

Vowel Representation in the Spelling of Kindergarten Children

Chandlor G. Simon, Krystal L. Werfel, C. Melanie Schuele

KEYWORDS. Hearing, speech, child, vowel

BRIEF. A study interpreting the results of kindergarten children's spelling of vowel sounds in words.

ABSTRACT. The purpose of this study was to analyze vowel representation in the spelling of monosyllabic words by kindergarten children. Fifty-seven kindergarten children from two different schools participated in the study. The children were typically developing, had no prior history of speech or language therapy, and spoke English primarily. Children who natively spoke another language were excluded for the validity of the research. The children were asked to spell seventy-four monosyllabic words with consonant blends in the second semester of their kindergarten year. Responses were analyzed for the ability to spell vowel sounds correctly and logical representation of vowels to describe differential accuracy across vowel types (Frontal vowels, High vowels, Back low vowels, Mid vowels, etc.). Children demonstrated differential success, depending on the phonetic properties of vowels, including tongue height and position. These findings support an order for the way our brain learns vowels; some vowels are easier to learn than others, whether it is because there are few ways to spell or it sounds like the letter by which it is represented. Specifically, low and frontal vowels are the easiest for children to logically represent, whereas high and back vowels are more difficult for children to interpret.

INTRODUCTION.

Speech is a spectacular phenomenon that occurs in nature. As individuals with a well-structured communication system, not only can we communicate messages to each other, but we can create new messages that have never been said before, and continue endlessly to develop new words in our lexicons.

All words are made up of consonants phonemes (speech sounds) surrounding vowel phonemes. Thus, it can be said vowels are individual speech sounds that serve as the nucleus of syllables. Vowel phonemes are produced through lack of obstruction to outgoing breath. That is, vowels are 'open' sounds, rather than the generally 'closed' sounds of consonants.

Consonants are created through breath obstruction created by articulators (tongue, teeth, et cetera). This build-up of air makes it much easier to identify consonant sounds in spoken language than vowel sounds because there are visual cues and sounds that come from one mouth position. Unlike consonants, vowels' sole form of identification is through changes in position of the tongue and rounding of the lips. This makes all vowel sounds more closely related in sound than consonant speech sounds. In terms of tongue position, vowels can

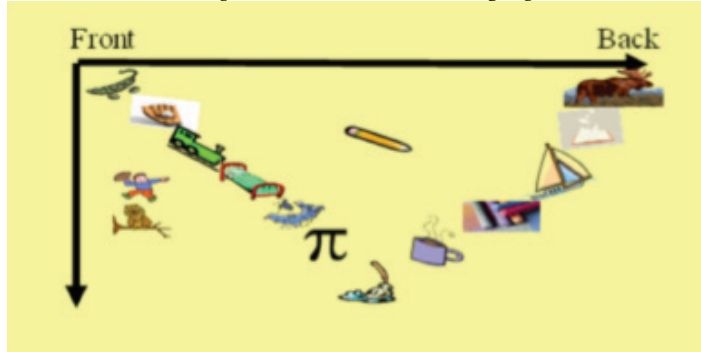


Figure 1. Shows the position of the tongue (whether Frontal/ Back, High or Low) when each of the vowel sounds in the following words is spoken (words listed left to right, high to low) Pea, Boy, Owl, Mitt, Train, Bed, Bat, Pi, Pencil, Mop, Mug, Chalk, Boat, Book, Moose).

be recognized as front, central, or back and high, mid, or low (see Figure 1) [1].

Commonly, vowels are referred to as 'short' or 'long'. These terms are inappropriate as what separates these two categories of vowels is not the length of the sound, but the level of tension in the voice. Tense vowels require more muscle tension, and in education are referred to as long vowels, while the term lax is used to describe short vowels, or vowels that do not require as much muscle tension. You can note this difference by placing your middle and pointer fingers beneath your jaw and making the sounds 'ee' and 'ah'. You should feel your muscles expanding more on 'ee' and any other tense vowel phoneme. In spelling, certain rules can be used to determine if vowels are either tense or lax. For example, in *vowel-consonant-e* (cake), the first vowel is tense. In *vowel-c-k* (duck), the vowel is lax. These rules also lead to multiple spellings of the same sound [2].

