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Early cognitive profiles of emergent readers: A longitudinal study

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ABSTRACT

This longitudinal study examined the contribution of phonological awareness, phonological memory, and visuospatial ability to reading development in 142 English-speaking children from the start of kindergarten to the middle of Grade 2. Partial cross-lagged analyses revealed significant relationships between early performance on block design and matching letter-like forms tasks and later reading ability. Rhyme awareness correlated with later reading ability during the earliest stages, but onset awareness did not emerge as important until after the children had started reading. Digit span correlated significantly with future reading ability at every stage. These findings indicate that although phonological awareness, phonological memory, and visuospatial ability are all necessary for emergent reading, their relative importance varies across the first 2 years of reading development.

Introduction

Although reading is rapid and automatic in skilled readers, in beginning readers it emerges only as a result of the complex and effortful interaction between perceptual and linguistic processes (Schatschneider, Fletcher, Francis, Carlson, & Foorman, 2004). These processes rely on children's grasp of fundamental skills—visual perceptual skills, awareness of the sounds of the spoken language, short-term memory skills—that develop during the preschool years before the commencement of reading instruction. Although much is known about the interactions between these skills and reading ability in early readers, skilled readers, and impaired readers, less is known about the relationships between these skills in prereaders and emergent readers. The aim of this study was to shed new light on these relationships from the start of kindergarten to Grade 2.

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Cognitive predictors of reading development

It is generally accepted that although phonological skills are important for the development of reading, children often identify words initially on the basis of their shape rather than their constituent sounds (Ellis & Large, 1988; Frith, 1985). The ability to recognize whole words depends on children's ability to process and distinguish between visual forms, yet relatively little is known about the development of visual skills (i.e., the perception of visual forms and patterns) in prereaders or about the role that these visual skills play in early reading development. Studies have explored children's early knowledge of alphabetic print (Lonigan, Burgess, & Anthony, 2000; Parrila, Kirby, & McQuarrie, 2004; Storch & Whitehurst, 2002) and their familiarity with environmental print (Goodman, 1986; Lonigan et al., 2000), and these have reported that preschool/Grade 1 knowledge of alphabetic letters and word forms predicts subsequent reading development. Other researchers have asked preschool children to copy or match simple alphanumeric symbols (Badian, 2001), to reproduce visual patterns from memory (Vellutino, Tunmer, Jaccard, & Chen, 2007), and to remember relationships between visual forms (Huang & Hanley, 1997). However, these tasks still involve the recognition or matching of alphanumeric symbols, or they involve a substantial memory component; either of these factors will confound the interpretation of the results. One aim of the current study was to investigate preliterate children's ability to process nonalphanumeric stimuli to determine the contribution that visual perceptual skills make to early reading development and to see how long this effect endures once reading commences.

Phonological awareness is the ability to identify, distinguish between, and manipulate sounds within spoken language, and its importance to reading is widely acknowledged such that children who are better able to identify and manipulate individual sounds are more successful than their peers when learning to read (Carroll, Snowling, Hulme, & Stevenson, 2003; Lonigan et al., 2000; Parrila et al., 2004). However, the concept of phonological awareness is broad, and different aspects of phonological awareness emerge at different points in children's development. Although awareness of larger phonological units, such as the syllable and onset–rime, develop independently of reading instruction in 3- to 5-year-olds (Badian, 2001; Bradley & Bryant, 1983; Gipstein, Brady, & Fowler, 2000), awareness of smaller units of sound, such as the phoneme, usually develop only later as a result of reading development (Cardoso-Martins & Pennington, 2004; de Jong & van der Leij, 1999; but see Ziegler & Goswami, 2006, for a discussion of the development of phonemic awareness across languages). Given the high degree of intercorrelation between different phonological skills, it is necessary to tease apart the influence of each one to explain the reported relationships between different phonological skills and reading.

Because few longitudinal studies have administered measures of phonological processing to preschool children, relatively little is known about the early development of phonological awareness or the utility of such measures as predictors of emergent reading ability (Carroll et al., 2003; Parrila et al., 2004). Some have reported that preschool measures of phonological processing correlate with reading ability through the first school year (Badian, 1994; de Jong & van der Leij, 1999; Lervåg, Bråten, & Hulme, 2009; Torgesen, Wagner, & Rashotte, 1994) and up to 4 years later (Cardoso-Martins & Pennington, 2004; Kirby, Parrila, & Pfeiffer, 2003; Parrila et al., 2004). However, this relationship has been questioned, with studies indicating that preschool phonological awareness is a poor and inconsistent predictor of later reading ability after controlling for autoregressive effects (i.e., effects that may be explained by the presence of a skill at a previous time or by reciprocal relationships between measures at a previous time) (Badian, 2000; Duncan & Seymour, 2000; Lervåg et al., 2009; Muter & Snowling, 1998; Wimmer, Landerl, & Schneider, 1994).

Alongside phonological awareness, phonological memory—the temporary storage of sound-based information, also often referred to as verbal short-term memory—has been identified as a key component of phonological processing that is necessary for reading development (Alloway et al., 2005; Gathercole, Service, Hitch, Adams, & Martin, 1999; Wagner & Torgesen, 1987). Phonological memory predicts vocabulary acquisition by providing a temporary phonological representation of unfamiliar words while the individual forms an enduring representation in long-term memory (de Jong & Olson, 2004; Gathercole & Baddeley, 1989). It also contributes to the acquisition of letter knowledge (de Jong & Olson, 2004), supports the identification of words during the application of grapheme–phoneme