the first type of letter, intermediate on the second type, and most poorly on the third type (Evans et al., 2006; McBride-Chang, 1999; Treiman et al., 1998). These differences suggest that children bring their knowledge of letter names to the learning of letter-sound correspondences, using the letters' names to help learn and remember the sounds they represent. Thus, knowing *v*'s name helps children learn its sound because /v/ appears in the salient initial position of the letter's name. Knowing *m*'s name is less helpful in learning its sound because /m/ appears in a less salient position of the name, and knowing *h*'s name provides no useful cues to its sound. In the work reported here, we examined these differences among categories of letters to shed light on how children bring their knowledge and skills to early literacy learning.

Several lines of research support the idea that the superiority for sound-at-beginning-of-name letters over other letters in the sound task reflects children's use of letter names. Children who are familiar with letter names may say that *y* makes the sound /wə/ or that *w* corresponds to /də/, treating these letters as if their sounds were at the beginnings of their names (Ellefson, Treiman, & Kessler, 2007; Thompson, Fletcher-Flinn, & Cottrell, 1999; Treiman, Weatherston, & Berch, 1994). Additional evidence comes from children who learn letter sounds before they have mastered letter names. This is common in the United Kingdom, where letters' sounds are currently taught before the names and where parents do not place much stress on the early learning of letter names. Correspondingly, British children do not perform better on sound-at-beginning-of-name letters than on other letters in the letter sound task (Ellefson et al., 2007). The different results for British and U.S. children speak against the idea that the sound-at-beginning-of-name letters are most frequent in English or that their shapes are easier to distinguish. If either of these were true, then all groups of children exposed to English should have shown similar results.

If the sounds symbolized by the sound-at-beginning-of-name letters were easier for children to produce than the sounds of the other types of letters, this could explain children's better performance on these letters in the sound task. However, that does not appear to be the case. We used Shriberg's (1993) rankings of speech sound mastery to determine whether the consonant sounds associated with the sound-at-beginning-of-name letters *b*, *d*, *j*, *k*, *p*, *t*, *v*, and *z* are mastered earlier than the sounds associated with the sound-at-end-of-name letters *f*, *l*, *m*, *n*, *r*, and *s* or the sound-not-in-name letters *h*, *w*, and *y*. A Kruskal–Wallis test showed no significant difference among the three categories. Further evidence against a potential confound with production mastery is the above-mentioned finding that British children perform no better on sound-at-beginning-of-name letters than the other types of letters in the sound task (Ellefson et al., 2007).

Thus, the finding that children with good knowledge of letter names perform better in the sound test with letters such as *v* than letters such as *m* and *h* is best explained by the idea that these children use the letters' names as guides to the sounds they represent. What skills are required to make such inferences? Many researchers have assumed that explicit phonological awareness is needed (e.g., Bowey, 2005; Foulin, 2005; Share, 2004; Treiman et al., 1998). According to this view, children must be able to segment a syllable such as /vi/ into /v/ and /i/ in order to derive the letter sound /v/ from the letter name /vi/. Children with poor phonological awareness, who treat the syllable /vi/ as a unitary whole, will not benefit from the letter name in learning the letter sound. As Foulin (2005, p. 139) stated, "extracting letter sounds from letter names obviously requires a certain level of phoneme analysis skill." Bowey (2005, p. 166) echoed this view when she stated that "phonological sensitivity and letter-name knowledge together help *some* children to derive letter sounds for themselves." The idea that phonological awareness is important in letter-sound learning fits with the view that it is important in learning to read and spell more generally (e.g., Ehri et al., 2001). In this view, the widely reported correlations between phonological awareness and reading ability reflect, in part, a causal link from phonological awareness to reading. A minority opinion is that children do not need explicit phonological awareness in order to link print and speech and that research has not conclusively demonstrated a causal role for phonological awareness in reading success (Castles & Coltheart, 2004; Laing & Hulme, 1999; Snowling & Hulme, 1994). That remains a minority view, however, with many researchers and educators agreeing that the discovery of the role of phonological awareness in literacy acquisition is one of the success stories of modern educational research (e.g., Adams, 1990; Lundberg, 1991).

