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Mnemonic Value of Orthography for Vocabulary Learning in Monolinguals and Language Minority English-Speaking College Students

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The study examined whether exposure to spellings of new vocabulary words improved monolinguals' and language minority (LM) students' (n = 25) memory for pronunciations, meanings, and spellings of the words. College students who are native English-speaking monolinguals (n = 12) and LM students who learned English as their second language (n = 13) were taught the meanings of 20 words over five trials. During the trials, written forms of half the words were shown underneath the pictorial representation of the word. The participants were assessed on the pronunciation, meaning, and spelling of each word. Results indicated that including spellings improved memory for pronunciations and spellings of words but not for meaning. Additionally, monolinguals outperformed LM students on memory of pronunciations in both spelling conditions.

KEYWORDS *literacy, orthographic knowledge, vocabulary*

The population of language minority (LM) learners (August & Shanahan, 2008) in the United States continues to increase each year. LM learners now represent nearly 11.2 million students in U.S. schools (U.S. Department of Education, National

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Center for Education Statistics [NCES], 2012). Unfortunately, the disparity in academic achievement between LM and native English speakers is vast (García & Kleifgen, 2010). For LM students it is more difficult to acquire literacy in a second language (August & Shanahan, 2008), once acquired growth is slower (Kieffer, 2008), and LM students are more likely to develop reading difficulties by the end of the primary grades (Kieffer, 2010). While the field acknowledges that LM learners are at increased risk for reading difficulties, the sources of the difficulties have yet to be fully understood (August & Shanahan, 2006). Additionally, despite the large body of literacy research, it still is not clear how ecological and psychological characteristics relate to students' cognitive reading profiles and subsequently, their reading proficiency (Kieffer & Vukovic, 2012).

Vocabulary Learning

The National Reading Panel (2000) confirmed the central role of vocabulary knowledge for successful reading comprehension and academic achievement. Vocabulary skills have been shown to be strongly related to reading comprehension in both children and adults (Braze, Tabor, Shankweiler, & Mencl, 2007; Perfetti & Hart, 2002; Ransby & Swanson, 2007). Unfortunately, research has demonstrated a sizable disparity in vocabulary knowledge between advantaged and disadvantaged populations (Biemiller & Slonim, 2001; Hart & Risley, 1995). Considering the fact that these disparities exist between subgroups of students who all speak English, it is alarming to consider what this disparity may look like for LM learners of English of whom 75% are considered to have low SES (García & Kleifgen, 2010). Additionally, it is important to note that learning a new vocabulary word includes learning the phonological, syntactic, semantic, orthographic, and morphological identity of a word, which makes the process all the more challenging for LM students who have less exposure to colloquial English (Gathercole, 2006; Nagy & Scott, 2000).

Role of Orthography in Vocabulary Learning

Research has demonstrated the important role of spellings in word learning. Ehri and Wilce (1979) showed that the spellings of words serve as a mnemonic device that supports the reader's ability to retain the pronunciation of nonwords in memory. In their study, first and second grade students were given multiple trials to learn four nonsense syllables. In the experimental condition students were shown the spelling of the words, and the other condition did not see any spellings. The findings demonstrated that nonword syllables were recalled significantly better when spellings of words were present during learning trials. The authors explained that spellings facilitate word learning by activating connections between orthographic representations and pronunciations in memory. Additionally, Ricketts, Bishop, and Nation (2009) found that 8–9 year olds were better able to recall the spellings and meanings of nonwords when the orthographic representation of the word was available. Overall, the authors found that children learned the spellings and referent pairings of words better when training included orthography, although no attention or instruction was given to the orthography by the experimenter

Rosenthal and Ehri (2008) also investigated the role of orthography in acquiring new vocabulary words. In their study, the authors explicitly taught second and fifth grade students the spoken forms and meanings of several low frequency nouns. The words were pronounced, defined in a sentence using a concrete synonym, and pictorially represented. The spellings of the words appeared on training cards in one condition, but not in the other. The researchers assessed recall of pronunciation and meaning. The results indicated that spellings of words significantly enhanced memory of pronunciations and meanings of words. Rosenthal and Ehri suggested that orthographic knowledge of the words strengthened vocabulary learning by decreasing dependence on phonological memory.

