Foundations of reading comprehension in children with intellectual disabilities

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Evelien van Wingerden [a,*], Eliane Segers [a], Hans van Balkom [a,b], Ludo Verhoeven [a]

[a] *Behavioural Science Institute, Radboud University, Nijmegen, The Netherlands*
[b] *Royal Kentalis, Sint Michielsgestel, The Netherlands*

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ABSTRACT

Background: Knowledge about predictors for reading comprehension in children with intellectual disabilities (ID) is still fragmented.
Aims: This study compared reading comprehension, word decoding, listening comprehension, and reading related linguistic and cognitive precursor measures in children with mild ID and typically developing controls. Moreover, it was explored how the precursors related to reading achievement.
Method and procedures: Children with mild ID and typical controls were assessed on reading comprehension, decoding, language comprehension, and linguistic (early literacy skills, vocabulary, grammar) and cognitive (rapid naming, phonological short-term memory, working memory, temporal processing, nonverbal reasoning) precursor measures. It was tested to what extent variations in reading comprehension could be explained from word decoding, listening comprehension and precursor measures.
Outcomes and results: The ID group scored significantly below typical controls on all measures. Word decoding was at or above first grade level in half the ID group. Reading comprehension in the ID group was related to word decoding, listening comprehension, early literacy skills, and temporal processing.
Conclusion and implications: The reading comprehension profile of children with mild ID strongly resembles typical early readers. The simple view of reading pertains to children with mild ID, with additional influence of early literacy skills and temporal processing.

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1. Introduction

The simple view of reading states that reading comprehension is essentially a product of word decoding and listening comprehension (Hoover & Gough, 1990). For children with intellectual disabilities (ID), learning to read is less straightforward than for typically developing children, and reading comprehension causes additional difficulties. A large proportion does acquire literacy to some degree, but the reading level differs widely (Jones, Long, & Finlay, 2006; Lemons et al., 2013; Ratz & Lenhard, 2013). Although recent studies in children with ID did focus on predictors of word decoding and predictors of

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reading comprehension (Nash & Heath, 2011; Soltani & Roslan, 2013), a comprehensive model has not yet been established. In addition, it is unclear to what extent reading-related abilities such as working memory, rapid naming, and vocabulary contribute to literacy performance in this population. Recent studies have shown that the simple view of reading applies to individuals with Down syndrome (Nash & Heath, 2011; Roch, Florit, & Levorato, 2011), however, these results may not generalize to other aetiologies. The present study aimed to investigate to what extent the reading comprehension abilities of children with mixed-etiology mild ID can be explained from their word decoding and language comprehension, and relevant linguistic and cognitive precursor measures.

1.1. Typical reading development

In typical readers, it is known that a combination of word decoding and listening comprehension determines the level or reading comprehension (Hoover & Gough, 1990).

For word decoding the reader must merge letter-sound combinations into words, which requires a basis of underlying linguistic skills. First, the reader must be aware of the different sounds and sound clusters within speech and be able to manipulate them (phonological awareness). Second, the reader must know the connection between speech sounds and their corresponding letters (letter knowledge). This combination of skills (to be called 'early literacy skills' from this point forward) are closely related to the attainment of word decoding in orthographies of different levels of transparency (Melby-Lervåg, Lyster, & Hulme, 2012). Phonological representations in memory are further refined when vocabulary expands (Walley, Metsala, & Garlock, 2003). Additionally, vocabulary knowledge supports word identification (Perfetti, 2007). Language-related cognitive skills are necessary for a fluent word decoding process. Rapid naming is related to word reading fluency, as it reflects processing speed and the level of integration of linguistic and perceptual reading-related processes (Norton & Wolf, 2012). In addition, phonological short-term memory capacity is necessary for blending letters into a word, and temporal processing to enable speech perception, which is instrumental in the development of phonological awareness (Georgiou, Torppa, Manolitsis, Lyytine, & Parrila, 2012; Huss, Verneij, Fokster, Mead, & Goswami, 2011; Malenfant et al., 2012; Perez, Majerus, & Poncelet, 2012).

ssOnce children have reached a basic level of word decoding, they learn to incorporate written words into meaningful sentences and text. For beginning readers, word decoding is the main determinant of reading comprehension. Over time, word decoding becomes an automatic process and reading comprehension becomes mainly dependent on language comprehension (Vellutino, Tunmer, Jaccard, & Chen, 2007). Listening comprehension is the second element of the simple view of reading. It requires vocabulary for knowledge of word meanings (Lee, 2011) and grammar comprehension for sentence comprehension (Kintsch & Rawson, 2005). For comprehension of texts, working memory and reasoning skills are needed for text integration and to perform the more complex tasks such as inference drawing and use of reading strategies (Fuchs et al., 2012; Seigneuric & Ehrlich, 2005). Temporal processing is necessary for speech perception, grasping the order of phonemes and words, and detecting the prosodic patterns in spoken language (Gordon, Jacobs, Schuele, & McAuley, 2015; Malenfant et al., 2012). Finally, recent studies have pointed out that vocabulary is also an independent predictor for reading comprehension, next to decoding and language comprehension (Protopapas, Mouzaki, Sideridis, Kotsolakou, & Simos, 2013).

1.2. Reading in children with mild ID

Children with mild ID have severe delays in working memory (Van der Molen, Van Luit, Jongmans, & Van der Molen, 2007) and early literacy skills, which hinders the development of word decoding, and reading comprehension accordingly (Channell, Loveall, & Conners, 2013; Jones et al., 2006). In addition, Levy (2011) found in adolescents with moderate to borderline ID of different etiologies that the general level of cognitive capacity affects the reading level on top of language-related predictors.

Several large studies have inventoried the word decoding levels of children with ID through teacher reports. One study included 1629 German students of 6–21-year-old with ID, regardless of etiology. Regarding the 529 students who were classified as having mild ID, their teachers reported that 35.8% decoded by deliberate, letter-by-letter decoding, and 59% was able to read by direct orthographic word recognition (Ratz & Lenhard, 2013). In a second study, scores on a curriculum-based reading measures were used to determine word decoding levels among 3811 American students of 8–21 years old who had mild to moderate ID. The benchmark for first grade word decoding level was obtained by 33.6% on average, with the percentage increasing by age (Lemons et al., 2013).

Although children with mild ID lag behind in the development of reading, the underlying predictors seem, to a certain extent, similar to those in typically developing children. Early literacy skills (Dessemontet & de Chambrier, 2015) and rapid naming (Barker, Sevcik, Morris, & Romski, 2013; Soltani & Roslan, 2013) are prominent predictors for word decoding in mild ID. Phonological short-term memory is an indicator in some studies (Conners, Atwell, Rosenquist, & Sligh, 2001), but in other studies was not predictive when phonological awareness was controlled for (Soltani & Roslan, 2013). Compared to typically developing children, however, the word decoding level of children with mild ID appears to be more strongly related to cognitive skills such as nonverbal reasoning and temporal processing (Van Tilborg, Segers, Van Balkom, & Verhoeven, 2014).

Reading comprehension has been studied less frequently in individuals with ID than word decoding, and indications of reading comprehension levels are rarely reported. One study among 19 literate adults with mild ID, revealed a reading