



Early language learning profiles of young children with autism: *Hyperlexia* and its subtypes



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ABSTRACT

This study utilized a standardized and comprehensive computer-aided language assessment tool to identify the early learning characteristics (e.g., *hyperlexia*) of young children with autism. The tool consisted of six subtests: decoding, homographs, auditory vocabulary comprehension, visual vocabulary comprehension, auditory sentence comprehension, and visual sentence comprehension. Thirty-five children with ASD between the ages of 4 and 6 from Tao-Yuan County in Taiwan participated in the study. Fifteen children with ASD whose decoding performance was 1 standard deviation above the norm of age-matched typically developing children were identified as *hyperlexic* and selected for further analysis. Five potential *hyperlexic* subtypes of language learning profiles emerged from this group of children with ASD. This study revealed the heterogeneous nature of language learning characteristics of young children with autism. Such findings have important implications for preschool teachers and other early interventionists who seek to develop specific strategies that capitalize on the learning strengths of young children with ASD.

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1. Introduction

The term *hyperlexia* was first used by Silberberg and Silberberg (1967) to refer to individuals whose ability “to recognize certain words is greater than their ability to comprehend and integrate them” (p. 41). Based on the current literature, children with *hyperlexia* represent a heterogeneous group that shares the unique attribute of advanced word recognition, which is usually accompanied by poor reading skills. Specifically, *hyperlexia* has been observed in individuals with Turner Syndrome (Temple & Carney, 1996), Tourette Syndrome (Burd & Kerbeshian, 1988) and other developmental and learning disabilities, such as attention deficit disorder. *Hyperlexia* even occurs in normal preschoolers (Pennington, Johnson, & Welsh, 1987). There is evidence from case and group studies indicating that there is a higher frequency of *hyperlexia* among children with Pervasive Developmental Disorders (PDD), which include ASD and PDD-NOS, than among children with other developmental delays or disabilities (Grigorenko et al., 2002).

Huttenlocher and Huttenlocher (1973) documented 3 *hyperlexic* children with ASD who could only follow very simple, written instructions. Goldberg and Rothermel (1984) reported the difficulty in comprehending short paragraphs as experienced by *hyperlexic* children with ASD. Similarly, children with *hyperlexia* described by Healy, Aram, Horowitz, and Kessler (1982) were able to comprehend short literal sentences but demonstrated very poor comprehension of larger chunks of text. Welsh, Pennington, and Rogers (1987) indicated that *hyperlexia* may be characterized as unexpected reading precocity as compared to IQ; however, reading comprehension as not unexpectedly deficient. For children with *hyperlexia*,

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the phonological route to reading appeared to be preferred to the lexical route, and the overall abilities most closely paralleled to that of the surface dyslexic subtypes. Thus, the earlier clinical observations of *hyperlexic* children suggested a well-developed phonological strategy for reading but limited reading comprehension. In other words, reading comprehension in *hyperlexic* children is not absent; however, it is less developed than the single-word reading process.

Tiresh and Canby (1993) compared 5 *hyperlexic* children with ASD to 5 *non-hyperlexic* children with ASD. The study found that splinter skills were exhibited more frequently in the *hyperlexic* group, consisting of visual motor abilities, such as drawing, mechanical manipulations, and the relative persistence of immediate echolalia. Although the complexity of marked language and behavioral characteristics may have suggested that *hyperlexic* children with ASD suffer abnormal neurological functioning, there have been few clinical neurological findings to support this hypothesis. Nevertheless, some clinical evidence indicated that males described as *hyperlexic* far outnumber females, with a ratio of approximately 7:1 and that those with *hyperlexia* appeared to have more family histories of language and reading disorders (Aram, 1997; Aram & Healy, 1988).