Although many researchers maintain that the ability to take advantage of the connection between a letter's name and its sound requires phonological awareness, the few studies that have tested this idea have found mixed results. Share (2004) reported significant correlations between phonological awareness and letter sound learning when children were familiar with letter names. Evans et al. (2006), however, found that these correlations were no longer significant when certain other abilities were taken into account.

Given the inconclusive findings of past research, the present study used atypical populations to test the hypothesis that children need phonological awareness in order to extract letter sounds from letter names. We examined letter knowledge in 5–6 year olds with a history of speech sound disorders, comparing them to children without such a history. Children with speech sound disorders are delayed in the acquisition of developmentally appropriate speech sounds, resulting in reduced intelligibility. The idiopathic speech sound disorders that these children experience are not due to known factors such as cleft palate or hearing loss. Children with speech sound disorders show an elevated risk of problems with phonological awareness and literacy (Bird, Bishop, & Freeman, 1995; Larrivee & Catts, 1999; Lewis & Freebairn, 1992), making them a good population with which to test the hypothesis that children need phonological awareness in order to benefit from letter names in the learning of letter sounds. According to this hypothesis, children with speech sound disorders should show smaller differences among categories of letters in the letter sound task than typically developing children do. Those speech-disordered children with very low levels of phonological awareness would be expected to memorize the sounds of all letters by rote, making the sounds of letters like *v* and *m* no easier to learn than the sounds of letters like *h*.

The hypothesis that phonological awareness is required in order to extract the sounds of letters such as *v* and *m* from their names further predicts that performance on the letter sound task with these types of letters should correlate with phonological awareness. Performance on the letter sound task with sound-not-in-name letters should not correlate as highly with phonological awareness, as children cannot use their phonological skills to derive the sound of a letter such as *h* from its name. We tested these predictions in the current study.

A secondary question addressed by our study was whether children who go on to develop serious reading problems learn basic letter-sound correspondences in a different way than children who do not develop reading problems. Many reading-disabled children are thought to approach print less analytically than typically developing children, relying more on rote memorization (Rack, Snowling, & Olson, 1992; van IJzendoorn & Bus, 1994). If a tendency toward rote memorization characterizes these children's early learning of letter sounds, as their later reading, then children who develop reading disabilities should not use their knowledge of letter names and their phonological awareness to learn letter sounds. Consequently, these children should perform no better in the sound task on letters that have their sounds in their names than letters that do not. We tested this hypothesis in the current study by using data on children's reading and spelling skills that were collected $2\frac{1}{2}$ to 3 years after the initial testing.

Our participants were part of a larger study at the University of Denver examining speech sound disorders and reading disability. Other reports from this project include Raitano, Pennington, Tunick, Boada, and Shriberg (2004), who described the children's performance on tests of preliteracy skills at 5–6 years of age, and Peterson, Pennington, Shriberg, and Boada (submitted for publication), who presented data on reading and spelling skills at Time 2. Raitano et al. (2004) pooled children's performance in the letter name and sound tasks across all letters and, in most analyses, did not separate name and sound knowledge. The finer grained analyses reported here made distinctions as a function of task – name vs. sound – and letter type – sound at beginning of name, sound at end of name, and sound not in name. Of particular interest was whether children with speech sound disorders as a group and specific subsets of these children showed different levels of performance on the three categories of letters in the sound task.