The critical role of orthographic knowledge in vocabulary learning is explained by theories of how new words become established as sight words (Ehri, 1992, 2005; Share, 2008). Vocabulary words are encoded and retrieved through a visual-phonological route, instead of a visual-semantic route in which words are simply attached to meanings. Ehri explained that sight word reading, the most efficient form of reading, involves establishing systematic visual-phonological connections between spellings of words and their pronunciations. Through knowledge of grapheme-phoneme or letter-sound relations the connections between the spelling and pronunciation of a word are encoded. Letter-sound relationships are first used when a reader encounters a new word. Through this phonological recoding process the reader establishes the visual-phonological pathway for a new word by connecting the spelling of the word to its pronunciation in memory. Once these pathways are established in memory, the reader will be able to flexibly retrieve the spoken and written version of the word, as well as its meaning.

Role of Orthography in Learning a Second Language

Experiments have been conducted with second language learners in an effort to determine what best predicts and enhances their vocabulary skills. Sparks et al. (1997) focused on high school age native English-speaking students learning a foreign language. The authors found that the best predictors of foreign language performance were end of first year grade in foreign language and a measure of phonology-orthography. The authors argue that readers of a foreign language are applying orthographic and phonological rules of the foreign language to produce a pronunciation and to retrieve the meaning of the word.

However, profound differences exist in how orthographies function in relation to phonological representation. Research on the varying symbolic relations between languages systems (Ziegler & Goswami, 2005) and the potential lack of correspondence within languages of the same system (Bialystok, Luk, & Kwan, 2005 who cite a 1989 study by Coulmas) suggests that access to the orthographic representation of a second language may be critical to support accurate perception and production of phonemes (Bear, Templeton, Helman, & Baren, 2003; Cardenas-Hagan, 2011; Honig, Diamond, Gutlohn, & CORE, 2008; Raynolds & Uhry, 2010; Raynolds, Uhry, & Brunner, 2013). Without the orthographic representation of the second language, perception and production of phonemes may not be as precise possibly due to interference from the native language or due to limited command of

the phonology in the second language. Thus, LM students who learned English as a second language may be more reliant on orthography than monolinguals in order to clarify phonologic representations. The current study is designed to investigate this supposition.

Present Study

The present study is a replication and extension of Rosenthal and Ehri (2008). The main hypotheses are the following:

- Seeing the spellings of words will improve memory for the pronunciations and meanings of target words for both native English-speaking monolinguals and LM students compared to not seeing spellings.
- LM students will demonstrate poorer memory for pronunciations in the spellings not seen condition as compared to monolinguals whereas LM students and monolinguals will demonstrate equal performance on remembering pronunciations in the spellings seen condition. In other words, seeing the spellings of words will provide a bigger boost for LM students than for monolinguals in remembering pronunciations.

The following research question will also be investigated:

- Will LM students differ from monolinguals in remembering the meanings of words? Memory for meanings will be supported by pictures and defining sentences in addition to seeing the spelling of the word so it is unclear if there will be a differential effect of orthography on memory of meanings for LM students versus monolinguals.

METHODS

Participants

Twenty-six college students from an urban public university were recruited for the study. Twelve participants were native English speaking monolinguals (age: $M = 24.09$, $SD = 3.65$) and 14 were LM students who learned English as a second language (age: $M = 24.33$, $SD = 6.76$). One LM student was excluded from the analysis because she had already completed an undergraduate degree at a private university, and she learned both English and her native language in a balanced manner from birth. This resulted in a total of 13 LM participants and an overall sample size of 25. There were nine female participants in the monolingual group and 10 female participants in the LM group. Participants were from a range of SES and racial/ethnic backgrounds, and they were enrolled in several different majors at the university.

LM students spoke a variety of native languages (four Spanish, four Russian, two Cantonese, one Mandarin, one Fujanese, one French, one Creole). All LM students passed the TOEFL exam in order to gain admission to the university. A questionnaire was used to qualify participants as LM or monolingual. LM students were from a home where they spoke a language other than English since their

birth and then learned English as a second language at some point in their childhood or adolescence. Age of initial learning of English ranged from 4–14 years of age, and varied in intensity of initial exposure from watching television in English to being immersed in an English-speaking country. Monolinguals were from homes where English had been the only language spoken since birth.

Materials and Procedures

Literacy and Language Measures

Three measures were administered to assess students' orthographic knowledge and vocabulary level in English. One questionnaire was given to assess students' proficiency with languages other than English.

