

Letter Knowledge, Invented Spelling and Sensitivity to the Sublexical Units at the Beginning of the Kindergarten Year.

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1. Introduction

This paper reports the results of the study that investigated the early stages of literacy development among kindergartners, and is a part of a year-long longitudinal study. The focus of this paper is on early spelling attempts, i.e., invented spelling, at the beginning of the kindergarten year, prior to the beginning of formal reading instruction. Less literature is dedicated to the relationship between letter knowledge and early spelling, but available evidence shows that there is a strong correlation (Treiman, Pennington, & Shriberg, 2008; Zaretsky, Kuvac Kraljevic, Core, & Lancek, 2009). Indeed, early spelling attempts can provide an insight into the role alphabet knowledge plays in providing representations of sounds in words. Empirical evidence suggests a strong correlation between letter naming, children's invented spelling and early decoding skills, as letters in print stand for phonemes in speech, and goes as far as to suggest that letter naming in kindergarten predicts future reading as well as a comprehensive test battery (Shatil, Share, & Levin, 2000; Foulin, 2005).

We examined the issue of sensitivity to sublexical units – onset and rime - in early spelling attempts and its relationship to alphabet knowledge and phonological awareness (PA) abilities. We also tested the hypothesis that letter name type i.e., letters that have their sounds in the initial position of the name, such as 'b' (CV type) vs. letters that have a vowel as the initial sound of their name, or 'm' (VC type) may help children learn sound representations (letter-sound correspondences), and support children's abilities to represent onsets and rimes within words.

Research in early literacy development has always placed a very important role on the PA and is rich in evidence that PA is the best predictor for early reading acquisition. However, there is an opposing view that explicit PA may not be required for learning to link print and speech sounds (Castles & Coltheart, 2004), as researchers have demonstrated that letter-sound knowledge is an important predictor for learning to read (de Jong, 2007). It has been postulated that the alphabet knowledge, both naming and production skills, that children have before the onset of formal reading instruction begins may be one of the most powerful predictors of later reading ability and is considered to be a pre-requisite on the par of PA (Mann & Wimmer, 2002; Hulme, Snowling, Caravolas, & Carroll, 2005). The logic behind this assumption is that letter knowledge provides initial connections between print and speech, as the letter has both visual and phonological properties. A deeper view of the relationship between letter knowledge and early reading development maintains that it accounts for more variance in early reading than early home literacy experience. Alphabet knowledge may be viewed as a proxy measure for the variances associated with phonological memory, as it requires learning and recalling phonologically coded information, such as saying the letter name (Share, 2004). Therefore, letter knowledge and the ability to say the letter name, may directly

relate to phonological awareness skills as both rely on phonological memory (Share and Stanovich, 1995; Share, 2004).

In early literacy development, there is clear evidence that children first become aware of the larger units of written language, such as whole words and syllables, and then progress to identification of onsets and rimes, and finally to the ability to identify individual phonemes (Treiman, 1992; Symour & Duncan, 1997). However, there is no consensus within the research community regarding which PA skills, i.e., onset-rime awareness vs. awareness of individual phonemes, may be the best predictors of early reading achievement (Hulme, Hatcher, Nation, Brown, Adams, & Stuart, 2002). Some evidence points to the fact that children's sensitivity to either onsets or rimes in their early reading attempts may boost their early decoding skills (Savage, Blair & Rvachew, 2006). More specifically, it is not clear whether some particular PA tasks have the greater predictive value in the development of spelling skills among 5-6-year-olds. Caravolas, Hulme and Snowling (2001) provided some empirical evidence that phoneme segmentation may be the precursor of early spelling ability, as it may provide clues for children's acquisition of letter sound knowledge. Even less is known about the way PA, subsyllabic units (onsets and rimes), and letter-name knowledge converge to influence the development of children's early spelling.

