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Predicting school achievement from early theory of mind: Differential effects on achievement tests and teacher ratings

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ABSTRACT

This study investigates long term consequences of early theory-of-mind abilities on different measures of school achievement. A group of 86 children (50% girls) completed theory-of-mind tasks and standardized tests on working memory, language, and nonverbal abilities at the age of 4 years. In Grade 1 and Grade 2, they were presented with a test on reading and two tests on mathematical competencies (arithmetic skills and numeracy). Moreover, teachers rated children's competencies with regard to literacy, mathematics, attention, and social-emotional aspects. The results showed that with the exception of numeracy there were no or only weak predictive relations between theory-of-mind understanding in preschool and performance on achievement tests in school after controlling for socioeconomic status, gender, nonverbal abilities, working memory, and language abilities. However, in first grade, theory of mind turned out to be a significant predictor of teachers' ratings of children's reading and mathematical competencies even if the other child variables were controlled for.

1. Introduction

The emergence of children's theory of mind in the preschool period is seen as an important step in children's social-cognitive development (Harris, 2006). Theory of mind refers to the understanding of one's own and others' mental states and includes, among others, understanding of thoughts, intentions, desires, or beliefs (Flavell, 1999). Children's theory of mind is found to undergo a substantial developmental shift around the age of four when children understand that people can hold and act on beliefs that contrast with reality, so called false beliefs (Wellman, Cross, & Watson, 2001). Whereas most studies focused on the developmental trajectory and individual differences in these abilities in preschool it seems equally important to identify the potential consequences of individual differences in children's early theory-of-mind abilities that can be observed later on when children have entered elementary school. However, empirical data coming from longitudinal studies are sparse and most studies investigating consequences of individual differences in early theory-of-mind abilities have concentrated on aspects of social or emotional development (e.g., Dunn, Cutting, & Fisher, 2002; Mostow, Izard, Fine, & Trentacosta, 2002). To date, only little is known about the impact of early theory-of-mind abilities on academic achievement in the early grade school years (see also Hughes & Devine, 2015).

There are several reasons to assume an association between theory of mind in preschool and indicators of school achievement at the beginning of elementary school. One theoretical rationale to link theory of mind with school learning has been put forward by Astington and Pelletier (2005), thereby extending an idea by Tomasello, Kruger, and Ratner (1993) and Olson and Bruner (1996). They propose that children's theory-of-mind abilities are related to their cultural learning via collaboration and instruction and that many (pre-)school activities, such as communicating beliefs about the world or understanding the intentions of (preschool) teachers, come easier to children whose theory of mind is more advanced. In their view, theory-of-mind understanding in combination with metacognitive language provides the basis for children's ability to engage in more complex forms of learning such as collaborative learning. Children's mentalistic language which probably reflects an advanced theory-of-mind understanding might be helpful in order to exchange ideas and to form and revise beliefs about the world, especially, when the focus is on the construction rather than on the transmission of knowledge (Astington & Pelletier, 1996).

In addition to the idea that theory of mind may be relevant for communication in school and may help to effectively learn from teacher instruction, other social aspects of school learning have to be considered as they may also constitute a possible link between theory of mind and academic achievement. With regard to children's social behavior, Astington (2003) reported that preschool children's understanding of false beliefs was associated with aspects of teacher-rated social competence, in particular those that involve an awareness of other's mental states. Similar findings have been reported in another longitudinal

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study (Mostow et al., 2002) indicating that individual differences in early theory of mind matter for social competence in school which in turn is essential in the context of overall school adjustment (Denham, 2006; La Paro & Pianta, 2000; Ladd, Herald, & Kochel, 2006). Furthermore, there is evidence that children's understanding of mental states is related to the quality of the relationships between teachers and children (Garner & Waajid, 2008) and research consistently indicates that positive student–teacher relationships are associated with desirable school-related outcomes (Davis, 2003; Hamre & Pianta, 2001; Pianta & Stuhlman, 2004).

Another reason for assuming a relationship between early theory of mind and later school achievement might be that children require a more sophisticated understanding of mind in order to evidence metacognitive behaviors in school settings (Meichenbaum & Biemiller, 1992) which in turn have repeatedly been shown to impact learning outcomes (e.g., Dunlosky & Metcalfe, 2009; Koriat & Goldsmith, 1996; Roebers, Krebs, & Roderer, 2014; Schneider & Lockl, 2008). It is likely that children with more advanced theory-of-mind development reflect more often and/or more efficiently on their own learning activities and show more metacognitive behaviors such as defining tasks, planning, monitoring, and evaluating. Meichenbaum and Biemiller (1992) used the label "self-directed child" to characterize a child who shows metacognitive behavior and "knows what needs to be done and does it without having to be told" (p. 9). Children with an advanced understanding of mind may also recognize that the capacity of the mind is limited, and that strategies could be employed to facilitate comprehension, memory performance and learning (Wellman, 2016). Thus, metacognitive knowledge could mediate between children's theory of mind and academic performance. Longitudinal studies demonstrated that children's theory of mind is predictive for children's metacomprehension (Lecce, Zocchi, Pagnin, Palladino, & Taumoepeau, 2010) and metamemory (Ebert, 2011; Lecce, Demicheli, Zocchi, & Palladino, 2015; Lockl & Schneider, 2007a) which holds true even if earlier scores on metamemory were controlled for (Ebert, 2015). In a similar vein, another possible mechanism suggesting an association between theory of mind and academic achievement could be children's beliefs about learning. As reported by Lecce, Caputi, and Pagnin (2015) children with an advanced false-belief understanding at the age of 5 were more likely to have a constructivist view of learning at the age of 8 which might have implications on their actual learning behavior.

