

## **SOCIAL PROBLEM SOLVING IN COOPERATIVE AND PROBLEMATIC CONTEXTS IN STUDENTS WITH AND WITHOUT ATTENTION DEFICIT HYPERACTIVITY DISORDER**

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*The social problem-solving capacities of students aged 9 to 12 years with Attention Deficit Hyperactivity Disorder (ADHD) (N=30) were compared to their non-ADHD peers (N=30) in hypothetical cooperative and problematic contexts. In the cooperative science task, the students with ADHD were more non-collaborative and less able to elaborate in response to their leader's proposal. The students with ADHD were more positive than their ambivalent non-ADHD peers at the prospect of cooperative group participation. When the problematic situation was presented, students were equally aggressive in response, the students with ADHD proposed more positive outcomes for perpetrator of the problem. Such studies of the more complex social and cognitive outcomes of ADHD are essential to progress their educational management beyond the current behavioral focus.*

The purpose of this study was to explore the social problem-solving capacities of students with and without Attention Deficit Hyperactivity Disorder (ADHD) in hypothetical science investigations that were first cooperative and then problematic. It was predicted that students with ADHD would be impaired relative to their non-ADHD peers because of hypothesized deficiencies in the executive functions of self-regulation and reconstitution that contribute to problem-solving ability.

### *Theoretical Framework*

Students with ADHD are characterized by core behavioral symptoms of hyperactivity, impulsivity, and inattentiveness that impact significantly on their learning and social participation in class. Effective management of the behavioral symptoms, through medication and behavior management strategies, leads to improvements in social outcomes and compliance in class (Jensen & Hinshaw, 2001). However, the effects of pharmacological and behavioral interventions on cognitive outcomes are less impressive, with an overall effect size of 0.28 reported in a recent meta-analysis of intervention (Purdue, Hattie, & Carroll, 2002).

The importance of studying cognitive outcomes for students with ADHD is emphasized by theoretical proposals that ADHD is a neuropsychological disorder of response inhibition (Barkley, 1997, 2000). The consequences of impaired response inhibition at a neurological level are particularly significant for the four associated

executive functions of nonverbal working memory, verbal working memory, self-regulation of emotion and motivation, and reconstitution. If educators are to understand the implications of ADHD for student achievement, it is essential to extend investigations beyond the behavioral impacts of the disorder, particularly as students move through school grades into more academically demanding contexts.

As students progress from childhood to adolescence, the hyperactivity symptoms of ADHD frequently diminish (Willoughby, 2003) and this is likely to mislead teachers that the disorder has diminished. However, the impairments of response inhibition and executive function are genetically determined to a large extent and are likely to persist, albeit in less conspicuous ways (Levy, Hay, McStephen, & Wood, 1997). Accompanying the transition from childhood to adolescence, the school curriculum also increases in cognitive complexity. From about age 9, students are expected to engage in problem-solving tasks that require self-regulation of actions over extended periods of time. The students with ADHD is therefore placed in a situation of double jeopardy: (1) teachers believe that the combined effects of medication and puberty have ameliorated the disorder, and (2) school tasks simultaneously place higher demands on the executive functions that are most implicated by the disorder.

The current study investigated social problem-solving embedded within a realistic task to explore the impact of ADHD on the responses of students aged 9 to 12 years. Clinical studies of social problem solving have demonstrated that boys with ADHD generate fewer solutions, and boys with combined ADHD and conduct disorders also generated more aggressive responses than peers without ADHD (Matthys, Cuperus, & van England, 2002). However, clinical studies tend to emphasize the most severe aspects of ADHD, which is now viewed not as a qualitatively discrete disorder, but rather as a disorder on a continuum from normal to impaired (Levy et al., 1997). If response inhibition is normally distributed across the population, then there is presumably a *grey area* along the levels of response. This distinction is important to recognize if teachers are to avoid responding negatively to all manifestations of distinction in students with ADHD, given that a range of disinhibition is expected among all students.

Social problem-solving tasks are particularly challenging for individuals with ADHD because problems require the generation of novel responses and goal-directed persistence (Barkley, 1997). With appropriate levels of inhibition, individuals are capable of analyzing situations into their component parts, and then drawing on previously unrelated units to generate novel outcomes. The creativity of the solution is given in part by the increasing fluency and flexibility of potential response elements. This joint process of analysis and synthesis is reconstitution, the fourth executive function. Goal-directed persistence is given as children learn to self-regulate their levels of arousal. In response to problem-solving tasks, individuals who lack response inhibition are therefore predicted to be (1) less fluent than their non-ADHD peers in generating responses to the problem and (2) more highly aroused in their affective response to new situations.

## **Method**

### *Participants*

The study sample (N=60) comprised of 30 students (27 boys, 3 girls) with ADHD and 30 students (27 boys, 3 girls) without ADHD, matched for age and gender, recruited

from elementary schools. The mean age of the ADHD group as 135.5 months and for the control group, 135.2 months (SD=12.5, Range=114-151 months, for both groups). Parents consented to allow the researcher to identify students with an ADHD diagnosis from school records. All testing was conducted in group settings during normal school hours, and students with ADHD were medicated with psycho-stimulant medication (Dexamphetamine or Methyl Phenidate).