An additional factor that has been postulated to play a role in young children's use of letters in their early spelling is the letter name itself. Not all letters (consonants) in English language have the same pattern encoded within the letter name. Some letters have initial sounds that represent the first sound of the letter name, e.g., 'b' or 'd', constituting a CV pattern. It has been proposed that this pattern may be more conducive for learning letter-sound correspondence and may be used more for early spelling purposes (Roberts, 2003). On the other hand, letters that have a vowel sound at the beginning of the letter name, e.g., 's', 'f', (constituting VC pattern,) may be more difficult for children to accurately represent in their early spelling attempts (Roberts, 2003; Treiman, Shriberg, & Pennington, 2008). How the phonological information encoded within the letter name influences children's early attempts to represent sounds in invented spelling tasks is a valuable area of research that may contribute to our understanding of early writing development.

Given the paucity of the research investigating influential factors in early spelling, the current study took a closer look at the relationships between PA, letter name knowledge, and children's letter representations, i.e. the role of letter type, in an invented spelling task. The following questions were addressed in this study:

1. Is there a relationship between alphabet knowledge and spelling accuracy in invented spelling task?
2. Is letter name/alphabet knowledge related to the representation of onset/rime in spelling tasks?
3. Do children show a preference for CV letter types over VC types by accuracy of use?
4. Are there differences in accuracy of onsets/rime in spelling?
5. Is letter knowledge a better predictor than PA for the accuracy and sensitivity of onset/rime representation in early spelling? And more specifically, can we identify PA tasks most strongly associated with children's early spelling attempts?

2. Methodology

Participants

Thirty-one kindergartners participated in this year-long study ($M=5;5$, $SD=.32$, range 5;1-6;1). We report here only the results from the beginning of the year testing (T1), prior to the onset of formal instruction in reading. All children were assessed on measures of PA, i.e., rhyming, segmentation, initial and final sound isolation, phoneme deletion, substitution and blending by administering the Phonological Awareness Test (PAT, Roberstson & Salter, 1997). As a measure of early literacy skills, all children were given the Early Reading Screening Instrument (ERSI, Lombardino, Morris, Mercado, DeFillipo, Sarisky & Montgomery, 1999). The screening involved naming letters of the alphabet, both upper and lower case, and writing the letters (no preference for cases were given)¹; decoding a set of 10 words (regular CVC pattern) and sight reading a set of 10 irregular but highly recognizable words; and an invented spelling task. The alphabet letters were presented in two separate randomized lists: one for upper and one for lower case letters. The children were asked to point to each letter and name it. For the letter production, the children were given a clean piece of paper and were asked to write the letters that were dictated to them (all letters of the alphabet in randomized pattern). The invented spelling task, which is the focus of this paper, consisted of 12 monosyllabic words. The words used 14 consonant sounds total (7 with CV pattern and 7 with VC pattern in their names). The CV consonants and VC consonants were equally represented in the beginning and the end of the words. Five vowels were also used in the words (a, o, i, u, e). The words were dictated to all children and children were asked to write them down to the best of their abilities. A spelling score was obtained by awarding points for each correct phoneme, in accordance with the authors' guidelines. Spelling attempts were also coded for spelling accuracy by onsets and rimes, as well as for the accuracy of use of CV and VC letter types.

3. Results

Correlation analyses were used to answer our first and second research questions regarding the relationships between alphabet knowledge, spelling accuracy, use of CV and VC letter types and representation of onset/rimes in spelling tasks. As predicted, we found strong significant correlations between all above-mentioned items. Specifically, alphabet naming (both upper and lower cases) and alphabet production strongly and significantly correlated with spelling accuracy ($r=.683$, $r=.734$ and $r=.457$, $p=.01$ respectively). Alphabet naming for both cases also played a very strong and significant role in the use of letters with either CV or VC patterns ($r=.554$ and $r=.617$, $p=.01$ for upper case; $r=.527$ and $r=.473$, $p=.01$ for lower case). Naming lower case letters also significantly correlated with onset/rime accuracy ($r=.574$ and $r=.563$, $p=.01$ respectively). Interestingly, children's ability to write the letters of the alphabet (production) correlated only with the overall number of spelled words ($r=.457$, $p=.01$), although we did not

¹ Compared to Caravolas et al. (2001), this study did not address the letter-sound knowledge.

specifically set out to see that particular correlation. It was also related to the representation of onsets ($r=.449$, $p=.01$), but did not influence the preference for a specific letter type. (See Table 1).

