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Approaches to learning and medicated ADHD: The potential impact on learning and assessment

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ABSTRACT

The current study examined how student approaches to learning (ATL) and ATL's association with school achievement differ in children diagnosed with ADHD who are taking medication and children who are not diagnosed with ADHD. Results indicated that pharmacological interventions may be associated with a decrease in core symptoms of ADHD (e.g., ADHD-related ATL items such as concentration, keeping on task, and maintaining interest) as rated by parents; however, parents of children receiving medication also rated their children as lower on ATL items not typically associated with ADHD symptomatology, including creativity, eagerness, and initiative. Evaluation of a model examining the association between ATL and achievement revealed that as ADHD-related ATL items decreased, both reading and math achievement increased. However, the relationships between non-ADHD-related ATL items (e.g., creativity, eagerness, and initiative) and achievement scores differed for children with ADHD receiving medication. We discuss the implications for learning and assessment.

1. Introduction

Broadly speaking, the term 'approaches to learning' (Kagan, Moore, & Bredekamp, 1995) describes those early childhood behaviors that have been found to be associated with academic achievement and school readiness (e.g., McClelland, Morrison, & Holmes, 2000; McWayne, Fantuzzo, & McDermott, 2004; McDermott, 2014). Approaches to learning (ATL), also referred to as adaptive learning behaviors (Vitiello, Greenfield, Munis, & George, 2011), have been defined by Fantuzzo et al. (2007) as those "distinct, observable behaviors that indicate ways children become engaged in classroom interactions and learning activities" (p. 45). Although the off-task behavior associated with Attention-Deficit/Hyperactivity Disorder (ADHD) could appear as the result of poor ATL development, ADHD differs in several important ways. ADHD has been found to affect the development of the executive functions related to inhibitory processes (Barkley, 1997; Crosbie et al., 2013; Hart et al., 2014) and working memory (Holmes et al., 2014; Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005). Thus, children with ADHD, who are already at risk for achievement and readiness problems, likely also suffer from poor ATL.

Surprisingly, a search of the literature did not yield many investigations of ATL in children diagnosed with ADHD. The purpose of the current study was to examine the relationship of ATL with academic achievement comparing students with ADHD receiving medication to students without ADHD. The focus on children with ADHD receiving medication was deemed important as first, children diagnosed with ADHD experience symptoms that will likely affect their ATL and second, medication therapy is the intervention of choice for ADHD and many parents and educators expect it to improve not only children's symptoms but ATL as well. Thus, the overarching importance of the current study is to examine what ATL behaviors if any serve as "academic enablers" for not only typical children but also for children with ADHD taking medication. We did not examine children with ADHD not receiving medication as first, this was a nebulous group in terms of why they did not receive pharmacological treatment (i.e., parental refusal, expense of medication, simply mild symptoms of ADHD, or the treatment of other comorbid disorders taking precedence, etc.) and second, this group appeared to have significantly worse achievement than children without ADHD and children with ADHD receiving medication. As a result, the inclusion of children with ADHD not receiving medication did not seem appropriate for these reasons.

2. Review of the literature

The literature regarding the association between students' ATL and academic outcomes varies and depends on how ATL is operationally defined. Thus, a discussion of these definitions should precede any review of the literature. Definitions of ATL have included but are not limited to behaviors including attentiveness, persistence, initiative, emotion regulation, flexibility, and organization (Chen & McNamee, 2011; Fantuzzo et al., 2007; McWayne et al., 2004). Similarly, Bumgarner, Martin, and Brooks-Gunn (2013) have defined ATL as those "behaviors and characteristics that facilitate their own and classmates' learning," (p. 243). Claessens, Duncan, and Engel (2008) described approaches to learning as a constellation of student attitudes and behaviors that include

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persistence, attention, independence, and organization. The United States' Head Start Child Development Early Learning Framework defined ATL as a function of initiative, curiosity, persistence, attention, and cooperation (US Department of Health and Human Services, 2010). Finally, Musu-Gillette, Barofsky, and List (2015) conceptualized ATL most broadly as, "a child's fit within the instructional, organization, and social context of the classroom," (p. 4). While definitions of ATL do overlap, other definitions focus on the cognitive aspects of learning content in secondary and higher education settings (e.g., Biggs, 1999; Entwistle, 1988), which have been criticized for generalizing cognitive approaches to learning specific content, such as reading, to account for the general goals of learning in higher education without regard to context (see Haggis, 2003) and are, therefore, not examined in the current study.

Ultimately, DiPerna, Volpe, and Elliott (2005) termed the approaches to learning behaviors and characteristics as "academic enablers" (p. 379) as students exhibit the appropriate behaviors and characteristics in order for learning to take place rather than the actual cognitive processes of learning. While definitions of ATL may vary, the overarching significance of ATL across studies lies in its relation to learning outcomes (Chen & McNamee, 2011), thus alluding to their role as academic enablers. A child with higher levels of ATL should have an enhanced ability to learn (Hyson, 2005, 2008). For example, a student with higher or more adaptive ATL should be able to focus on materials despite distractions from other students as well as cooperate with classmates (Blair, 2002; Raver, 2002).