2. Method

2.1. Participants

At Time 1, there were 104 children with a history of childhood speech sound disorders (SSD group) and 39 control children with no such history (control group). At Time 2, reading and spelling data were available from 89 children with speech sound disorders and 36 control children. The children who returned for Time 2 testing were in most respects representative of the original sample (see Peterson et al., submitted for publication, for details). We included in the current analyses all children who had data on letter name and sound knowledge at Time 1, one of whom was missing data on Time 1 phonological awareness tests. Because of our criteria for inclusion in the analyses, and because three of the children originally identified by Raitano et al. (2004) were later found not to fit the requirements of the study, the numbers of children in the present analyses differ slightly from those reported by Raitano et al. (2004) and Peterson et al. (submitted for publication). The recruiting procedures and exclusionary criteria are described in full by Raitano et al.

Table 1 shows the demographic information for children in the control group and the whole SSD group. As Raitano et al. (2004) reported, the SSD children had significantly lower nonverbal IQs than the control children, $t(140) = 4.16$, $p < .001$

Table 1
Means (standard deviations) for demographic variables for control group, whole SSD group, and SSD subgroups

Measure	Control vs. whole SSD		Within SSD group				
	Control	Whole SSD	SSD normalized no LI	SSD persistent no LI	SSD normalized LI	SSD persistent LI	2 × 2 ANOVA findings
N	39	104	52	29	13	10	
Age in months	67.5 (5.3)	69.1 (8.2)	70.2 (8.7)	66.4 (6.8)	72.3 (8.2)	66.7 (7.8)	Main effect persistence
Nonverbal IQ	112.2 (8.0)[***]	103.8 (11.7)	106.5 (9.9)	105.9 (11.4)	94.4 (12.6)	96.3 (11.6)	Main effect LI
Hollingshead score	56.7 (7.7)[*]	52.5 (9.8)	54.7 (8.4)	50.1 (10.7)	50.2 (11.9)	50.7 (9.7)	No significant effects
% Male	62	69	56	66	77	60	
% Caucasian	87	83	85	79	77	100	

[*] $p < .05$ for control vs. whole SSD group difference.
[***] $p < .001$ for control vs. whole SSD group difference.

(nonverbal IQ data were not available for one child). Although attempts were made to match control and SSD participants on socioeconomic status, the groups differed in their Hollingshead Four Factor Index score (Hollingshead, 1975). The families of the control participants had significantly higher Hollingshead Index scores than the families of the SSD participants, $t(139) = 2.39$, $p = .018$ (Hollingshead scores were missing for two children).

We used the same criteria as Raitano et al. (2004) to classify the SSD participants at Time 1 according to two dichotomous metrics. The first was whether the child's speech production had normalized or whether the production problems found earlier in childhood persisted. These groups are referred to as SSD normalized and SSD persistent, respectively. The second dimension was whether the child was also language impaired (LI). Other reports (Peterson et al., submitted for publication; Raitano et al., 2004) suggest that children who have general language impairments in addition to speech sound disorders are more likely to experience literacy-related problems than children who have isolated speech sound disorders. In addition to examining the results for the whole SSD group, therefore, we examined each subgroup. Because children had been recruited for the study based on their SSD status, the numbers of children in each subgroup were not equal. Table 1 provides information about the characteristics of the SSD subgroups.

In order to assess associations between the demographic variables and SSD persistence and LI status, we performed a series of ANOVAs using the factors of persistence (SSD persistent vs. normalized) and LI (LI vs. not). As Table 1 shows, children with persistent speech production difficulties were significantly younger than children whose difficulties had normalized, $F(1, 100) = 5.97$, $p = .016$. Also, children with general language impairments had lower nonverbal IQ scores than children who did not, $F(1, 99) = 17.36$, $p < .001$. Given these associations, which were also reported by Raitano et al. (2004), we covaried age and nonverbal IQ when looking within the SSD subgroups.

