An investigation of factors associated with letter-sound knowledge at kindergarten entry[☆]

Francis L. Huang [a,*], Laura S. Tortorelli [b], Marcia A. Invernizzi [b]

[a] College of Education, University of Missouri, United States
[b] Curry School of Education, University of Virginia, United States

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ABSTRACT

Letter-sound knowledge is necessary for children to begin reading and writing, and kindergarteners who know only a few letter sounds are at risk for later reading difficulties. This study examines the letter-sound knowledge of 1197 first-time kindergarteners who were economically disadvantaged, in light of six hypotheses about letter-sound knowledge acquisition: (1) the letter-name structure effect hypothesis, (2) the letter-sound ambiguity hypothesis, (3) the letter-name knowledge hypothesis, (4) the own-name advantage hypothesis, and 5) the phonological awareness facilitation hypothesis, as well as the (6) interactions between phonological awareness and letter-name structure. Results using three-level multilevel modeling indicate that letter sounds have varying levels of difficulty and several letter- and child-related factors are associated with naming a letter sound correctly. Implications for instruction are discussed.

1. Introduction

Alphabet knowledge in young children has been consistently and empirically shown to be an important early literacy skill and one of the strongest predictors of later reading ability (Foulin, 2005; Hammill, 2004; National Early Literacy Panel, 2008; Puranik, Petscher, & Lonigan, 2012; Whitehurst & Lonigan, 1998). Alphabet knowledge includes alphabet recognition, letter-name knowledge, letter-sound knowledge, and letter production (Puranik, Lonigan, & Kim, 2011; Scanlon, Anderson, & Sweeney, 2010). Of these, *letter-sound knowledge*, the ability to provide the sound(s) associated with a particular letter form (e.g., /b/ for *b* as in *bat*), has the closest relationship to decoding skill, the ability to sound words out.

Letter-sound knowledge contributes to a child's early literacy in three ways. First, letter-sound knowledge helps children fully grasp the *alphabetic principle*, the understanding that language is made up of discrete sounds and that letters represent those sounds in a systematic way. Grasping the alphabetic principle is a watershed event in early literacy development, marking the transition from emergent or early literacy to conventional reading (Liberman, Shankweiler, & Liberman, 1990). Second, letter-sound knowledge is necessary for children to begin accurately decoding words. Third, letter-sound knowledge provides the basis for phonics instruction in which children must use letter-sound associations to understand increasingly complex spelling features like consonant blends. As a result, letter-sound knowledge is potentially "one of the most optimal predictors" of later reading success (McBride-Chang, 1999, p. 304). Children who fail to master letter-sound correspondences may fall behind in their literacy development and be at risk for later reading and writing difficulties (Hammill, 2004; Storch & Whitehurst, 2002; Treiman, Tincoff, Rodriguez, Mouzaki, & Francis, 1998).

Our understanding of how children develop letter-sound knowledge is particularly important because letter sounds, unlike letter names, are usually not taught at home before kindergarten entry (Adams, 1990; Treiman & Kessler, 2003; Treiman, Tincoff, & Richmond-Welty, 1996). As students who begin kindergarten knowing few letter sounds are at risk for later reading difficulties, letter-sound knowledge is an important school readiness issue, in particular for students at risk based on socioeconomic factors. For children who enter school with knowledge of few letter sounds,

more advanced literacy skills (e.g., full phonemic awareness, decoding, and writing) are out of reach.

Currently, there is no one dominant curricular approach to alphabet instruction, but popular approaches include introducing letter sounds in alphabetic order (e.g., Open Court Reading PreK, Waterford Early Reading program), or introducing the most common letter sounds first (e.g., Frontline Phonics, Jolly Phonics), usually focusing on one letter sound per week (Huang & Invernizzi, 2012; Justice, Pence, Bowles, & Wiggins, 2006; Purcell, 2002). Alternatively, some programs have begun to incorporate comparing and contrasting letter sounds, differentiation by difficulty, and cycles of review (Jones & Reutzel, 2012, 2013). Some programs introduce letter forms, letter names, and letter sounds together and some teach children to associate letter sounds directly with letter forms (Piasta, Purpura, & Wagner, 2010).

In the present study, we examined the letter-sound knowledge of 1197 first-time kindergarteners from economically disadvantaged homes, in light of six hypotheses about how letter-sound knowledge develops. An improved understanding of the characteristics associated with letter-sound knowledge can help in improving early literacy curricula, screening for potential reading difficulties, and designing interventions to enhance reading success.