A handful of longitudinal studies have examined the importance of the relationship between ATL and academic achievement. Duncan et al. (2007) reviewed six longitudinal studies that examined the relationship between school readiness as ATL and later school achievement in math and reading. Findings indicated that attention-related skills such as concentration, task persistence and self-regulation were consistently related to later reading and math achievement (Duncan et al., 2007). One other longitudinal study found that the achievement trajectories of children with more adaptive ATL grew faster than those with less adaptive ATL while accounting for race/ethnicity and socioeconomic status (Li-Grining, Votruba-Drzal, Maldonado-Carreno, & Haas, 2010).

3. ADHD and ATL

Children with ADHD as well as other disabilities with emotional and behavioral implications may exhibit different or less positive approaches to learning as compared to children without disabilities. Children with ADHD are typically characterized as having, "inattention and/or hyperactivity-impulsivity that interferes with functioning or development" (American Psychiatric Association, 2013, p. 59). In school settings, children with ADHD can have trouble persisting at certain tasks until finished as well as concentrating on tasks and ignoring distractions. These behaviors as related to symptoms of ADHD can lead to deficits in ATL, which could later be associated with less positive academic outcomes such as underachievement (Barry, Lyman, & Klinger, 2002; Hinshaw, 1992), lower subsequent IQ scores (Fergusson & Horwood, 1995), and lower achievement (Loe & Feldman, 2007). These less positive academic outcomes for individuals with ADHD have been documented for individuals as young as preschool-aged (DuPaul, McGoey, Eckert, & VanBrakle, 2001). Not surprisingly, children with ADHD who demonstrate educational need, which is associated with deficits in ATL, are frequently targeted for special education referral (Elder, 2010).

4. Impact of Pharmacological Intervention on ADHD

Pharmacological intervention is a common means of treating ADHD. For example, Safer and Zito (2000) found that anywhere from 52% to 71% of students with a clinical diagnosis of ADHD had been prescribed a psychotropic medication at one time point across the five years of study. Pharmacological interventions in general for treating ADHD appear to have been on an upward trend (Olfson, Gameroff, Marcus, & Jensen, 2003). These interventions have been associated with positive behavioral outcomes (e.g., Prasad, 2013; Ryan, Katsiyannis, & Hughes, 2011). Yet, the results are more mixed with respect to academic outcomes among children with ADHD (e.g., Ryan, Reid, Epstein, Ellis, & Evans, 2005; Scheffler, 2009).

In addition to intended outcomes, however, medications can have unexpected negative outcomes known as adverse events or side effects. Data from the existing literature suggest that medications for ADHD have been associated with physiological and cognitive side effects (e.g., Domnitei & Madaan, 2010; Lakhan & Kirchgessner, 2012; McDonagh, Peterson, Dana, & Thakurta, 2007; Meijer, Faber, van den Ban, & Tobi, 2009). Ryan et al. (2011) summarized the range of side effects associated with medications prescribed for ADHD, including but not limited to nervousness, headache, irritability, and dizziness. In a recent survey, 48% of 325 patients taking ADHD-related medications reported having experienced side effect(s) such as loss of appetite, sleep problems, mood disturbance, nausea, gastrointestinal pain, and headaches (Cascade, Kalali, & Wigal, 2010).

In addition to these physiological side effects, some research has indicated the possibility of adverse effects of ADHD medication on cognition (see Advokat, 2010 for review of literature). Studies based on samples of non-ADHD adults provide evidence that although stimulant medications for ADHD possibly improve retention of previously acquired information and facilitate memory consolidation, they may actually impair adaptation, flexibility and planning (Advokat, 2010). While symptoms of ADHD may adversely impact working memory (e.g., Alderson, Rapport, Hudec, Sarver, & Kofler, 2010; Kofler et al., 2011), Mattay et al. (2000) reported that an ADHD medication, *dextroamphetamine*, had a beneficial impact on adult, neurotypically developing participants with lower working memory capacity at baseline, but had a deleterious impact on participants with higher working memory capacity at baseline.

While there is limited literature addressing the effect of ADHD medication on creativity, the results from existing research are inconclusive. In a recent study, Fugate, Zentall, and Gentry (2013) found that gifted students with characteristics of ADHD (whether these children were taking medication is unknown) received higher mean scores on the Torrance Tests of Creative Thinking than students without characteristics of ADHD. Yet, in a quasi-experimental study, Funk, Chessare, Weaver, and Exley (1993) found that children with ADHD who were receiving pharmacological treatment on average were scored .80 standard deviations lower than children without ADHD on the Torrance Tests of Creative Thinking, which suggests that medicated children with ADHD may be less creative than children without ADHD. In a comparative study between college students with and without ADHD, White and Shah (2011) found that the individuals with ADHD exhibited more preference for idea generation (as a source of creativity), whereas the individuals without ADHD exhibited more preference for problem clarification and idea development. Krautkramer (2005) explicitly proposed that ADHD medications impede creativity, potentially hindering children's future success.

Despite the adverse effects associated with ADHD medications (e.g., sleep problems, mood disturbance and working memory) (Mattay et al., 2000; Ryan et al., 2011), ADHD medications have been clearly linked to significantly improved student behaviors related to ATL (i.e., attentiveness, hyperactivity and impulsivity) (Ryan et al., 2011). Thus, the purpose of the current study was to examine the relationship between ATL items and achievement comparing students with ADHD receiving medication to students without ADHD. We hypothesized that students with ADHD treated with medication should not significantly differ in their ATL characteristics as compared to students without ADHD. First, item response theory (IRT) techniques were employed to examine this relationship in conjunction with Classical Test Theory (CTT) techniques. We next examined the relationship of