2.2. Measures and procedures

2.2.1. Letter knowledge (Time 1)

Flash cards with capital letters were presented in a random order and children were asked to name the letter shown. If children did not respond correctly, two options were provided and children were asked to choose the correct response. After identifying the letter, children were asked to say the letter's sound. Children who did not provide the correct sound were asked to choose one of two sounds. For the present analyses, we used scores on selected letters from the spontaneous portions of the letter name and letter sound tasks (performance on the forced choice version was less informative because it approached ceiling for some tasks and groups). For each child and each task, we calculated proportion correct on the sound-at-beginning-of-name letters *b*, *d*, *j*, *k*, *p*, *t*, *v*, and *z*, sound-at-end-of-name letters *f*, *l*, *m*, *n*, *r*, and *s*, and sound-not-in-name letters *h*, *w*, and *y*. We did not include vowel letters in our analyses because they do not fit neatly into one of the categories. Their "long" sounds begin with their names, and indeed are identical to their names, whereas their "short" sounds do not appear in their names. The letters *c* and *g* were excluded because they are considered to have both ''soft'' and ''hard'' sounds, the first of which appears at the beginning of the name and the second of which does not. And *q* and *x* were excluded because they typically symbolize two phonemes rather than one. Responses with or without a schwa after the appropriate sound (e.g., /və/ or /v/ for V) were scored as correct.

2.2.2. Rhyme judgment (Time 1)

We used the Bird and Bishop (1992) rhyme judgment task, which consists of 5 practice items and 14 test items during which the child must judge which of 4 words rhymes with a target word by pointing to a picture. Target and test words are spoken by the examiner.

2.2.3. Elision (Time 1)

The 20-item Elision subtest of the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999) requires children to omit specified sounds from words in order to create new words. The items require: (a) omission of a component word from a compound word (e.g., *popcorn*, omit /pɑp/; 2 items), (b) omission of a syllable (e.g., *spider*, omit /dɚ/; 1 item), and (c) omission of a phoneme (e.g., *farm*, omit /f/; 17 items). In this and the other CTOPP subtests, items are presented in increasing order of difficulty and testing stops if a child makes a specified number of errors. Not all of our participants completed all items for this reason.

2.2.4. Blending (Time 1)

The 20-item Blending Words subtest of the CTOPP requires children to piece together sound units that make real words when combined. Each item is presented to the child in a standardized manner via audiotape (e.g., ''What word do these sounds make: /tɘ/ /ɔɪ/?'' correct answer = *toy*). Items required the synthesis of syllables (3 items), onsets and rimes (1 item), and phonemes (16 items).

2.2.5. Sound matching (Time 1)

The 20-item Sound Matching subtest of the CTOPP requires children to indicate which of three words starts or ends with the same phoneme as a target word. Each word is pictured, and participants must point to the correct picture to answer each question.

2.2.6. Nonverbal IQ (Time 1)

Children completed the Matrices and Pattern Construction subtests of the Differential Ability Scales (Elliott, 1990). T-scores from these two subtests were transformed to standard scores and averaged to form a composite score.

2.2.7. Woodcock–Johnson Word Attack (Time 2)

We administered the Word Attack subtest of the Woodcock–Johnson-Revised Tests of Achievement (Woodcock & Johnson, 1990) to assess children's ability to decode unknown words. Standardized scores on this test were used for analysis.

2.2.8. Wechsler Individual Achievement Test (Time 2)

We used the Basic Reading and Spelling subtests of the Wechsler Individual Achievement Test (WIAT; Wechsler, 1991) to assess children's ability to read and spell individual words. Standardized scores were used in the analyses.