#### *Data Sources*

##### *Cooperative Task*

In class groups, students were shown a poster and the accompanying vignette was read aloud to the class: *Here are three boys in a science lesson. The teacher is saying to the boys,*

*“I have an interesting science problem for you to solve in your group. On your table you have some straws, two wooden blocks, some pins, a pair of scissors, a bag of weights and a little cart to hold the weights. Your job is to build a strong bridge. You must design the bridge to carry as much as weight as possible. When you have finished the bridge, we will count how many weights it can hold. You must work in groups of 3 and you have 10 minutes to solve this problem. You can’t use any other material. Start now.”*

Students were then directed to write responses to four questions printed on the answer sheet:

1. *Now imagine you are the blue boy. When the teacher goes away, what will you say?*
2. *What does the green boy say next?*
3. *How does the green boy feel?*
4. *What does the green boy do?*

On completion of this task, the second and third posters were displayed and the second vignette was read: *Here are the same three boys in another science lesson. The teacher is saying to the boys, “I have an interesting electrical problem for you to solve in your groups. On your table, you have some batteries and a light bulb joined by electrical wires. The wires have two crocodile clips at the ends. When you clip the end together, the light bulb shines and tells you that the electricity is flowing through the circuit. Over here we have some objects – a piece of candle, a metal strip, some metal rings, a plastic strip, a key. Your job is to find out which if these objects will conduct electricity. You must work in groups of 3 and you have 10 minutes to solve this problem. You can’t use any other material. Start now.”* As soon as the teacher goes away, the green boy fiddles with the equipment and breaks the light bulb. In the second picture, he is saying to the blue boy, *“Look! I have broken the bulb!”*

The same four questions were presented and the students wrote their second set of responses. Written responses were analyzed qualitatively by the researcher. They were coded on the basis of the categories that emerged.

#### **Results and Conclusions**

##### Task 1: Cooperative group task

Q1.1 *What does the blue boy say?* All students responded as if the blue boy was the group leader, and they initiated either *No strategy* (e.g. *How do you make this?*), a *General strategy* (e.g. *Let’s get started and make it strong*), or a *Specific strategy* (e.g.

*Why don't we put the straws on the blocks and pin them in?*). There were minimal differences in the proportions of responses between the two groups.

Table 1.1 Initiation	No strategy	General strategy	Specific strategy
ADHD	26.7%	40.0%	33.3%
Control	26.7%	43.3%	30.0%

Q1.2 *What does the green boy say?* The green boy's rejoinder was either *non-collaborative* (e.g. *Stop being bossy, blue boy!*), *acquiescent* (e.g. *Good idea!*) or *elaborative* (e.g. *If we double the straws up, it could make it stronger*). The students with ADHD generated more non-collaborative comments, and fewer elaborative comments than their non-ADHD peers.

Table 1.2 Rejoinder	Non-collaborative	Acquiescence	Elaborative
ADHD	26.7%	23.3%	50%
Control	10%	23.3%	66.7%

Q1.3 *How does the green boy feel?* The green boy's affective tone was described as *positive* (e.g. happy, excited) or *negative* (e.g. annoyed, worried, unsure). The students with ADHD generated many more positive comments than their more ambivalent non-ADHD peers.

Table 1.3 Affective tone	Positive	Negative
ADHD	72.4%	27.6%
Control	43.3%	56.7%

Q1.4 *What does the green boy do?* The outcomes for the green boy were coded as *conflict* (e.g. *He argues with the blue boy*), *non-participation* (e.g. *The green boy gives up and starts playing with the wooden cart*) or *constructive participation* (e.g. *He lays the straws over the wood and starts to pin*). The two categories (combined) of nonproductive outcomes are slightly more frequent among the non-ADHD students than their ADHD peers.

Table 1.4 Outcomes	Conflict	Non-participation	Constructive participation
ADHD	6.7%	13.3%	80%
Control	3.3%	23.3%	73.3%

The ranked and dichotomous scores for each of the variables 1.1 to 1.4 were then entered into a Linear Discriminant analysis (using SPSS Version 11.5) to determine which of the variables discriminated among ADHD and non ADHD students. Two variables, the Rejoinder (1.2) and Affective tone (1.3), contributed to the analysis and enabled 66.1% of the original grouped cases to be classified correctly.

#### Task 2: Problematic situation

Q2.1 *What does the blue boy say?* Two dimensions were evident for coding purposes, the leader's affective response to the green boy's announcement they he had broken

the bulb, and the leader's capacity to generate a proposal to address the situation. The affective response was coded as *neutral* (e.g. *We're going to need another one*), *accusative* (e.g. *You are such an idiot!*) or *sarcastic* (e.g. *You wrecked an assignment! Good on ya!*). The majority (80%) of responses from both ADHD and non-ADHD students were aggressively accusative or sarcastic.

Table 2.1 Leader affect	Neutral	Accusative	Sarcastic
ADHD	20%	66.7%	13.3%
Control	20%	63.3%	16.7%

The leader's responses to address the situation were divided between pessimism (*no proposal, can't do task, will get in trouble*) and optimism (*seeks alternative, tell the teacher, ask for replacement*), with the non-ADHD students identifying more optimistic proposals (50%) than the ADHD students (30.1%).