Grigorenko et al. (2002) investigated the incidence of *hyperlexia* in a clinically referred sample of 80 children (2.67–12.5 years of age) with developmental delays. Twelve *hyperlexic* children were selected who demonstrated a decoding performance that was 2 standard deviations, or 2 years of developmental age, above their IQs. All 12 children were ASD or PDD-NOS, receiving the diagnosis of *hyperlexia*, on average, at 5.9 years (SD = 2.46). In this study, *hyperlexia* was not observed among children with attention deficit disorder/attention deficit hyperactivity disorder, language disorder or mental retardation. In addition, this study indicated that there was no difference between *hyperlexic* and *non-hyperlexic* children in terms of IQs or in subsequent development.

Atkin and Lorch (2006) reported a case study of a 4-year-old *hyperlexic* child with ASD who demonstrated precocious oral-reading ability in the absence of spontaneous speech. Specifically, while the child exhibited a reading ability beyond the norm for this age, the child lacked the ability to communicate verbally and had an IQ comparable to a child 1 year and 5 months old. In addition, oral language was only produced in response to written stimuli. This highly developed reading ability is paradoxical in the context of profound impairment in cognitive development and an absence of spoken language. Such findings suggested the possibility of an atypical route to language acquisition.

Nation, Clarke, Wright, and Williams (2006) investigated reading skills in 41 children with ASD aged 6–15. The study found that the accuracy levels of word and non-word reading and of text reading fell within the average range, although reading comprehension was impaired. However, marked individual differences were also observed in this sample; there were *hyperlexic* as well as dyslexic children with ASD. In this study, among 20 children with ASD who demonstrated a decoding performance comparable to that of normal children, 10 children demonstrated abilities comparable to normal children in reading comprehension, while the other 10 exhibited reading comprehension that lagged behind their normal counterparts. These findings demonstrated the heterogeneous nature of reading skills in children with ASD.

Newman et al. (2007) compared the reading skills of 20 *hyperlexic* children with ASD, 20 age-matched *non-hyperlexic* children with ASD and 18 single-word reading matched typically developing children in the USA. The selection criteria for *hyperlexia* included precocious decoding as reported by parents, and a combination of average decoding abilities with below average reading comprehension. The *hyperlexic* children with ASD were found to perform better than the *non-hyperlexic* children with ASD in reading single words and in non-word decoding. Compared to the matched typically developing group, the *hyperlexic* children with ASD performed comparably in all categories, with the only exception in reading comprehension. These findings were replicated in other countries, such as in the United Kingdom (Saldana, Carreiras, & Frith, 2009) and in Brazil (Cardoso-Martins & Silva, 2010).

Hyperlexia thus appears to be an independent aptitude that is often accompanied by other forms of disability, such as PDD. While early research on *hyperlexia* focused on individual case reports, later studies, such as Newman et al. (2007), expanded the sample size (i.e., group study) and found no marked difference in performance between *hyperlexic* children with ASD and typically developing children with age-matched decoding abilities, with the only exception in reading comprehension. In contrast to the developmental patterns observed among dyslexic children and typically developing children, the decoding abilities among *hyperlexic* children with ASD are independent of the development of abstracting abilities such as comprehension and verbal speech.

Prior to this study, we developed a computer-aided multimedia assessment tool to capitalize on the unique early language learning abilities of children with ASD. This tool incorporated both visual and auditory stimuli to identify early language learning subtypes. This tool was proven to be both valid and reliable (Lin, Chang, Liou, & Tsai, 2013). In the present study, a subset of 15 children (out of the 35 children with ASD recruited during the development of the computer-based tool) was selected as *hyperlexic* readers. These children demonstrated stronger abilities than their age-matched typically developing peers by more than 1 standard deviation in the decoding subtest. The goals of this study were to identify the subtypes among this *hyperlexic* group.

2. Methods

2.1. Participants

Thirty-five children with ASD aged 4–6 participated in this study. Their diagnoses were confirmed by pediatric psychiatrists, and the children were referred by the Chang Gung Children Hospital in Tao-Yuan, Taiwan. Fifteen of the 35

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