3. Results

Table 2 shows the proportion of correct responses on the letter name and sound tasks for the three types of letters for the whole SSD group, the SSD subgroups, and the control group at Time 1. To compare the whole SSD group to the control group, we performed an ANOVA using the factors of group, task (name vs. sound), and letter type (sound at beginning of name, sound at end of name, sound not in name). In this and other ANOVAs, we used the Huynh–Feldt correction when the assumption of sphericity was violated. There was a main effect of group, $F(1,141) = 9.73$, $p = .002$, with the SSD children performing more poorly than the control children. The effect of group remained significant in an additional analysis that covaried nonverbal IQ and Hollingshead scores, $F(1,136) = 3.98$, $p = .048$. A main effect of task was also observed, $F(1,141)=129.08$, $p < .001$, such that children did better on the name task than the sound task. The main effect of letter type, $F(2,250) = 54.01$, $p < .001$, was qualified by an interaction with task, $F(2,260) = 52.40$, $p < .001$. In the sound task, children did best on sound-at-beginning-of-name letters, significantly more poorly on sound-at-end-of-name letters, and significantly again more poorly on sound-not-in-name letters. The three types of letters did not differ reliably from one another in the name task. These effects did not interact with group, indicating that the pattern of performance on the three types of letters was similar for the SSD group and the control group. That is, although the children with a history of speech sound disorders were less knowledgeable about letters than the typical children, they showed the signature pattern on the sound task of best performance on letters like *v*, intermediate performance on letters like *m*, and poorest performance on letters like *h*. This pattern does not reflect ease of articulation because, as discussed earlier, the sounds associated with the three types of letters do not differ reliably in age of production mastery.

To examine possible differences within the SSD children, we conducted an ANOVA using the factors of persistence (SSD persistent vs. normalized), LI (LI vs. not), task (name vs. sound), and letter type (sound at beginning of name, sound at end of name, sound not in name). We found main effects of task, $F(1,100) = 128.13$, $p < .001$, and letter type, $F(2,182) = 18.55$, $p < .001$. These main effects were qualified by an interaction between the two variables, $F(2,192) = 18.53$, $p < .001$. As before, children performed best in the sound task on sound-at-beginning-of-name letters, intermediate on sound-at-end-of-name letters, and most poorly on sound-not-in-name letters. No significant differences among the three types of letters were detected in the name task, even though the SSD children did not score as close to ceiling as the typical children of the previous analysis. When nonverbal IQ and age were covaried, we observed a significant main effect of LI, $F(1,97) = 6.10$,

Table 2
Mean (standard deviation) proportion correct responses on letter name and sound tasks for different types of letters for control group, whole SSD group, and SSD subgroups

Task	Letter type	Control group	Whole SSD group	SSD normalized no LI	SSD persistent no LI	SSD normalized LI	SSD persistent LI
Name	Sound at beginning of name	.95 (.16)	.79 (.30)	.87 (.24)	.78 (.30)	.64 (.40)	.64 (.36)
	Sound at end of name	.93 (.19)	.81 (.31)	.90 (.19)	.75 (.37)	.71 (.40)	.63 (.34)
	Sound not in name	.92 (.19)	.76 (.34)	.85 (.27)	.70 (.39)	.56 (.44)	.70 (.25)
Sound	Sound at beginning of name	.88 (.27)	.69 (.39)	.84 (.28)	.62 (.40)	.58 (.46)	.25 (.40)
	Sound at end of name	.71 (.38)	.51 (.39)	.63 (.34)	.43 (.39)	.45 (.45)	.20 (.33)
	Sound not in name	.52 (.41)	.37 (.38)	.45 (.38)	.30 (.38)	.36 (.44)	.13 (.23)

$p = .015$, but no significant main effect of SSD persistence. There was also a three-way interaction involving language impairment, SSD persistence, and task, $F(1,97) = 4.99$, $p = .028$, and a two-way interaction involving SSD persistence and task $F(1,97) = 6.82$, $p = .010$. The children with persistent speech delays, especially those with language impairments, performed especially poorly on the sound task relative to the name task. This may partly reflect a difficulty in articulating isolated letter sounds by children with speech problems. However, the most important finding for present purposes is that all subgroups of SSD children showed the signature performance on the sound task of best performance on letters like *v*, intermediate performance on letters like *m*, and poorest performance on letters like *h*. The magnitude of the differences did not vary reliably across subgroups.