Table 2.1B Leader proposal	No proposal	Can't do task	Trouble	Seeks alternative	Tell the teacher	Replacement
ADHD	43.3%	13.3%	13.3%	6.7%	6.7%	16.7%
Control	23.3%	23.3%	3.3%	10%	10%	30%

Q2.2 *What does the green boy say?* The responses attributed to the perpetrator of the broken bulb varied from *reactive* (e.g. *You don't have the guts to tell on me*) to *placatory* (e.g. *Take it easy, okay, I will get another one*), with differences in the distribution of responses for the two groups. The students with ADHD were more likely to be reactive (i.e. highly aroused to respond (e.g. *Shut up! Why don't you do it yourself?*) or contrite, accepting responsibility, feeling sorry, but not generating solutions (e.g. *sorry, now what?*). In contrast, the non-ADHD students dismissed the incident (e.g. *Who cares?* or *It doesn't matter*) claimed more creatively that the breakage was accidental (e.g. *I didn't mean to break it; Whoops, I'm a bit clumsy*) or placated the group by proposing solutions (e.g. *I'll get another one; We will just make up our answers*).

Table 2.2 Perpetrator response	Reactive	Dismissive	Resigned	Accidental	Contrite	Placatory
ADHD	23.3%	3.3%	10%	16.7%	33.3%	13.3%
Control	3.3%	20%	6.7%	30%	6.7%	33.3%

Q2.3 *How does the green boy feel?* The student responses to this question were significantly diverse, including *angry, anxious, ashamed, disappointed, embarrassed, guilty, sad, and stupid*. The majority of responses from ADHD (70%) and non-ADHD (63.3%) students indicated that the green boy acknowledged that he felt...*bad about wrecking the assignment*.

Q2.4 *What does the green boy do?* The outcomes for the green boy who has caused the problematic situation for the group range from *negative* (e.g. *He cries in a corner*) to constructive *replacement* of the bulb (e.g. *He asks the teacher for a new one*). The students with ADHD are more likely to anticipate positive outcomes (80%) while the non-ADHD students are divided between negative/passive (46.6%) and more positive outcomes (53.3%).

Table Q2.4	Negative	Passive	Tries to fix it	Tells teacher	Replaces bulb
ADHD	10%	10%	20%	20%	40%
Control	33.3%	13.3%	23.3%	13.3%	16.7%

The ranked scores for each of the variables 2.1A, 2.1B, 2.2 and 2.4 were then entered stepwise into a Linear Discriminant analysis (using SPSS Version 11.5) to determine which of the variables discriminated among ADHD and non ADHD students. The single variable Perpetrator Outcome (2.4) contributed to the analysis and enabled 65% of the original grouped cases to be classified correctly.

#### *Educational and Scientific Importance of the Study*

The study confirms that students with ADHD are less fluent in their elaboration of responses to the cooperative group task (Q1.2). They also appear to be more highly aroused in a positive sense, since they responded with positive outcomes both to the prospect of group participation (G1.3) and in their attempts to rectify the problem (Q2.4). However, when confronted with a conflict, some students with ADHD responded initially with higher negative arousal, reacting angrily to the accusation that they had broken the light bulb, while others were contrite, and few of them could immediately generate a verbal responses that deflected blame or placated the group (Q2.2).

The students without ADHD are more self-regulated and possibly more reflective in their affective reactions to aspects of the task. They perceived more sources of uncertainty than the impulsive enthusiasm of the students with ADHD for the first task (Q1.3) and were less likely to imagine that the problem if the broken bulb could be overcome (Q2.4). When confronted with their error, the students without ADHD were less reactive in their initial verbal responses, and more readily deflected the attention of the group, either by dismissing the problems, or by proposing that the breakage was accidental and that they could easily fix the problem. These findings are therefore consistent with Barkley's model (1997, 2000) of execution dysfunction in ADHD, demonstrating the impulsive high arousal of students with ADHD and their problems in generating fluent responses to problems.

It is also interesting to note the extent of aggressive response among all the students to the problematic social situation. The students responses signaled a high level of distress that the project would not be able to be completed, and demonstrates the unintentional levels of stress that teachers may create through the demand characteristics of learning tasks. From an adult perspective, it would not be challenging to tell the instructor and/or ask for a replacement globe, yet this solution was proposed by less than half (45%) of all respondents (18/30 ADHD students and 9/30 non-ADHD students). It is evident that the attribution of aggressive responses to disorders such as ADHD may be inappropriate without consideration of stressors for

all students within many classrooms, particularly when assessment tasks are presented.

The development of the social problem-solving tasks within a familiar classroom context and the qualitative analyses of the student responses have provided valuable insights to the cognitive capacities and emotional responses of students with and without ADHD. The outcomes suggests that students with ADHD may benefit from explicit structured consideration of consequences and deliberate creative strategies to improve the fluency of their ideas, and will assist teachers to promote more considered learning that goes well beyond limited behavioral level of analysis.

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