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Metamemory development in preschool children with ADHD ☆

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ABSTRACT

An aspect of metacognition, metamemory (knowledge and awareness of one's memory) was investigated across time in preschool children with ADHD (n = 31) and a sample of age, sex, socioeconomic and IQ-matched typically developing children (n = 31). Only children with stable ADHD diagnoses were included. Participants were assessed on a variety of cognitive and parent report measures. Longitudinal results indicated that the preschool children with ADHD and typically developing children had similar intellectual capacities. In addition, at age 4, children with ADHD and typically developing children had comparable metamemory skills. Nevertheless, one year later, when control participants made strong gains in metamemory development, children with ADHD began to lag behind. It is therefore crucial that metamemory difficulties in children with ADHD are detected as soon as they appear so that they can be fully assessed and remediation programs put in place in the school and home.

1. Introduction

Metacognition, or the knowledge, awareness, and control of cognitive processes, is a topic of considerable interest in developmental psychology (Bjorklund, 1987; Kreutzer, Leonard, & Flavell, 1975). Aspects of metacognition that have been researched most heavily are metamemory and metacomprehension; metamemory refers to accuracy in predicting memory performance, knowledge about memory strategies and how best to regulate study strategies (Cavanaugh & Perlmutter, 1982). Metacomprehension refers to thoughts about comprehension and like metamemory, is often quantified as a rate of accuracy in predicting performance. Metamemory is easier to assess in young children, as metacomprehension experiments often rely on reading passages and answering questions (Matlin, 2005; Nelson, 1999).

While the process of metamemory may begin in preschool, the ontogenic course of metamemory development is rather protracted. For example, by age 3, children recognize that they will remember a smaller set of pictures better than a larger set (Schneider & Pressley, 1997). Nevertheless, preschool children generally do not comprehend that effort must be exerted in order to memorize (Joyner & Kurtz-Costes, 1997). Similarly, 7-year olds are often unaware that words are easier to remember when the words are related, rather than randomly selected (Schneider & Pressley, 1997). Likewise, older children (ages 8–9) are often inaccurate or poor at determining whether or not they have committed some piece of information to memory (Schneider, 1999).

Using a cohort sequential design, the classic study by Yussen and Levy (1975) demonstrated developmental progression of metamemory through childhood and adolescence. When asked to state how many words they could hold in their memory, preschoolers (age 4.6 years) vastly overestimated the number of items they could recall. Nonetheless, by age 8 (3rd grade), performance on this task was very similar to college students and very close to actual memory performance. This suggests that between the ages of 4 and 8, impressive improvements in metamemory occur.

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Others have considered how best to explain the stark improvements in metamemory between ages 4 and 8 (Schneider & Sodian, 1988). Some have proposed that the improvement in metamemory parallels the development of theory of mind; as children expand their knowledge about how their mind works and come to understand that others have minds as well, their metamemory skills improve (Flavell, Green, & Flavell, 2000; Schneider, 1999). Others have suggested that based on an association between metamemory and actual memory performance, the use of strategies improves metamemory that, in turn, affects memory performance (Schneider & Pressley, 1997; Schneider, 1999). In addition, younger children often do not realize that effort must be exerted in order to memorize material and that memory strategies are not spontaneously used (Flavell, Miller, & Miller, 2002). Improvements in impulse regulation also may account for the expansion of metamemory skills, as metamemory is more accurate when waiting before making recall predictions (Dunlosky & Nelson, 1994). In sum, metamemory development is most likely multifactorial.

Metacognition and metamemory are often subsumed under the umbrella construct, "executive function" (Cornoldi, Barbieri, Gaiani, & Zocchi, 1999). Executive function is a rather ambiguous term that refers to a set of various interrelated cognitive abilities that operate metaphorically as a company "executive" and organize the brain's mental resources to accomplish pre-specified goals (Denckla, 1989; Goldman-Rakic, 1987). Executive functioning can be affected by various medical and psychiatric disorders (Pennington & Ozonoff, 1996) including attention-deficit/hyperactivity disorder (ADHD; Barkley, 1997). There is a burgeoning interest in executive functioning in preschool children (Hughes, 2002; Isquith, Crawford, Espy, & Gioia, 2005) and it is somewhat surprising that few extant data have specifically addressed executive functioning in preschool children with ADHD.