Our second research question related to possible preference for letter types, e.g., CV or VC pattern in the letter name, measured by accuracy of use for each of the types. Paired sample t-test analyses showed that CV letters were used more accurately than VC letter types, indicating a preference for CV letter patterns (Mean=11.333, SD=18.6, $t=2.981$, $df=23$, $p=.007$). Next, we investigated the onset-rime accuracy. We further explored this question in order to understand the interaction between letter types and their use to represent sublexical structures in the invented spelling task through a two-way repeated measure ANOVA. Two factors were used in the analyses: “letter type” with two levels, i.e., CV and VC, and “word position” with two levels, i.e., onset and rime.

Table 1. Alphabet Knowledge, Total Number of Invented Spelling Words, Letter Pattern and Onset/Rime Representations.

	1	2	3	4	5	6	7	8
1. AlphUpperCase	-	.520**	-	.683**	.554**	.617**	-	-
2. AlphLowerCase	-	-	.655**	.734**	.527**	.473*	.580**	.481*
3. AlphProduction	-	-	-	.457**	-	-	.449*	-
4. Invented Spelling	-	-	-	-	.840**	.711**	.621**	.626**
5. CV pattern	-	-	-	-	-	.766**	.684**	.671**
6. VC pattern	-	-	-	-	-	-	.740**	.486*
7. Onset	-	-	-	-	-	-	-	.608**
8. Rime	-	-	-	-	-	-	-	-

** Significant at the .01 level

* Significant at the .05 level

The data met the assumption of the test with $\alpha=.05$. There was no effect of “letter type”, i.e., when word position is taken into the account children did not show more accuracy in using one type of letter over the other ($F=1.047$ (1,23), $p=.317$). However, there was a significant main effect for the “word position” ($F=51.448$ (1,23), $p<.0001$). The onsets were more accurately represented in children’s spelling attempts regardless of letter types. There was also significant interaction between “letter type” and “word position” ($F=7.35$ (1,23), $p=.012$) (Figure 1). This finding can be interpreted as follows: the CV letter types are used more accurately than VC types in both onset and rime positions and, VC letter types were much more accurate in onset position than in rime position.

Our fourth research question concerned the sensitivity of children to sublexical structure of the word, was examined through paired samples t-test comparing the accuracy of onset/rime representation showed significant differences. The results were significant: Children were clearly more apt to spell the onset, rather than rime, correctly ($M_{\text{onset}}=72.513$, $M_{\text{rime}}=39.49$, $t=5.654$, $df=29$, $p<.0001$) (Figure 2).

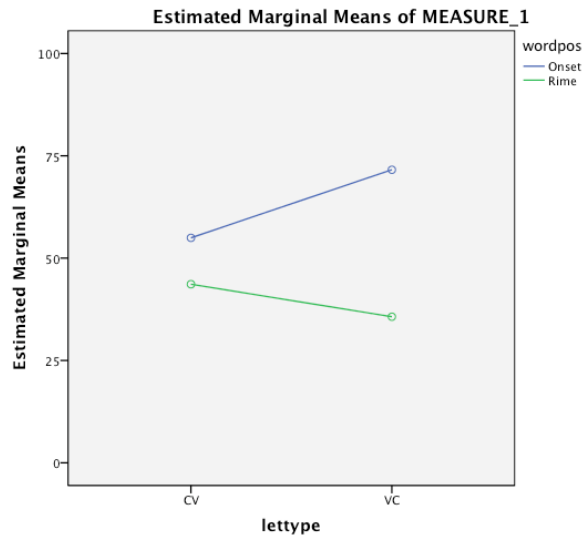


Figure 1. Use of “letter types” in representation of sublexical units.