1. **Vocabulary.** Form G of the vocabulary subtest of The Nelson-Denny Reading Test was administered to assess students' receptive vocabulary. The split-half reliability of this measure was .97.
2. **Reading Nonwords.** The Word Detective nonsense word decoding assessment was administered to assess students' decoding skills. Participants were given five minutes to silently decode 40 sets of three orthographic non-words. The goal of the assessment is to choose the orthographic non-word that when decoded represents a real word phonetically. The split-half reliability of this measure was .93.
3. **Spelling Words.** The college/adult list of the Boder Spelling Test was administered to assess students' spelling ability of orthographically regular words. Students were asked to spell 20 words (10 regularly and 10 irregularly spelled real words). The split-half reliability of this measure was .91.

Language and Social Background Questionnaire

A questionnaire (adapted from Luk & Bialystok, 2013) regarding students' social background and proficiency with languages other than English was administered to assess students' level of bilingualism/multilingualism.

Vocabulary Learning and Measures

Two sets of ten concrete, low frequency real words served as the target vocabulary words (see Table 1). Target words were the same as from Rosenthal and Ehri (2008), except the words *juggernaut* and *gangrel* were replaced due to their ceiling effect on the meaning recall task in that study. Words were randomly assigned to two sets. One set was taught with spellings, the other set without spellings in a repeated measures design. Pictures depicting the meanings of the words were presented on a computer. One set of words showed the written word beneath the picture, while the other set did not. Instead, for the other set of words the experimenter pronounced the word additional times and the students repeated the words additional times to equate stimulus exposures across the two conditions. The order

TABLE 1. Target Vocabulary Words and Definitions

| |
|---|
| <p>Barrow: a small hill Jockteleg: a large Swiss Army knife Wimple: what nuns wear on their heads Mullock: a pile of trash Tandem: a horse drawn carriage Fribble: a foolish, shallow person Potlach: a Native American festival where the chief gives out gifts Dobson: a bug that is a kind of beetle Muleta: a red cape Koomkie: a female elephant that attracts male elephants Vibrissa: the whiskers on a cat Gadroon: the decoration on the handle of silverware Tamarack: a big tree found all over America Chigger: a kind of bug that eats the blood of animals and people Hicatee: a kind of turtle that lives in the water Laburnum: a small tree with bright yellow flowers Kerfuffle: a fuss or fight Proboscis: a really big nose Frenulum: a tongue Scrivello: the tusks on an elephant</p> |
|---|

of treatment condition (spellings seen and spellings not seen) and the word set used in each treatment (set 1 and set 2) were counterbalanced.

At the start of the vocabulary learning task, procedures were explained and illustrated with an example. Participants were told that they should learn the name and meaning of each picture because later they would be tested. The first trial was a study trial in which the words were introduced. Participants were shown each picture (with or without the spelling below the picture based on the spelling condition), heard the word pronounced and embedded in a defining sentence, and repeated the word aloud. The following trials interleaved four sets of pronunciation and meaning recall trials. The order of the words varied across trials. In the pronunciation trials participants were presented with the picture without any spellings regardless of the word condition, and they were prompted to recall the pronunciation of the word. Feedback consisted of the experimenter stating the word and embedding it in a sentence while the picture continued to be displayed. During this feedback, the spelling of the word was shown if the word was in the spelling seen condition and in the spelling not seen condition participants heard and pronounced the word extra times. During the meaning recall trials, each word was spoken and participants recalled the meaning of each word. Feedback consisted of the experimenter providing a defining sentence and showing a spelling in the spelling seen condition. Oral definitions were scored as correct or incorrect based on participants' recall of exact key words or familiar synonym of key words (i.e., festival = celebration).

It is important to note that no attention was drawn to the written word during the experiment, and the written words were not present during recall trials, except when feedback was given for the spelling present condition. Thus, exposure to

spellings was limited to specific points during the study and test trials. Spellings appeared beneath pictures of the words from the spelling present condition in the initial study trial. During the subsequent trials, after each attempt to recall the spoken word, the experimenter provided feedback by showing the written form of the word for words in the spelling seen condition beneath their pictures while saying the words and their meaning.

All testing took place with individual participants over two sessions each lasting one hour. In one session students were taught 10 words and exposed to their spellings. In the other session, 10 words were learned without spellings. Participants received five trials to learn the pronunciations and definitions of words from each set. For the two spelling conditions, mean number of monolingual and LM participants who recalled each spoken word and each definition correctly per trial was analyzed. During Session 1 participants were given the language proficiency questionnaire, and then they were administered a study trial and four learning trials with the first set of 10 words. Following the experiment participants spelled the words, and they completed two literacy measures. During Session 2, participants were administered a study trial and four learning trials for the second set of 10 words. Following the experiment participants spelled the words for the second set, and they completed the remaining literacy measure. The order of treatment condition (spellings seen or spellings not seen) and the word set used in each treatment (Set 1 or Set 2) were counterbalanced. Participants were randomly assigned to condition.