1.1. Factors associated with letter-sound knowledge

Research on letter-sound knowledge in young children has often focused on the overall predictive and developmental relationships between *letter-name knowledge*, the ability to identify a letter by its name, and letter-sound knowledge (Evans, Bell, Shaw, Moretti, & Page, 2006; McBride-Chang, 1999; Share, 2004; Treiman & Broderick, 1998; Treiman et al., 1998). Some letter sounds are more difficult to learn than others, however, and children approach learning letter sounds with different levels of literacy knowledge and experience (Huang & Invernizzi, 2012). The relationship between the letter name and its sound, the relative difficulty of identifying and isolating a letter's sound, and the number of sounds a letter can represent, are all factors that may make some letters more likely to be mastered earlier and some to be mastered later or require more explicit instruction (Evans et al., 2006; Huang & Invernizzi, 2012; Justice et al., 2006; McBride-Chang, 1999; Treiman et al., 1998). Children's early literacy skills support the development of alphabet knowledge (Clay, 1975; Foy & Mann, 2006; Justice et al., 2006). Children's knowledge of their own written names, their ability to recognize and identify letters by name, and their *phonological awareness* (PA) ability, the ability to reflect on sounds within words apart from their meanings, all support the development of letter-sound knowledge (Evans et al., 2006; Foy & Mann, 2006; Kim, Petscher, Foorman, & Zhou, 2010; Treiman et al., 1998). All of these factors can act in concert, making letter sounds easier or more challenging depending on the interaction among characteristics related to individual children and individual letters (Evans et al., 2006; Kim et al., 2010)

The present study aims to simultaneously examine the association of several factors with children's letter-sound knowledge at the beginning of kindergarten. Letter-sound knowledge is the ability to pronounce the sound associated with the letter form. We specifically investigate six hypotheses about the letter and child factors that may be associated with particular letter sounds being more or less likely to be known at the beginning of kindergarten.

1.2. Letter-related hypotheses

Letter sounds can be coded according to their characteristics such as the consistency or ambiguity in the way that letters represent speech sounds and the phonological relationship to the pronunciation of their letter names, in particular, whether the pronunciation of the letter name includes the letter sound. Accordingly, we investigate two letter-related hypotheses.

1.2.1. Letter-name structure hypothesis

The *letter-name structure effect* is a hypothesis about how children use the connections between English letter names and their corresponding sounds to learn those sounds. The relationship between a letter name and the letter sound varies and some are more difficult to grasp than others. For example, the /b/ sound at the beginning of the letter name for *b* ("bee") is straightforward whereas the relationship between the letter name *y* ("why") and the sound /j/ is more abstract. Previous research suggests that letter sounds that are more closely connected to their names are easier to learn and more likely to be known at an earlier age (Cardoso-Martins, Mesquita, & Ehri, 2011; Evans et al., 2006; McBride-Chang, 1999; Piasta & Wagner, 2010b; Share, 2004; Treiman & Broderick, 1998; Treiman et al., 1998). In English, consonant letter sounds can be represented in their letter names in two ways, either as the initial sound in a consonant-vowel (CV) pattern letter name (i.e., *b, d, j, k, p, t, v, z*), or as the final sound in a vowel-consonant (VC) pattern letter name (i.e., *f, l, m, n, r, s*). Other letter names are not associated (NA) with their primary sounds (i.e., *c, g, h, w, y*). The letter names for *c* and *g* letter names are associated with their soft sounds, as in *circle* and *giant*, but not their more common, hard sounds as in *cat* or *gas*. English vowel names approximate the long vowel sounds, but are not associated with the short vowel sounds. Young children often use letter names to make connections between printed words and spoken words (Treiman et al., 1996). Much research has established that the sounds of CV letters are the easiest for children to learn and most likely to be known early in a child's educational career (Evans et al., 2006; Kim et al., 2010; McBride-Chang, 1999; Piasta & Wagner, 2010b; Share, 2004; Treiman & Broderick, 1998; Treiman et al., 1998). The research is divided on whether the sounds associated with VC letters are also easier than those associated with NA letters and vowels. Some studies have shown no effects for VC letters (Evans et al., 2006), but others found effects commensurate with that of CV letters (Share, 2004; Treiman & Broderick, 1998). We predict that sounds associated with CV letters will be the most well-known in our sample, followed by the sounds associated with VC letters, and that the sounds associated with NA letters and vowels will be less well-known.

1.2.2. Letter-sound ambiguity hypothesis

Some letters are associated with multiple sounds at the beginning of words (*c* as in *car* or *circle*, *a* or as *apple* or *ape*) or share beginning sounds with other letters (*c* and *k* as /k/). Because many alphabet books and other teaching tools present key words that begin with all sounds of a given letter (i.e., *gorilla* and *giant* on the same page), or make unexplained distinctions between words that begin with the same sound but different letters (i.e., *giant* on the *g* page and *jump* on the *j* page), these letter sounds may take more time and/or instruction to master than those that have more consistent relationships to letters at the beginning of words (Scanlon et al., 2010). We predict that the sounds associated with the letters *a, c, e, g, i, j, k, o,* and *u* at the beginning of words will less likely to be known at kindergarten entry than the sounds associated with other letters for this reason.

1.3. Child-related Hypotheses

In addition to the characteristics of letter names and letter sounds, child-level characteristics can also affect the ease or difficulty of learning letter sounds. Children's prior knowledge and early literacy experiences may impact their letter-sound knowledge. Children's prior knowledge of letter names, their familiarity