To examine whether the signature pattern of performance on the sound task characterized even children with low levels of phonological awareness, we classified children according to their performance on the rhyme judgment task and the sound matching task. These were the two phonological awareness tasks in which children were required to choose among a set of alternative responses and for which chance levels of performance can be calculated. We classified children as chance-level performers if they scored 4 or fewer correct on the rhyme judgment task (for which 3.5 correct responses would be expected on the basis of random guessing) and 7 or fewer correct on the sound matching task (for which 6.7 correct responses on the 20-item task would be expected on the basis of random guessing; we classified those children who did not complete all 20 items on the basis of those items they did complete). These children appeared to lack the ability to analyze syllables into onsets and rimes and to compare syllables on the basis of rimes (rhyming task), onsets (all the initial matches on sound matching task involved consonant onsets), and other units. Table 3 shows the numbers of children classified as performing at chance and above chance in the phonological awareness tasks and the performances of the two groups in the name and sound tasks. The children who performed at chance on phonological awareness were all from the SSD group; eight had language impairments and six did not. An ANOVA using the factors of group, task, and letter type found a main effect of group, $F(1,140) = 17.53$, $p < .001$. The chance-level performers did more poorly than the above-chance performers. Group interacted with

Table 3
Mean (standard deviation) proportion correct responses on letter name and sound tasks for different types of letters for children performing at and above-chance levels on rhyme judgment and sound matching tasks

Task	Letter type	Chance ($n = 14$)	Above chance ($n = 128$)
Name	Sound at beginning of name	.60 (.30)	.86 (.27)
	Sound at end of name	.64 (.35)	.86 (.27)
	Sound not in name	.55 (.36)	.83 (.30)
Sound	Sound at beginning of name	.37 (.38)	.78 (.35)
	Sound at end of name	.17 (.20)	.61 (.39)
	Sound not in name	.12 (.21)	.44 (.40)

task, $F(1,140) = 4.22$, $p = .042$, such that the group difference was larger on the harder task, the sound task, than the easier task, the name task. As in the preceding analyses, there were main effects of task, $F(1,140) = 92.00$, $p < .001$, and letter type, $F(2,249) = 19.49$, $p < .001$, which were qualified by an interaction between them, $F(2,258) = 17.98$, $p < .001$. The interaction involving task, letter type, and group was not significant. The children who performed at chance on the phonological awareness tasks, like the other children, did substantially better on the sound-at-beginning-of-name letters than the other types of letters in the sound task. The chance-level performers showed little superiority in the sound task for the sound-at-end-of-name letters over the sound-not-in-name letters. However, this result must be interpreted with caution given these children's low levels of performance on these types of letters and given the small number of letters in the sound-not-in-name category.

If phonological awareness is needed to derive the sounds of letters such as *v* and *m* from the letters' names, then children's knowledge of these letters' sounds should correlate with their phonological awareness. The correlation between phonological awareness and sound task performance should be lower for sound-not-in-name letters such as *h*, as children cannot use their phonological skills to locate the sounds of these letters in the letters' names. The correlations between performance on the sound task and phonological awareness, as measured as the summed score on all four phonological awareness tasks, were .61 for sound-at-beginning-of-name letters, .70 for sound-at-end-of-name letters, and .68 for sound-not-in-name letters, based on all the total group of children. All three correlation coefficients were significant ($p < .001$), but the correlation involving sound-not-in-name letters was not the lowest of the three. Phonological awareness, as measured here, is not more closely related to knowledge of letter sounds for letters that have their sounds in their names than letters that do not.

A secondary question addressed by our study was whether the signature pattern on the sound task of best performance on sound-at-beginning-of-name letters, intermediate performance on sound-at-end-of-name letters, and poorest performance on sound-not-in-name letters characterizes children who become poor readers and spellers. To investigate this issue, we classified children according to their single-word reading and spelling skills at Time 2. Children were considered poor readers and spellers if their mean standard score on the Woodcock–Johnson Word Attack, WIAT Basic Reading, and WIAT Spelling subtests was at least 1.5 standard deviations below the control group mean, or less than 89. Such children perform noticeably more poorly than the classmates with whom they would most naturally be compared, classmates who themselves are above national norms. As Table 4 shows, 17 children were poor readers and spellers at Time 2 by our criterion, 15 of whom were in the SSD group. An ANOVA using the factors of group, task, and letter type found a main effect of group, $F(1,123) = 8.45$, $p = .004$, such that poor readers and spellers were less knowledgeable about letters than good readers and spellers. Group interacted with task, $F(1,123) = 3.93$, $p = .050$, with the group difference larger on the harder sound task than on the easier name task. There were main effects of task, $F(1,123) = 99.59$, $p < .001$, and letter type, $F(2,223) = 21.81$, $p < .001$, as well as an