RESULTS

Results of independent sample t-tests revealed that, on average, LM students were equivalent to monolinguals in age ($p > .05$) and GPA ($p > .05$), and a chi square revealed no difference between the groups in gender ($p < .05$; see Table 2 for descriptive statistics of age and GPA for both groups).

Performance on the literacy measures revealed that, on average, LM students did not differ statistically from monolinguals on decoding and vocabulary knowledge (see Table 3 for descriptive statistics for both groups). Independent sample t-tests revealed no significant differences in performance between the two

TABLE 2. Scores of Monolinguals and LM Students on Language on Demographic Information

| Demographic | Mean(SD) | t(21) |
|-----------------------|--------------|----------|
| Age | | |
| Monolinguals (n = 11) | 24.09 (3.65) | .11 ns |
| LM students (n = 12) | 24.33 (6.76) | |
| GPA | | |
| Monolinguals (n = 12) | 3.59 (0.38) | -1.06 ns |
| LM students (n = 12) | 3.41 (0.43) | |

Note. Standard deviations in parentheses. ns = not statistically significant.
 * $p < .05$. ** $p < .01$.

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TABLE 3. Mean Performance of Monolinguals and Bilinguals on Language and Literacy Measures

| Pretests | Mean(<i>SD</i>) | <i>t</i> (23) |
|-----------------------------------|-------------------|-----------------|
| Nelson-Denny Vocabulary | | |
| Monolingual (<i>n</i> = 12) | 61.67 (11.99) | –1.97 <i>ns</i> |
| LM students (<i>n</i> = 13) | 50.92 (14.94) | |
| Word Detective Decoding | | |
| Monolingual (<i>n</i> = 12) | 33.83 (7.20) | –1.77 <i>ns</i> |
| LM students (<i>n</i> = 13) | 28.54 (7.74) | |
| Boder Spelling Adult Word Level | | |
| Monolingual (<i>n</i> = 12) | 11.08 (4.94) | –1.31 <i>ns</i> |
| LM students (<i>n</i> = 13) | 8.08 (6.36) | |
| Boder Spelling Adult Letter Level | | |
| Monolingual (<i>n</i> = 12) | 173.50 (12.27) | –2.62* |
| LM students (<i>n</i> = 13) | 154.15 (23.36) | |

Note. Standard deviations in parentheses. *ns* = not statistically significant.
* $p < .05$. ** $p < .01$.

groups on the decoding and vocabulary measures (Nelson Denny, $p > .05$; Word Detective, $p > .05$). However, there was a significant difference between the groups on the Boder Adult spelling measure at the letter level of analysis ($p < .05$), with monolinguals outperforming bilinguals.

A preliminary analysis was conducted to evaluate the potential effects resulting from the counterbalanced design: word set (i.e., Set A vs. Set B) and learning order (i.e., words with spellings learned before vs. after the words without spellings). To do this four three-way analyses of variance (ANOVAs) were conducted with word set and learning order, as well as language (monolingual vs. bilingual) as the between-subject, independent factors. The dependent measures looked at the difference in the spelling present vs. spelling absent conditions for pronunciation recall, meaning recall, and spelling recall at the word level and at the letter level. For all of the analyses there were no interactions (all $ps < .05$) and there was one main effect of learning order in the pronunciation analysis ($p < .05$). The grand mean difference scores were 4.88 ($SE = 2.59$) when the words were shown with the spellings first and 12.17 ($SE = 2.15$) when the words were shown with spellings second. This indicates that the difference in scores favoring seeing spellings over no spellings was diminished for students in the group where spellings were shown first. This diminished difference for seeing spellings first was evident in the mean differences for both monolinguals ($M = 2.10$ spellings seen first; $M = 9.00$ spellings seen second) and bilinguals ($M = 7.67$, spellings seen first; $M = 13.75$, spellings seen second).

As a follow-up, two way ANOVAs were conducted for each language group separately with word set and learning order as the between-subject, independent factors. The dependent measures of pronunciation recall, meaning recall, spelling at the word level, and spelling at the letter level were used in four separate ANOVAs. There were no main effects or interactions in the analyses (all $ps < .05$). Therefore, word set and learning order were dropped from further analyses.

