

# High School Students' Orthographic Fast-Mapping Abilities

C.M. Scott and K. Apel

*Department of Communication Sciences and Disorders, College of Education*

## 1. Introduction

Orthographic fast-mapping (OFM) is the ability to quickly store visual information of a new word after minimal exposures. Individuals store orthographic images (letter patterns) of words or word parts (syllables). These images help create clear mental orthographic images (MOIs) [1] that allow for quick and efficient retrieval of words needed in reading and spelling tasks. Much research regarding the contributions of phonological and morphological knowledge to reading and spelling have been conducted, but not as much research has been conducted regarding the contribution of MOIs for reading and spelling development [2]. The clarity of these mentally stored images may be affected by ambiguous spellings of words, such as syllables that contain unstressed vowels (schwas) or infrequently occurring long vowel spelling patterns (e.g., 'oe' representing the long 'e' sound in 'amoeba') [3]. Apel, Wolter, Apel, and Patyk [4] found that students were less likely to recognize misspellings when those errors contained ambiguous spelling patterns (long vowels and schwas). For example, long vowels can be represented by single and multiple vowel patterns, such as, the long 'e' sound can be written as 'e, ee, ea, ie, ei, oe, and CeCe. Unstressed syllables (schwas) are also problematic because vowel sounds can be written with any of the five vowel letters and still be pronounced as an unstressed syllable.

## 2. Experiment, Results, and Discussion

This study sought to extend the work of Katz and Frost [3] and Apel et al. [4] by examining the effects of frequency and ambiguity of spelling patterns on the development of clear MOIs. An orthographic fast-mapping technique was used to investigate the effects of frequent sound to letter patterns (i.e., ea, ai, and short vowels) with less frequently occurring sound to letter relationships (i.e., oe, ae, and schwas). Vowels were chosen as the focus of this study because multiple patterns exist for each sound. Our hypothesis was that fast-mapping would be more effective and would result in more accurate spellings when the vowels are represented by frequently occurring long vowel patterns (i.e., ee, ea, CeCe for long 'e') rather than infrequently occurring long vowel patterns (i.e., oe for long 'e') Also, short vowel patterns would be fast-mapped more efficiently than schwa vowels because short vowels contain constant spelling patterns (i.e., the short 'a' in bat) whereas the schwa can be any vowel (i.e. the word 'accommodation' contains three schwa syllables, each one written with a different vowel pattern).

Participants in this study included 30 high school freshmen enrolled in the local public school district. None of the students were currently receiving any special education services. Fourteen females (47%) and 16 males (53%) participated in this study. The diversity of the group closely approximated the surrounding community (i.e., three Hispanic (10%), nine African-American (30%), and eighteen European-American (60%) participants).

The following procedures were conducted over a three week time frame. Two subtests from the Woodcock Reading Mastery Test – Revised were administered: the word identification (sight word reading ability) and the word attack (decoding novel words). The Test of Written Spelling – 4, a spelling dictation test, was given to assess current spelling ability. Finally, the design sequences subtest from the Detroit Test of Learning Aptitude–3 was administered to assess participants' visual memory.

The experimental test consisted of 16 four-syllable novel words. Each syllable contained one of the following vowel patterns: a high frequency long vowel; a low frequency long vowel; a short vowel; and a schwa vowel. The order of these four patterns was counterbalanced so that each type occurred four times in each of the four syllable positions of the novel words. A sample novel word is presented below:

VASOETIZOK	VA	- vay	Long vowel, high frequency occurrence
	SOE	- see	Long vowel, low frequency occurrence
	TI	- tuh	Schwa vowel
	ZOK	- zok	Short vowel

The descriptive statistics for the experimental novel words are presented in Table 1. A 1x4 ANOVA compared the OFM effects for each vowel type. A significant effect was found ( $F(3, 87) = 22.02, p < .001$ ) regarding the four vowel types. Protected paired sample t-test analysis was conducted post hoc and the results indicated that high frequency long vowels were significantly fast-mapped over low frequency long vowels ( $t(20) = 5.89, p < .001$ ) and short vowels were significantly fast-mapped over schwas ( $t(20) = 3.69, p < .01$ ).

The results indicated a significant mild to moderate correlation between fast-mapping ability and word identification ( $r = .41, p < .05$ ) and visual memory ( $r = .38, p < .05$ ). When these correlations were entered into a multiple regression analysis, word identification accounted for 17% of the variance.

**Table 1**  
**Descriptive Statistics For Vowels in Novel Words**

	<b>N</b>	<b>Mean</b>	<b>Std Dev</b>
Long Vowel High	30	11.63	2.59
Long Vowel Low	30	8.83	3.51
Short Vowel	30	12.10	2.40
Schwa	30	10.63	2.87

### 3. Conclusions

The results of this study indicated that students quickly store orthographic information from novel words after minimal exposures. Their fast-mapping ability is influenced by the frequency of occurrence of letter-sound patterns and also by the ambiguity of the vowels in an unstressed syllable. A mild to moderate significant relationship existed between the participants' fast-mapping ability and their ability to read words and their visual memory for storing MOIs.

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### 5. References

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