Table 4
Mean (standard deviation) proportion correct responses on letter name and sound tasks for different types of letters for children with poor and adequate later reading and spelling skills

Task	Letter type	Poor ($n = 17$)	Adequate ($n = 108$)
Name	Sound at beginning of name	.71 (.36)	.85 (.26)
	Sound at end of name	.73 (.34)	.86 (.28)
	Sound not in name	.65 (.38)	.83 (.30)
Sound	Sound at beginning of name	.47 (.45)	.77 (.35)
	Sound at end of name	.25 (.32)	.60 (.39)
	Sound not in name	.25 (.36)	.43 (.40)

interaction between them, $F(2, 224) = 18.92$, $p < .001$. In this analysis, unlike the preceding ones, there was an interaction involving task, letter type, and group, $F(2, 224) = 4.21$, $p = .019$. The 5–6 year olds who later became poor readers and spellers performed better on sound-at-beginning-of-name letters than on the two other types of letters in the sound task, but unlike the other children they did not perform better on sound-at-end-of-name letters than on sound-not-in-name letters. The lack of a difference here must be interpreted with caution, however, because some of these children performed quite poorly in the sound task and because there were few sound-not-in-name letters.

4. Discussion

Our results show, consistent with previous work (e.g., Treiman et al., 1998), that typically developing U.S. children of 5–6 usually know the names of many letters and that they know the sounds that a number of letters represent as well. Children of this age who have a history of speech sound disorders perform more poorly on letter name and sound tasks than their peers, especially if they also have general language impairments. Letter knowledge at 5–6 years of age tends to be poor, as well, among children who score low on phonological awareness tasks and children who later develop reading and spelling problems. These findings agree with previous work showing that letter knowledge is a good predictor of later literacy skill (e.g., McBride-Chang, 1999; Riley, 1996). The findings are also consistent with the idea that children who perform poorly on phonological awareness tasks, children with speech sound disorders, and children with language impairments are at risk of problems in learning to read and spell (e.g., Bird et al., 1995; Larrivee & Catts, 1999; Lewis & Freebairn, 1992).

Our study went beyond previous work by asking about the knowledge and skills that are involved in the learning of letter sounds. To address this issue, we compared letter sound knowledge for letters that have their sounds at the beginnings of their names, letters that have their sounds at the ends of their names, and letters that do not have their sounds in their names at all. Children who use letters' names as guides to their sound should show differences among these categories of letters. In contrast, children who memorize basic letter-sound correspondences in a rote fashion, not using the letter names as clues, should not show differences among the categories. Contrary to the suggestion that some groups of children rely heavily on rote memorization in learning about links between print and speech (Rack et al., 1992; van IJzendoorn & Bus, 1994), we found that a wide range of children benefited from letter names in the learning of letter sounds. Children with speech sound disorders, children with language impairments as well as speech sound disorders, children with low levels of phonological awareness, and children who later developed serious difficulties in reading and spelling all did better on the letter sound task with letters that had their sounds at the beginnings of their names than with other letters. These results suggest that using what one knows to help learn something new – using letters' names to help learn letters' sounds, in this case – characterizes a wide range of children. Children appear to do this on their own, as parents and teachers rarely tell children that letters' names suggest their sounds and the experimenters did not provide such hints.