In terms of spelling, vowel graphemes, or written representation of phonemes, have greater variance than consonant graphemes do (Table S2 S1) [1]. Mostly, this is because vowels rely on the consonants around them to determine their spelling. This makes the spelling of vowels much more difficult than that of consonant; because consistency in rules is what children rely on to, these multiple spellings of vowels can lead to extra trouble for young children who are just being introduced to written language and cause discouragement. Thus, the hypothesis for the experiment was if the vowel has more multiple spellings and/or does not give a visual signal as to what the vowel is, then it will be more difficult for the child to represent correctly/logically.

MATERIALS AND METHODS.

This study is an analysis of data from an extant database; fifty-seven kindergarten children with no history of speech-language therapy were requested for testing. Age was seventy-two months, with a standard deviation of four months. Participants were native English speakers, and were not members of a household in which multiple languages were spoken (this was done to ensure consistency in the data).

Participants were asked to spell seventy-four monosyllabic words with different vowel sounds over an eighteen week period. This measure was performed three times at six-week intervals during the second semester of their kindergarten year. Monosyllabic words were analyzed to observe how children spelled to observe the child's logical representation of vowel phonemes in the words. These words included those listed in Table S2.

Words with diphthongs, 'R' and 'L' colored vowels, and nasalized vowels were excluded from the study. Diphthongs are vowel sounds that become other vowel sounds as they are spoken. This would include the vowel sound at the end of 'boy' and the vowel sound at the end of 'brown'. 'R' and 'L' colored vowels are vowels that change in frequency because they are followed or preceded by the letters 'R' or 'L'. This category would include words such as 'north', 'worthy', and 'bottle'. Nasalized vowels include words such as hand and camp that change the pronunciation of the vowel because they are sounded partially through the nose, thus sounding different from other vowels [3].

RESULTS.

The purpose of the experiment was to determine if kindergarten-aged children are differentially successful with vowel representation based on phonetic properties of vowels. This study used measurement of tongue position and tongue height to measure how children vary in success with vowel representation. Vowels were classified as long or tense for the 'A', 'E', 'I', 'O', and 'U' phonemes. Figure 2 shows the percentage of times that the vowel sound was either logically

represented or spelled correctly.

Children were more likely to logically represent different vowel sounds than to spell them correctly (see Figure 3). There is an apparent difference most present in tense vowels. Tense vowels sound like the names of the letters by which they are represented; however, in most cases that is not how they are spelled due to the wide variety of conventional spellings of tense vowels. This could be the reasoning behind the extreme difference in the representation and conventional spelling of tense vowels.

Kindergarten children were more likely to logically represent tense vowels as opposed to lax vowels. Again, this may be due to tense vowels sounding like the name of the letter that represents them. Furthermore, the relationship between /e/ (as in the word *day*) and name of the letter 'a' is much more noticeable than the relationship between /ae/ (as said in the word *bat*) and the letter name 'a'.

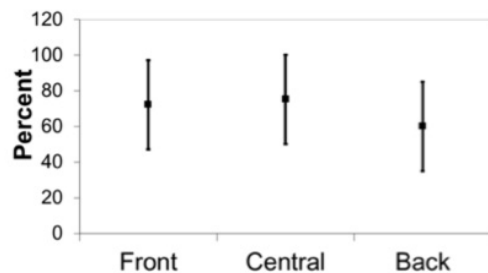


Figure 2. The percentage of time that the vowel sounds were represented correctly in each of the tongue height positions. Children were more likely to logically represent front vowels ($M = 72.27$, $SD = 26.39$) than back vowels ($M = 60.07$, $SD = 24.83$), and more likely to logically represent central vowels ($M = 75.06$, $SD = 25.29$) than back vowels ($p = .00$, $d = .48$)

Kindergarten children were differentially successful with vowel representation based on position of the tongue. It was more likely that the child would correctly represent a front or central vowel as opposed to a back vowel. Because front and central vowels are produced closer to the front of the mouth, children can more readily use visual feedback to determine the vowel.