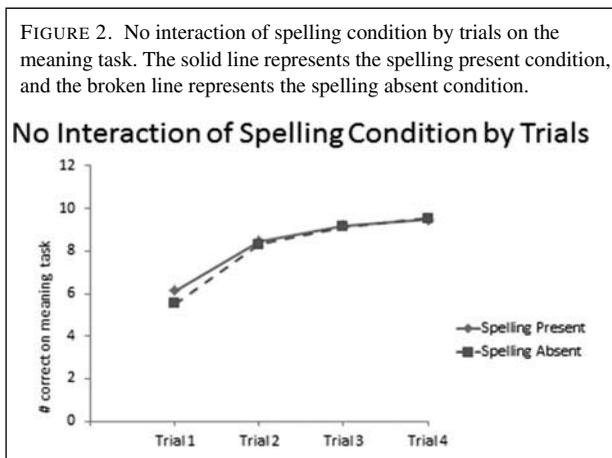
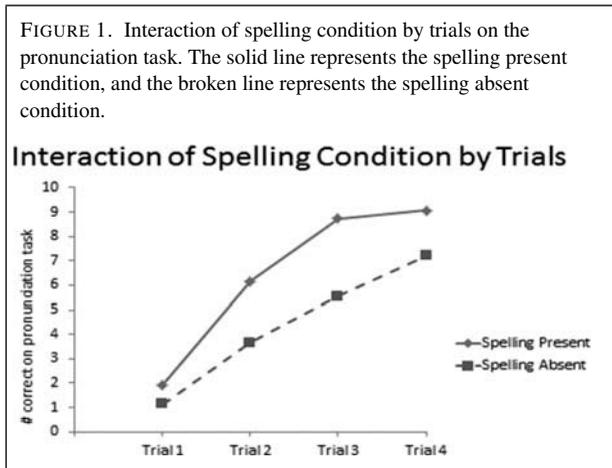
Repeated measures analyses of variance (ANOVA) were used to compare performance of LM students ($n = 13$) and monolinguals ($n = 12$) when spellings were

TABLE 4. Mean Performance of Monolinguals and LM Students on Posttest Measures Without Covariate

| | Spell Seen | Spelling Not Seen | Effect Size (<i>d</i>) | <i>F</i> (1, 23) |
|--|-------------|-------------------|--------------------------|--|
| Pronunciation Recog. (10 max) | | | | |
| Monolinguals (<i>n</i> = 12) | 7.00 (.48) | 5.35 (.49) | 3.40 | S: 37.10 ** L: 6.57* |
| LM students (<i>n</i> = 13) | 5.94 (.46) | 3.42 (.47) | 5.42 | T: 240.33** |
| Mean | 6.47 (.33) | 4.39 (.34) | 6.21 | SxL: 1.63 ns SxT: 11.27** LxT: .92 ns SxLxT: .25 ns |
| Meaning Recog. (10 max) | | | | |
| Monolinguals (<i>n</i> = 12) | 8.56 (.40) | 8.19 (.37) | 0.96 | S: .47 ns L: .53 ns |
| LM students (<i>n</i> = 13) | 8.08 (.39) | 8.08 (.35) | 0.00 | T: 72.76** |
| Mean | 8.32 (.28) | 8.13 (.26) | 0.70 | SxL: .47 ns SxT: 1.31 ns LxT: .42 ns SxLxT: .537ns |
| Spelling Word Level (10 max) | | | | |
| Monolinguals (<i>n</i> = 12) | 9.16 (.49) | 3.42 (.52) | 11.36 | S: 167.85 ** |
| LM students (<i>n</i> = 13) | 8.15 (.48) | 2.69 (.50) | 11.14 | L: 2.48 ns |
| Mean | 8.66 (.34) | 3.05 (.36) | 16.02 | SxL: .11 ns |
| Spelling Letter Level (148 max) | | | | |
| Monolinguals (<i>n</i> = 12) | 72.92 (.96) | 59.75 (2.62) | 6.67 | S: 59.11** |
| LM students (<i>n</i> = 13) | 71.46 (.92) | 55.39 (2.52) | 8.47 | L: 2.20 ns |
| Mean | 72.19 (.66) | 57.57 (1.82) | 10.68 | SxL: .59 ns |