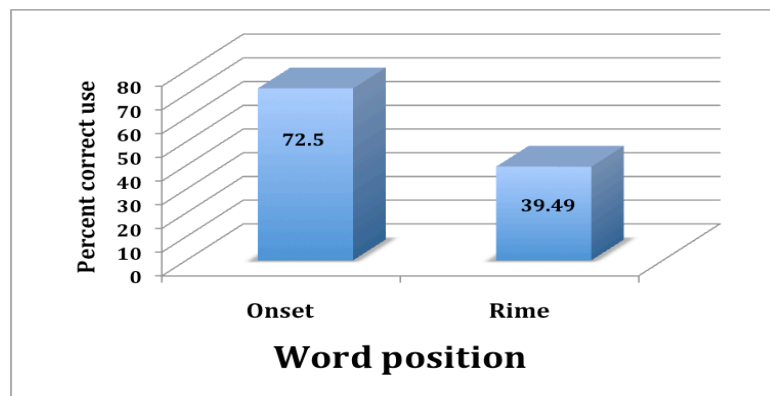


Figure 2. Differences in the accuracy of the onset/rime representation in early spelling.

Our final question addressed the identification of the best predictor for accuracy in children’s early spelling attempts. Specifically, we wanted to see the relative contribution of alphabet knowledge (both naming and production) and PA skills to emergent spelling. A series of regression analyses was used to answer this question. With the “Invented Spelling” scores a dependent variable, the following independent variables were entered into the model: AlphProduction, AlphUppercase, AlphLowercase and PAComposite score. The model was significant ($R^2=.707$, adjusted $R^2=.662$, $F=15.721$, $p<.0001$). The ability to write letters of the alphabet (AlphProduction) did not add significantly to the model ($\beta=-.021$, $p=.885$). Naming upper case letters approached significance, accounting for 27% of the variance ($\beta=.277$, $p=.063$). The composite score of all PA subtests also approached significance

($\beta=.247$, $p=.058$), but the most significant predictor for the accuracy in the invented spelling task was the ability to name the lower case letters of the alphabet, which accounted for 54% of the variance ($\beta=.546$, $p=.002$).

Two more regression analyses were conducted, with the Onset and Rime percent accuracy values as dependent variables with the same set of independent variables. This allowed us to look at the issue of predicting the accuracy of early spelling attempts even closer and support our earlier finding that lower case letter knowledge is an important factor in early spelling development. Both models were significant at $p=.029$ and $p=.026$ respectively, suggesting a good model fit, although the adjusted r^2 was low for both models ($r^2_{\text{onset}}=.234$, $F=3.217$ and $r^2_{\text{rime}}=.242$, $F=3.312$). However, the model allowed us to see the relative contribution of each dependent variable on the examined outcome measure. Only knowledge of lower case letters made a moderately significant contribution to the accuracy of Onset representations, accounting for 51% of the variances ($\beta=.514$, $p=.04$). The knowledge of lower case letters was again the only significant contribution to the accuracy of the Rime representations. However, the strength of that contribution was even more significant and accounted for 73.5% of the variances ($\beta=.735$, $p=.006$). This result shows that the ability to recognize and name lower case letters is very important not only in children's overall early spelling skills, but also as a boost to spelling of rime, which lags behind onset spelling as shown in previous analyses.

And finally, we wanted to know whether specific PA tasks may be identified as essential and play an important role in the development of spelling, i.e. with the use of different types of consonants and accuracy in onset/rime representation. This question was addressed using correlation analyses that allowed us to identify PA tasks that showed the strongest association with both, the type of letters and the sublexical units within the words. Two PA tasks showed predictive correlations to children's sensitivity to either the use of letter types or representation of onsets. Only the Phoneme Segmentation task, a skill that requires the child to name individual sounds that comprise the word, was significantly correlated with children's use of letter types in their spelling ($r=.608$, $p=.002$ for CV type and $r=.575$, $p=.003$ for VC type), while the Phoneme Deletion task, which requires the child to delete a letter within the word and say the new word, strongly and significantly correlated with onset spelling ($r=.538$, $p=.002$). None of the PA subtests correlated with the representation of the rime. In addition, Blending and Deletion of phonemes strongly and significantly correlation with the total accuracy of the invented spelling task ($r=.540$, $p=.002$ and $r=.560$, $p=.001$ respectively).²

4. Discussion

This study was undertaken to follow the development of early spelling skills in children at the beginning of the kindergarten year, before the onset of formal reading instruction. The current literature in early reading acquisition pays very limited attention to the early development of spelling skills, leaving a gap between our knowledge of stages of reading and spelling acquisition. In particular, there is a lack of literature and a lack of consensus regarding the relationship between skills found to be important in early