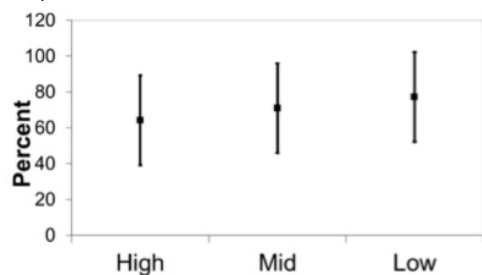


Figure 3. Supports that children were more likely to logically represent vowels ($M = 77.10$, $SD = 21.60$) than mid vowels ($M = 77.96$, $SD = 25.56$, $p = .00$, $d = .26$) and high vowels ($M = 64.08$, $SD = 25.58$, $p = .00$, $d = .55$), and are more likely to logically represent mid vowels ($M = 70.96$, $SD = 25.56$) than high vowels ($M = 64.08$, $SD = 25.58$, $p = .001$, $d = .27$).

The data shows that kindergarten children's level of success with vowel representation also relied on tongue height. The most likely vowels to be logically represented were low vowels, and the least likely were high vowels. The fact that low vowels require the most movement from rest and therefore children can more readily use articulatory feedback to determine the vowel may be why they distribute a higher percent represented correctly with lower vowels.

DISCUSSION.

This study showed several significant results that led to four major conclusions. It can be concluded that kindergarten children are significantly more likely to represent a vowel in a logical form than to spell the vowel in the manner it is represented in the word. In addition, kindergarten children are more likely to logically represent tense vowels than lax vowels, which accounts for the tremendous difference in Figure S2.

This is all likely due to the fact that tense vowels have a wider variety of conventional spelling for each vowel phoneme as opposed to lax vowels, thus increasing their chance of correctly representing the vowel (consult Chart S1). Also, tense vowels tend to sound like the name of the letter by which they are represented. For example, the tense or "long" vowel sound in the word '*pai*' sounds nearly if not identical to the sound used to describe the first letter of the English alphabet (A). However, lax or "short" vowels such as the lax sound in '*father*' do not very much sound like the letter 'A'.

Our results suggest that kindergarten children are differentially successful in the representation of vowels based on the tongue position. Front vowels were more likely to be logically represented than central vowels, and central vowels were more likely to be represented than back vowels.

We have determined this is likely because front and central (more prominently, front) vowels – like the vowel sound in *train* or the vowel sound in *mitt* – are produced closer to the front of the mouth and are easier to see. Thus, children can more readily use visual feedback to determine which vowel it is.

Kindergarten children are also differentially successful with vowel representation based on tongue height. The vowels most likely to be logically represented were low vowels; mid vowels were the next likely to be logically represented. The final class measured, high vowels, were the least likely to be represented logically. Rest position is the position your mouth is in when your mouth is shut and your teeth are not clenched. Low vowels (like the vowel sound in *map*) require a lot of movement from rest position compared to high vowels, such as *book*.

This shows us that kindergarten children are differentially successful with the representation of vowels based on their phonetic properties. The data shows that tense vowels are more likely to be logically represented than lax vowels, probably due to their sounding like the letter they represent. In addition, tongue height and tongue position are also important to understanding vowel representation. The lower a vowel is, and/or the closer it is to the front of the mouth, the easier it is to determine what the vowel is.

ACKNOWLEDGMENTS. Thank you to Krystal Werfel, Dr. Melanie Schuele, staff and faculty of the Bill Wilkerson Research Center for their time and cookies, and Dr. Jonathan Creamer and staff and students of The School for Science and Math at Vanderbilt.

SUPPORTING INFORMATION.

Figure S1. Shows percentage of percent of both tense and lax vowels logically represented.

Table S1. Demonstrates the multiple spellings of the tense 'A' grapheme.

Figure S2. Shows the percentage of times that the vowel sound was either logically represented or spelled correctly.

REFERENCES.

1. R. Treiman; *Beginning To Spell*. (Oxford University Press 200 Madison Avenue, New York, New York 10016 1993)
2. P. Ladefoged; *A Course in Phonetics*. (Thomson Learning Boston, Massachusetts 4th ed. 2001)
3. P. Ladefoged; *Vowels and consonants: an introduction to the sounds of languages*. (Blackwell, Maiden, Massachusetts, 2001)



Chandelor Simon is a student at Nashville School of the Arts and enrolled in the School for Science and Math at Vanderbilt.