ADHD and Reasoning Abilities: Bridging the Gap between Science and the Classroom

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Abstract

Human reasoning research using probability problem tasks offer a novel and exciting approach to understanding executive function impairments from a new perspective, such as with attention deficit/hyperactivity disorder (ADHD). ADHD is widely associated with lowered academic performance thought to arise from executive function deficits relating to inhibition, impulsivity, and attention. A wealth of research in executive function tasks and neurobiological fMRI studies cite impairments with executive inhibitory control as the origin of cognitive and behavioural deficits associated with ADHD.1,2,3,4 By integrating research from cognitive psychology on the science of reasoning, together with knowledge of ADHD and educational psychology, this research may offer new insight into the cognitive mechanisms of executive function impairments, such as with ADHD, to better prepare educators to instruct the 5% of children diagnosed with ADHD.5

Individuals typically implement a narrow range of procedural heuristics to simplify the process of problem-solving and decision-making, rather than systematically analyzing a problem through tedious rule-based approaches.6 Heuristic short-cuts are often based on prior experiences or beliefs that, while crucial to human survival, may sometimes be erroneous in nature.7,8 According to one account of dual process theories (DPT), our early judgments are considered to be drawn from fast, experiential, intuitive processes that conform to a belief bias (or the tendency to judge conclusions according to belief, regardless of validity).9 A central feature of these faster reasoning processes is autonomy; thus, beliefs generate a rapid default response, regardless of need, which must be suppressed for deeper analysis.10 Slower secondary processes enable analytic judgments that are effortful and taxing on working memory.11 As analytic reasoning must be deliberately engaged to override the quicker belief-based appraisals, it is assumed that slower logical evaluations do not interfere with intuitive responses. However, the autonomously produced and faster belief-based judgments are able to interfere with slower, more rational thinking operations.12

This master’s research examined and compared the reasoning abilities of university educated adults with and without ADHD. Both groups solved 24 base-rate problems in free time that asked for the likelihood of group membership for an individual (e.g., what is the likelihood that Paul is a doctor?) when offered two pieces of conflicting information: salient base-rates (3 doctors vs. 997 nurses) and a luring, but opposing, stereotypical description (Paul lives in a beautiful home in a posh suburb, is well spoken, interested in politics, and invests a lot of time in his career). The task was coupled with an instructional manipulation that asked reasoners to respond either with beliefs (cued by the stereotypical description) or to respond statistically by way of presented base-rates. For 12 randomly generated problems, base-rates and descriptions conflicted, cueing opposing judgments. Another 12 randomly generated problems had matching base-rates and descriptions that cued identical judgements. ADHD is broadly associated difficulties in inattention and impulsivity thought to originate from primordial deficits of executive inhibition.13 Thus, it was expected that ADHD participants would perform poorly on conflict problems when deciding with statistics, as inhibitory control is required to suppress the autonomously produced intuitive response derived from beliefs. It was very surprising to observe that ADHD reasoners were superior to controls at judging with statistics and on par with controls when deciding with beliefs. This is both startling and counterintuitive, considering ADHD is predominantly linked to difficulties in inhibition, attention to necessary tasks, and using working memory effectively.14, 15, 16

The literature supporting disinhibition theories of ADHD is solid, and yet ADHD participants did not demonstrate poorer reasoning abilities on a base-rate task widely assumed to require inhibitory control. This leads to the conclusion that perhaps base-rate problems do not measure inhibitory control, as is assumed.17 The fact that both groups were better at reasoning with statistics relative to beliefs challenges the assumption that base-rate processing
even requires deeper analytic processing. It may be that humans have a probabilistic intuition for processing base-rates spontaneously; 18 thus, suppression of an early, yet unfavourable response is not required.

A second finding is that ADHD reasoners were on par with controls in solving problems with beliefs. This reveals that ADHD reasoners are just as capable of encoding lengthy and ambiguous information as their non-ADHD peers, despite recognized cognitive deficits.

The third and most important finding is that ADHD reasoners were significantly better than controls when solving base-rate problems with statistics. This unexpected result raises the question of why this pattern emerged for ADHD thinkers. One hypothesis is that ADHD thinkers implemented a cost-effective cognitive strategy when clear, salient numerical information (base-rates) was offered that could be easily extracted for problem-solving. This strategy, however, was ineffective when resolving problems under the belief instruction that entailed the decoding of lengthy descriptive information.

The hypothesis of strategy use by ADHD reasoners was confirmed by comparing response latencies for both groups. For conflict problems, both groups required similarly longer response latencies to resolve problems with beliefs as compared to statistics. This corroborates that solving with statistics was easier than with beliefs, which contradicts serial models of DPTs. However, when solving non-conflict problems with beliefs – a task that should have been relatively easy as base-rates and descriptions cue the same response – the ADHD group required significantly more time than controls. This clearly evidences that ADHD participants have developed cost-efficient problem-solving strategy when clear, salient information is offered that can be easily extracted to solve the problem. However, they misapply this strategy to non-conflict problems when simple shortcuts could be used much more effectively. The over-application of this strategy on non-conflict problems resulted in longer latencies for the more difficult belief instruction.

The results evidence that ADHD university students are able to implement problem-solving strategies to overcome cognitive deficits when salient and easily extractable information is presented. This finding is vital for developing effective pedagogies relating to classroom instruction for students with ADHD. However, students must also be educated on the appropriate application of these strategies. Further comparative investigations related to ADHD and reasoning are vital to better understand the capacity for strategic learning in individuals with ADHD, leading to better more informed instructional approaches.