² We report only correlations that are significant at .01 level (2-tailed)

reading and their role in early spelling. Much of the literature that addresses the issue of spelling acknowledges the importance of PA, grapheme-phoneme mapping and reading (Treiman, Zukowski, & Richmond-Welty, 1995; Bruck, Genesee, & Caravolas, 1997), but is largely based on reading achievement, i.e., assuming that knowledge about orthography is derived through reading (Ehri, 1991, 1997). In Ehri's (1991, 1997) account of spelling development, the general knowledge about alphabetic system, i.e., segmentation words into phonemes, blending phonemes to represent words, as well as letter-name knowledge, constitute the foundation of literacy. More recent work that examined early spelling development addressed the issue of letter name as a possible component that influences the ease and accuracy of use in invented spelling tasks (Roberts, 2003; Treiman et al., 2008). However, there is a paucity of research that addresses the role of PA and alphabet knowledge in relation to the accuracy of word spelling, sensitivity to the sublexical structure of the word and also the use of letter types to represent the sublexical units, such as onset and rime.

Based on the results of this study, certain assumptions can be made regarding the factors that influence early spelling development and the nature of the relationship between letter knowledge, PA, and letter types with subsequent attempts at early spelling. It is indisputable that knowledge of the alphabet plays an important role in early spelling attempts and representations of sublexical structure of the word. However, it is the naming of the lower case letters, rather than the ability to write the letter, that is most important for early spelling, as this knowledge translates not only into total accuracy of spelling, but also into sensitivity to and representation of sublexical structure of the words. This finding is important in that spelling at the early stages is phonetically driven, therefore recognizing and naming lower case letters provides both, phonological and visual information for building up phoneme-grapheme correspondences. Regarding the role of letter names in spelling tasks, we found that letters that have their sound at the beginning of the letter name, i.e., the CV types, are used more accurately in spelling. Moreover, the word position, e.g., onset vs. rime, does not change this preference.

The study also showed that there are parallels between children's awareness of the initial sounds and onsets in reading and spelling, as reported in previous research (Hulme et al., 2002). This finding was supported by clear preference for onsets in early spelling attempts and it is an indication that mapping the initial phoneme onto its corresponding grapheme may be the earliest stage of orthographic knowledge. Our finding that letter naming, especially lower case letters, is the best predictor of early spelling skills is in line with the previous research in this area. Moreover, it may be postulated that knowledge of the letter name is as strong a predictor as the knowledge of letter sound (Hulme et al., 2005, de Jong, 2007, Share, 2004), although this study did not compare it directly. We saw that a composite PA score is not a good predictor for spelling development, and that only specific PA tasks correlated with spelling. However, we differ from other researchers (Caravolas et al., 2001, Hulme et al., 2004; Hulme et al., 2002) in identifying the most important PA skill that may predict spelling achievements. Previous studies proposed that phoneme isolation is the most consistent predictor of spelling development, which is in agreement with the idea that children are more aware of the small phonemic units in the initial position of the word. Our findings indicate that other PA skills are better at accounting for the accuracy of the overall spelling as well as for sublexical sensitivity and for the use of letter types for spelling. These skills have been identified as

Phoneme Segmentation, Blending and Deletion. It appears that PA tasks that require higher level of metalinguistic awareness are better suited to account for success in children's sensitivity to the structures of the word.

5. Conclusion

As seen from the results of this study, and in agreement with previous research (Caravolas et al., 2001; Ehri, 1991, 1997), alphabet knowledge is an important step in achieving early reading skills, as it is in early spelling attempts. Moreover, letter naming may be equally important as a developmental milestone as knowledge of the sounds the letters make. One of the limitations of this particular study is the fact that we did not access letter-sound knowledge. Another limitation may be seen that we did not look at the cognitive and linguistic influences in the development of early spelling, i.e., if strong vocabulary and morphosyntactic knowledge as well as verbal working memory, is part of that developmental process. Future work should look at the relationships between PA, letter knowledge and children's spelling attempts and the cognitive/linguistic mechanisms that underlie spelling development.

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