Note. Standard deviations are in parentheses. Calculation of effect size: mean of spelling seen minus mean of spelling not seen divided by pooled standard deviation. *F* values in analysis of variance for main effects of spelling condition (S); language (L); trials (T); interactions between spelling condition and language level (SxL); spelling condition and trials (SxT); language and trials (LxT); and spelling condition, language, and trials (SxLxT). *ns* = not statistically significant.
* *p* < .05. ** *p* < .01.

present versus absent on the pronunciation and meaning measures (see Table 4 for mean performance and F-values). The between subjects factor was language (monolingual vs. LM), and the within-subjects factors were performance on the pronunciation and meaning tasks on words with spellings either present or absent and across the four trials. Results indicated that there was a main effect of spelling (present vs. absent) and trials and an interaction of spelling by trials on the pronunciation measure (see Figure 1). Individuals performed similarly on the first trial in both the spelling present and spelling absent conditions. However, significantly greater performance was seen in the spelling present condition than in the spelling absent condition over the following three trials. The test of the between subjects effect was significant (*p* < .05), with monolinguals outperforming LM students in every trial across both conditions and with the disparity being slightly larger in the spelling absent trials. In the repeated measures ANOVA for meaning recall only the factor of trials was significant indicating that performance improved over the four trials (see Figure 2).



Repeated measure ANOVAs were also conducted for performance on the spelling task, both at the word and the letter level. The between subjects factor was language (monolingual vs. LM), and the within-subjects factors was performance on the pronunciation and meaning trials on words with spellings either present or absent. For performance at the word level and letter level, there was a main effect of seeing spellings ($ps < .01$). As expected, seeing the spellings of words enhanced memory for spelling words both at the whole word and letter level.

DISCUSSION

The purpose of this study was to investigate the effect of seeing the orthographic representations of words on memory for pronunciations, meanings, and spellings of words by replicating and extending Rosenthal and Ehri's (2008) findings to

include a sample of adults and LM students. The first hypothesis was that for both English-speaking monolingual and LM students, spelling exposure would facilitate learning pronunciations because spellings better secure pronunciations in memory, and word meanings would be learned more quickly if spellings secured pronunciations in memory earlier during the learning trials. Results indicated that pronunciations and spellings were better learned by all students when spellings were present during the training trials. This finding shows that spellings were remembered and they had an impact on the storage of pronunciations of the words. As Rosenthal and Ehri's suggested, orthographic knowledge of the words may have strengthened vocabulary learning by decreasing the dependence on phonological memory.

This was not the case for meanings. The results showed that there was no significant difference in performance between the spelling present and spelling absent conditions; although ceiling effects precluded the detection of a difference in the meaning task (75% of the students scored a 9/10 or 10/10 by the 3rd trial). This ceiling effect may be due to the fact that several of the words and definitions were the same as were used with the 5th grade sample in Rosenthal and Ehri (2008) study even though this was a sample of college age participants. Future studies should attempt to make the definitions more nuanced, as more age appropriate items may allow for greater sensitivity of the measures and potentially a clearer picture of the within and between group differences on the tasks.

The second hypothesis was that LM students' memory would be poorer for pronunciations in the spelling not seen condition as compared to monolinguals, whereas LM students and monolinguals would demonstrate equal performance on remembering pronunciations in the spellings seen condition. In other words, seeing the spellings of words would provide a larger boost for LM students than for monolinguals in remembering pronunciations. Results demonstrated that while there was not a differential effect of the spelling seen condition for LM students, this group simply performed significantly worse than monolinguals in both spelling conditions. This was the case even though both groups of college students did not differ in GPA, decoding, or vocabulary knowledge.

The LM students in this study were students at a four-year university who had passed the TOEFL exam for admission. Often, these students receive little or no support in English language development once they are enrolled. The current finding suggests that these students should enlist the strategy of using spellings to improve their retention of pronunciations of new vocabulary words. This is important when considering the fact that college is a time of building field specific knowledge, which includes learning and utilizing the technical vocabulary of a specific domain. Without the correct phonological pronunciation, the amalgamated storage of the meaning, spelling, and pronunciation of the word (Ehri, 1992, 2005), may be compromised, and may subsequently impair ability to use the word in functional settings, such as academia and work.

Additionally, future research should replicate this study with LM students who are in the process of learning English (i.e., have not passed a proficiency exam such as the TOEFL) to investigate whether seeing spellings provides a larger boost to the population of limited English proficient LM students. Furthermore, future

research should attempt to compare native English speakers with a homogenous group of bilinguals on these tasks. Findings could indicate differences in the way individuals of different orthographic backgrounds store the meanings, pronunciations, and spellings of English words.

