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Predicting literacy in children with a high-functioning autism spectrum disorder

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ABSTRACT

The most commonly reported reading profile for children with a high-functioning autism spectrum disorder (HFASD) is one of intact decoding combined with reduced reading comprehension. Whether or not the variables that predict decoding and reading comprehension for children with a HFASD are exactly the same as those identified for a non-ASD population is unknown. Therefore, the ability of cognition, phonological processing, oral language, and vision to predict decoding and reading comprehension was investigated. Regression analysis revealed that cognition, phonological processing, and syntax predicted decoding and reading comprehension for the HFASD and non-ASD groups. One notable difference was that semantics predicted literacy for the non-ASD children but not their HFASD peers.

1. Introduction

Reading is a complex cognitive skill that children require to successfully access the school curriculum. Children achieving early reading success typically exhibit better long-term educational and occupational attainment than children with a history of reading deficit (Boetsch, Green, & Pennington, 1996). However, not all children develop adequate reading, with children diagnosed with a high-functioning autism spectrum disorder (HFASD) being one group identified at risk for reading difficulty.

Autism spectrum disorder (ASD) is an umbrella term comprising those individuals diagnosed with autistic disorder (AD), Asperger's disorder (AsD), or pervasive developmental disorder not otherwise specified (PDDNOS). Children with an ASD diagnosis who do not have a co-morbid intellectual disability (ID), that is they have an IQ greater than 70, are diagnosed with a HFASD; those with AD and an IQ above 70 are referred to as having high-functioning autism (HFA). The most typical reading profile reported for individuals diagnosed with an ASD is one of adequate decoding from pre-school to adulthood combined with impaired reading comprehension, particularly from the later primary school years (Frith & Snowling, 1983; Griswold, Barnhill, Myles, Hagiwara, & Simpson, 2002; O'Connor & Klein, 2004). Nation, Clarke, Wright, and Williams (2006) found that as a group 41 children aged 6–15 years with an ASD had decoding skills that were in advance of reading comprehension. Similarly, Huemer and Mann (2010) in a study of 384 children diagnosed with an ASD with a mean age of 10–11 years reported disjunct between decoding and reading comprehension across the entire group.

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The profile of decoding in advance of reading comprehension also applies to individuals diagnosed with a HFASD. Minshew, Goldstein, Taylor, and Siegal (1994) for example identified no group differences on word and non-word reading but significant group differences on passage comprehension between 54 individuals with HFA (mean age 16 years) and IQ- and age-matched controls. O'Connor and Hermelin (1994) reported on a two year study of two males aged 5 and 8 years respectively at intake and identified decoding in advance of reading comprehension at all four testing points. In a retrospective analysis of school reports of 40 children with AsD aged 3–15 years Church, Alisanski, and Amanullah (2000) found that even though decoding was easily achieved reading comprehension for non-factually based materials was reduced. Finally, Williams, Goldstein, and Minshew (2006) reported that passage comprehension but not decoding discriminated group membership for 56 children with HFA aged 8–15 years and 56 age- and IQ-matched controls.

Proficient readers generally demonstrate competency with cognitive, phonological processing, oral language, and visual tasks, all of which have been identified as predictive of concurrent and future reading for typically achieving readers (Scarborough, 1998). Whether or not all of the predictors identified as important for normal reading development are also equally predictive of concurrent reading development for young children diagnosed with a HFASD has not yet been specifically investigated.

Nevertheless, there is evidence that at least some of the predictors of reading for the non-HFASD population apply equally to those diagnosed with a HFASD. Mayes and Calhoun (2008) examined the relationship between intellectual ability (Wechsler Intelligence Scale for Children – Fourth edition [WISC-IV]) (Wechsler, 2003) and reading achievement (Wechsler Individual Achievement Test – Second edition [WIAT-II]) (Wechsler, 2001) for 54 children diagnosed with HFA, aged 6–14 years. Full-scale IQ (FSIQ) was identified as the best predictor of reading (as opposed to the WISC-IV general ability index [derived from 6 of the 10 subtests used to calculate FSIQ], or the WISC-IV index scores). FSIQ and the WIAT-II word reading ($r = .64$) and passage comprehension ($r = .68$) composites were strongly associated. This suggests that cognition (as measured using FSIQ) is a strong predictor of literacy for young children with a HFASD as it is for non-HFASD populations. However, the authors did not examine the role of other known predictors of reading such as phonological processing in their HFASD group.