Although all groups of children performed better on the sound task with sound-at-beginning-of-name letters than other letters, there was some indication that children who went on to become poor readers and children with low levels of phonological awareness benefited less than other children from sounds at the ends of letter names. This finding, if replicated, could suggest that these children take advantage of the more obvious links between letter names and sounds, such as that between /vi/ and /v/, but not the less obvious links, such as that between /εm/ and /m/. However, the small differences that these children showed between sound-at-end-of-name letters and sound-not-in-name letters may reflect a floor effect, and we can draw no strong conclusions on this point.

Many researchers have suggested that children need phonological awareness in order to use letters' names to help learn the letters' sounds (e.g., Bowey, 2005; Foulin, 2005; Share, 2004; Treiman et al., 1998). However, our results suggest that phonological awareness, as commonly measured, is not required in order to benefit from letter names in the learning of letter sounds. Even children who showed no awareness of within-syllable units on widely used tests of phonological awareness – rhyming and sound matching – performed better on the sound task with letters that have their sounds at the beginnings of their names than with other letters. Moreover, the correlation between phonological awareness and sound task performance was no higher for letters that have their sounds in their names than for letters that do not. We should have seen such a difference if phonological awareness, as assessed by these common tests, were required to learn the sound of a letter like *v* but not the sound of a letter like *h*.

Our finding that children who could not make judgments about shared rhymes or phonemes benefited from letter names in the learning of letter-sound correspondences is reminiscent of the finding by Cossu, Rossini, and Marshall (1993) that some children with Down syndrome who have little or no phonological awareness can read words and nonwords. Cossu et al. argued, on the basis of their results, that phonological awareness as typically measured is not required to learn basic decoding skills. However, the study is limited by the fact that the phonological awareness tests were open-ended, making it difficult to determine which children performed at chance levels. Also, the children's mental retardation and poor language skills meant that they may not have understood the instructions. Indeed, later research showed that children with Down syndrome can pass phonological awareness task with less demanding instructions and can read and spell phonologically to some extent (Cardoso-Martins & Frith, 2001; Cardoso-Martins, Michalick, & Pollo, 2002; Fowler, Doherty, & Boynton, 1995; Snowling, Hulme, & Mercer, 2002). The case of Down syndrome, therefore, does not provide good support for the idea that common tests of phonological awareness are less important for reading acquisition than often assumed. The present study provides stronger evidence because it included two phonological awareness tasks for which chance levels of performance could be determined. In addition, a number of the children who performed at chance on the phonological awareness tests did not have general language impairments, suggesting that they understood the wording of the instructions as well as their peers.

Our results suggest that phonological awareness as measured by widely used tests is not as important for early literacy learning as many researchers and educators believe (e.g., Adams, 1990; Ehri et al., 2001; Lundberg, 1991). The degree of phonological skill that is required to use the link between *v* and /vi/ when learning to link *v* and /v/ is available to a wide range of children – including those with speech sound disorders and those with language impairments. In contrast, the degree of phonological skill that is required to succeed in standard tests of phonological awareness is not available to a number of these children. Current phonological awareness tests, it appears, demand more phonological skills than certain aspects of literacy learning do. In conventional phonological awareness tests, for example, children must deploy their phonological skills rapidly, after only a few examples from the tester. Children who are learning links between letters and phonemes, in contrast, can deploy their phonological skills gradually over the course of learning. They can use phonological similarity to strengthen an association like that between *v* and /v/ rather than having to generate a response from scratch. The skills demanded by conventional phonological awareness tests may be required for certain activities, such as generating a pronunciation for a previously unseen word on the first try, but they do not seem to be required for the acquisition of basic letter-sound links. We think that children need some phonological skills to learn about the sounds that letters represent and to learn how to combine letters to read and spell words. Like several other researchers (Castles & Coltheart, 2004; Snowling & Hulme, 1994), though, we conclude that phonological awareness as currently assessed is not a good measure of the phonological skills that are needed to learn to learn about letters and reading.

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