Taken together, early theory-of-mind abilities have been shown to be related to aspects of social functioning in school and to facets of metacognitive knowledge and epistemological beliefs about learning and it is likely that these aspects may also play a role in the formation of a possible link between theory of mind and academic achievement.

However, when looking at empirical data, there are only few longitudinal studies that directly addressed the association between early theory-of-mind performance (assessed via tasks on false belief and/or emotion understanding) on the one hand and cognitive indicators of school achievement on the other hand. Astington and Pelletier (2005), for example, reported that false belief understanding in kindergarten was related to later narrative comprehension but not to reading competence after having accounted for differences in language competencies. Blair and Razza (2007) investigated the predictive relation of false belief understanding in preschool to emerging math and reading literacy in kindergarten and found that false belief understanding was slightly but significantly associated with letter knowledge and exhibited a marginally significant relation with mathematics knowledge and phonemic awareness. In contrast, strong relations between theory of mind and school achievement were reported by Lecce and colleagues (Lecce, Caputi, & Hughes, 2011; Lecce, Caputi, & Pagnin, 2014). They followed a group of children from kindergarten until the second year (Lecce et al., 2011) and the fifth year (Lecce et al., 2014) in elementary school. Results showed that theory of mind assessed at the age of 5 predicted school achievement at the age of 7 and even at the age of 10. Interestingly, at both time points, earlier theory-of-mind scores were more predictive for academic achievement than concurrent theory-of-mind scores (Lecce et al., 2011; Lecce et al., 2014). Furthermore, a study by Trentacosta and Izard (2007) revealed that emotion understanding in kindergarten predicted modest but significant variance in academic competence. Similarly, looking at a longer time interval, Izard et al. (2001) found that individual differences in emotion knowledge in kindergarten were related to teacher ratings of academic competence at the age of 9 with emotion knowledge mediating the effect of verbal ability on academic competence.

Thus, although there are studies that indicate that theory of mind might be important for school achievement, the data base is relatively small and the strength of the correlations varies substantially across studies. The variation may be due to different characteristics of the studies, in specific the outcome measures (teacher ratings vs. achievement tests) used in the respective studies. A closer look at the studies mentioned above reveals that generally higher correlations between theory of mind and school achievement (with uncorrected *r*'s ranging from about $r = 0.40$ to $r = 0.60$) emerged when teacher ratings (Izard et al., 2001; Lecce et al., 2011) or aggregate scores including teacher ratings and test scores (Lecce et al., 2014) were used as outcome measures. In contrast, lower correlations (with uncorrected *r*'s ranging from about $r = 0.10$ to $r = 0.40$) were found for achievement tests (Blair & Razza, 2007; Trentacosta & Izard, 2007), e.g. tests on mathematics or letter knowledge. In general, using teacher ratings as the only indicator to assess academic achievement may be problematic. Although studies on the whole reveal acceptable levels of validity for teacher ratings (see Hoge & Coladarci, 1989; Jussim, Eccles, & Madon, 1996), teacher ratings on academic achievement may also be shaped by teachers' general perceptions of the children including their attention to academic tasks or their overall social-emotional behavior.

Furthermore, the studies differ in the way in which other child variables were included in the analyses. From a theoretical perspective, several child variables deserve attention when linking theory of mind and school achievement. More specifically, there is a need to consider variables that are assumed to influence theory-of-mind development on the one hand as well as aspects of school achievement on the other hand. Among these variables, language competencies are important, because they foster children's theory-of-mind understanding (e.g. Ebert, 2015; Lockl & Schneider, 2007a; Milligan, Astington, & Dack, 2007) and are known to be predictive for children's later school achievement, in particular for children's reading competencies (e.g. Ebert & Weinert, 2013; Muter, Hulme, Snowling, & Stevenson, 2004; NICHD Early Child Care Research Network, 2005), but also for children's social behavior in school (e.g. McCabe & Meller, 2004; Rose, Ebert, & Weinert, 2016). Beside language, working memory measures should be taken into account. In order to read or to solve different kinds of tasks, one must be able to keep track of incoming information to construct a coherent and meaningful interpretation of the given task. Accordingly, a multitude of studies has established relations between working memory measures and both reading competencies (e.g., Daneman, Carpenter, & Just, 1982; Ebert & Weinert, 2013; Gathercole & Baddeley, 1993) and mathematical ability (Bull & Scerif, 2001; Logie, Gilhooly, & Wynn, 1994) though the relation between working memory and theory of mind is less clear (Carlson, Moses, & Claxton, 2004; Keenan, Olson, & Marini, 1998). Finally, nonverbal abilities are relevant when linking theory of mind and school achievement as they influence various aspects of children's cognitive development and are known to be a reliable predictor of academic achievement in general (Schneider, Bullock, & Sodian, 1998).

Looking at the studies investigating consequences of early theory of mind on cognitive school achievement, to our knowledge all studies controlled for language competencies indicating some overlap in the prediction of school achievement from measures of theory of mind and language. However, only few studies included other theoretically relevant child factors (Blair & Razza, 2007; Trentacosta & Izard, 2007) and the results were rather mixed. For instance, after taking into account verbal and nonverbal abilities as well as different aspects of