Phonological processing encompasses mental procedures dependent upon the phonological structure of language. Phonological processing in the current study refers phonological awareness (PA), phonological memory (PM) and rapid naming (RN). It is however acknowledged that researchers differ with regard to the inclusion of RN as a phonological processing skill. Regardless, the relationship of PA, PM, and RN to early literacy development has not fully and concurrently been investigated for young children with HFASD. Possibly this reflects Frith and Snowling (1983) who stated that there is no indication that phonological abilities are impaired for individuals with AD who read. However, more recent research has reported phonological processing deficits within the HFASD population.

After controlling for FSIQ, Hooper, Poon, Marcus, and Fine (2006) reported that 23 children with HFA aged 5–12 years performed more poorly than a TD age-matched comparison group on PA tasks as measured by the phonological processing subtest of the Developmental NEuroPSYchological Assessment (Korkman, Kirk, & Kemp, 1998): reading ability or the relationship of PA to reading was not examined. Newman et al. (2007) found that 20 children with HFASD and no history of hyperlexia performed equally on PA (the sound awareness subtest of the Woodcock–Johnson Tests of Achievement-III [Woodcock, McGrew, & Mather, 2004]) to 20 age-matched children with an autism spectrum disorder (ASD) plus a history of hyperlexia, but poorer than 18 typically developing (TD) children (the latter groups did not differ). The groups may however have varied on FSIQ as this was not measured for the TD group. Additionally, only two groups, HFASD plus hyperlexia and TD, were matched on word reading. FSIQ and PA are associated with word reading and thus the poorer PA results of the HFASD without hyperlexia compared with the TD group may be expected given that word reading was lower in the former group. Differences may also have been due to differences in FSIQ between the groups. Hence, future research should ensure matching on FSIQ and word reading ability when examining predictor variables such as PA across HFASD and TD groups.

Most recently, Asberg and Sandberg (2012) found that 15 children aged 10–15 years with ASD (2 with low IQ) or an autism-like condition (2 children) were poorer on PA (a composite of a sound deletion and two spoonerisms tasks) than 14 TD, age-matched peers. Five ASD children identified as poor readers (decoders) (based on word reading below the 10th %ile) were compared on PA with five, word reading-level matched TD controls with no significant difference found. This suggests that for ASD children with impaired decoding, PA is also impaired, just as occurs within the non-ASD population. Whether or not the ASD children with adequate decoding in this study had PA skills similar to those of their TD peers is unknown as this comparison was not conducted. Furthermore, none of the above studies (Asberg & Sandberg, 2012; Hooper et al., 2006; Newman et al., 2007) examined whether or not PA correlated with, or predicted, decoding with none measuring reading comprehension and/or its relationship with PA. Nevertheless, the findings of Asberg and Sandberg (2012), suggest that PA is associated with decoding, and thus should predict decoding for young children diagnosed with a HFASD as it does for TD children.

Gabig (2010) though found no significant correlation between decoding (word and non-word decoding) and PA (elision and sound blending) for 14 children aged 5–7 years with AD. Based on the participants' description (functional verbal skills, non-verbal IQ $\geq$ 70) however it is unclear if all participants would meet criteria for HFA. Further, for the TD group only one correlation (between elision and non-word decoding) was significant, which is an unexpected finding for a TD population. Thus Gabig's results may reflect the small sample sizes and requires verification with larger participant groups.

Conversely, White et al. (2006) examined a cohort aged 8–12 years and reported a strong correlation between 'phonology' (a combination of PA and RN tasks) and literacy (a composite of word, non-word decoding, and spelling) for 9 ASD children identified as good readers, 13 ASD children identified as poor readers (with poor reading defined as being below an