1.1. Preschool children with ADHD

ADHD is difficult to diagnose in children younger than age 4 or 5 years, mainly due to variable behaviors that may be similar to characteristic symptoms. Additionally, it is difficult to diagnose a preschool child because symptoms of inattention are not often readily observed since young children typically experience few demands for sustained attention (APA, 1994). Not surprisingly, the diagnosis of ADHD in preschoolers has been a topic of debate (Barkley, 1997, Byrne, DeWolfe, & Bawden, 1998, Campbell, Szumowski, Ewing, Gluck, & Breaux, 1982, DeWolfe, Byrne, & Bawden, 2000, Shelton et al., 2000, Sonuga-Barke, Auerbach, Campbell, Daley, & Thompson, 2005). For example, while longitudinal data suggest that preschool children with high levels of activity and impulsivity continue to display comparable hyperactive and impulsive behaviors in childhood (Byrne et al., 1998; Campbell, Pierce, March, Ewing, & Szumowski, 1994), other data indicate that not all children with early ADHD symptoms continue to have difficulties, and some children do not develop ADHD symptoms (inattention) until middle childhood (Campbell, 1995). Nonetheless, the general consensus from these data is that ADHD can be reliably diagnosed in preschool children (Applegate et al., 1997; Lahey et al., 1998) with adequate predictive validity into childhood (Root & Resnick, 2003).

1.2. Metamemory in ADHD

A few investigators have empirically addressed metamemory development in children with ADHD. For example, Cornoldi et al. (1999) studied 6th and 8th grade children with ADHD and controls using a variety of measures designed to tap into the core deficits (e.g., impulse control) of children with ADHD. Also included in the research protocol was a metamemory questionnaire. Their data demonstrated that relative to control participants, middle school children with ADHD had less efficient and organized memory strategies yet improved appreciably when provided metacognitive assistance (Cornoldi et al., 1999). The control children did not improve much with metacognitive support, suggesting that they had already developed the necessary abilities to perform the task (Cornoldi et al., 1999).

Voelker, Carter, Sprague, Gdowski, and Lachar (1989) also investigated metamemory in ADHD. These researchers compared twelve boys with ADHD (ages 6–12) on a list-learning task of semantically related words. In addition, children completed a metamemory questionnaire designed to assess their knowledge of how different situations may affect encoding and retrieval. Boys with ADHD performed comparably to control participants on metamemory knowledge and less complex list learning. However, when effortful strategic deployment (e.g., semantic clustering) was required, boys with ADHD performed less well than control participants. This suggested a utilization, not knowledge, deficiency.

Given the developmental psychology literature documenting impressive improvements in metamemory between ages 4 and 8, we were interested in researching whether a similar developmental trajectory occurs in children with ADHD. In light of the high rates of learning disabilities and academic underachievement in children with ADHD (Frick et al., 1991; Hinshaw, 1992; Willcutt, Pennington, Olson, Chlabilidas, & Huslander, 2005) as well as the benefits of early identification and intervention for children with learning disabilities (O'Connor, Harty, & Fulmer, 2005), we feel that this is an important and potentially valuable area of research.

Similarly, due to the lack of data on preschool children with ADHD, early intervention planning for ADHD currently relies largely on data from children of school-age; in order to possibly better inform appropriate preventive and intervention efforts, more information is needed on the "start point(s)" or subcomponents (e.g., metamemory) of cognitive difficulties rather than focusing on the "end" points (e.g., memory recall). The current project represents an initial longitudinal investigation into metamemory development in preschool children with ADHD. At age 4, metacognition and metamemory is still an emerging skill. However, by age 5, metamemory has begun its ontogenic course. Accordingly, we hypothesized that at age 4, no differences would exist between control participants and participants with ADHD. However, at age 5, differences on metamemory measures would exist between the two groups.