With regard to the research question put forward by the author, the results demonstrated that LM students and monolinguals did not differ in remembering the meanings of words, although, as previously mentioned, a ceiling effect may have suppressed the detection of a difference. Memory for meanings was also supported by pictures, defining sentences, and seeing spellings; all of this may have diminished any differential effect of orthography. Future research should consider controlling for certain supports (i.e., pictures) while investigating the effect of others (i.e., defining sentences) on memory for meanings.

An interesting finding that came out of the preliminary analysis to test the effect of the control variables resulting from the counterbalanced design was that there was a main effect of learning order, meaning that participants who were shown spellings in the first set of words they learned performed significantly better in learning the second set of words, which did not have spellings, than participants who saw spellings later in the second set of words after they had already learned the first set without spellings. This suggests the possibility that participants who saw spellings in the first set were led to construct and visualize orthographic representations of the words in the second set when spellings were not available and they used the orthographic mental representation as a mnemonic device to remember pronunciations for the second set of words. Ehri and Wilce (1979) showed that instructing students to imagine spellings improved their memory for pronunciations compared to controls. Interestingly, a participant in this study asked the experimenter to see the spellings of the words when she received the spelling absent condition second, and another participant reported at the end of the spelling absent condition that he visualized the spellings of each word. On the other hand, participants who received spellings for the second set of words were not able to benefit from the priming effect of using spellings as a mnemonic device for their first set of words. Future studies should further investigate the effect of seeing spellings as a prime to support memory of pronunciations of words that are presented without spellings.

ABOUT THE AUTHORS

Katharine Pace Miles, PhD, is Assistant Professor of Early Childhood Education at Brooklyn College. Her research focus is on early literacy skill acquisition, including the role of orthography for sight word learning. She was a former teacher and learning specialist, who specialized in the diagnosis and remediation of reading disabilities.

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Mark D. Lauterbach, PhD, is Assistant Professor of Early Childhood Education at Brooklyn College. His research focus is in special education and literacy and language development. He has worked in education

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REFERENCES

- August, D., & Shanahan, T. (2006). Developing literacy in second-language learners. *Report of the National Literacy Panel on Language-Minority Children and Youth*. Mahwah: Lawrence Erlbaum.
- August, D., & Shanahan, T. (Eds.). (2008). *Developing reading and writing in second- language learners: Lessons from the report of the National Literacy Panel on Language-Minority Children and Youth*. New York, NY: Routledge.
- Bear, D., Templeton, S., Helman, L., & Baren, T. (2003). Orthographic development and learning to read in different languages. In G. Garcia (Ed.), *English learners: Reaching the highest level of English literacy* (pp. 71–95). Newark, DE: International Reading Association.
- Bialystok, E., Luk, G., & Kwan, E. (2005). Bilingualism, biliteracy, and learning to read: Interactions among languages and writing systems. *Scientific Studies of Reading*, 9(1), 43–61. doi:10.1207/s1532799xssr0901_4
- Biemiller, A., & Slonim, N. (2001). Estimating root word vocabulary growth in normative and advantaged populations: Evidence for a common sequence of vocabulary acquisition. *Journal of Educational Psychology*, 93(3), 498–520. doi:10.1037/0022-0663.93.3.498
- Braze, D., Tabor, W., Shankweiler, D. P., & Mencl, W. E. (2007). Speaking up for vocabulary: Reading skill differences in young adults. *Journal of Learning Disabilities*, 40(3), 226–243. doi:10.1177/00222194070400030401
- Cardenas-Hagan, E. (2011). Language and literacy development among English language learners. In J. R. Birsh (Ed.), *Multisensory teaching of basic language skills* (pp. 605–630). Baltimore, MD: Paul H. Brooks.
- Ehri, L. C. (1992). Reconceptualizing the development of sight word reading and its relationship to recoding. In P. B. Gough, L. C. Ehri, R. Treiman, P. B. Gough, L. C. Ehri, & R. Treiman (Eds.), *Reading acquisition* (pp. 107–143). Hillsdale, NJ: Lawrence Erlbaum. Retrieved from EBSCOhost
- Ehri, L. C. (2005). Development of Sight Word Reading: Phases and Findings. In M. J. Snowling, & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 135–154). Malden, MA: Blackwell. doi:10.1002/9780470757642.ch8
- Ehri, L. C., & Wilce, L. S. (1979). The mnemonic value of orthography among beginning readers. *Journal Of Educational Psychology*, 71(1), 26–40. doi:10.1037/0022-0663.71.1.26
- García, O., & Kleifgen, J. A. (2010). *Educating emergent bilinguals: Policies, programs, and practices for English language learners*. New York, NY: Teachers College Press.
- Gathercole, S. E. (2006). Nonword repetition and word learning: The nature of the relationship. *Applied Psycholinguistics*, 27(4), 513.
- Hart, B., & Risley, T. R. (1995). *Meaningful differences in the everyday experience of young American children*. Baltimore, MD: Paul H Brookes.
- Honig, B., Diamond, L., & Gutlohn, L., & Consortium on Reading Excellence, I. (CORE). (2008). *Teaching Reading Sourcebook* (2nd ed.). Consortium on Reading Excellence. Washington, DC: Arena Press.
- Kieffer, M. J. (2008). Catching up or falling behind? Initial English proficiency, concentrated poverty, and the reading growth of language minority learners in the United States. *Journal of Educational Psychology*, 100(4), 851–868. doi:10.1037/0022-0663.100.4.851
- Kieffer, M. J. (2010). Socioeconomic status, English proficiency, and late-emerging reading difficulties. *Educational Researcher*, 39(6), 484–486. doi:10.3102/0013189X10378400
- Kieffer, M. J., & Vukovic, R. K. (2012). Components and context: Exploring sources of reading difficulties for language minority learners and native English speakers in urban schools. *Journal of Learning Disabilities*, 45(5), 433–452. doi:10.1177/0022219411432683

- Luk, G., & Bialystok, E. (2013). Bilingualism is not a categorical variable: Interaction between language proficiency and usage. *Journal of Cognitive Psychology*, 25(5), 605–621.
- Nagy, W. E., & Scott, J. A. (2000). Vocabulary processes. In M. L. Kamil, P. B. Mosenthal, P. Pearson, & R. Barr (Eds.), *Handbook of Reading Research* (Vol. III, pp. 269–284). Mahwah, NJ: Lawrence Erlbaum.
- National Reading Panel. (2000). *Report of the National Reading Panel: Teaching children to read: An evidence-based assessment of the scientific research literature on reading and its implications for reading instruction: Reports of the subgroups*. Rockville, MD: NICHD Clearinghouse.
- Perfetti, C. A., & Hart, L. (2002). The lexical quality hypothesis. *Precursors of Functional Literacy*, 11, 67–86.
- Ransby, M. J., & Swanson, H. L. (2003). Reading Comprehension Skills of Young Adults with Childhood Diagnoses of Dyslexia. *Journal of Learning Disabilities*, 36(6), 538–555. doi:10.1177/00222194030360060501
- Raynolds, L. B., & Uhry, J. K. (2010). The invented spellings of non-Spanish phonemes by Spanish–English bilingual and English monolingual kindergartners. *Reading and Writing*, 23(5), 495–513. doi:10.1007/s11145-009-9169-7
- Raynolds, L. B., Uhry, J. K., & Brunner, J. (2013). Vowel representations in the invented spellings of Spanish–English bilingual kindergartners. *Reading and Writing*, 26(5), 647–664. doi:10.1007/s11145-012-9380-9
- Ricketts, J., Bishop, D. M., & Nation, K. (2009). Orthographic facilitation in oral vocabulary acquisition. *Quarterly Journal of Experimental Psychology*, 62(10), 1948–1966. doi:10.1080/17470210802696104
- Rosenthal, J., & Ehri, L. C. (2008). The mnemonic value of orthography for vocabulary learning. *Journal of Educational Psychology*, 100(1), 175–191. doi:10.1037/0022-0663.100.1.175
- Share, D. L. (2008). Orthographic learning, phonological recoding, and self-teaching. *Advances in Child Development and Behavior*, 36, 31–82.
- Sparks, R. L., Ganschow, L., Patton, J., Artzer, M., Siebenhar, D., & Plageman, M. (1997). Prediction of foreign language proficiency. *Journal of Educational Psychology*, 89(3), 549–561. doi:10.1037/0022-0663.89.3.549
- U.S. Department of Education, National Center for Education Statistics (NCES). (2012). *The Condition of Education 2011* (NCES 2011–045), Indicator 6. Washington, DC: National Center for Education Statistics.
- Ziegler, J., & Goswami, U. (2005). Reading acquisition, developmental dyslexia, and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin*, 131(1), 3–29. doi:10.1037/0033-2909.131.1.3