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ADHD symptom magnitude predicts creative problem-solving performance and insight versus analysis solving modes

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ABSTRACT

Executive-function deficits associated with Attention-Deficit/Hyperactivity Disorder (ADHD) symptoms have been hypothesized to benefit creativity via enhanced access to remote, non-obvious associations. This suggests that ADHD may facilitate the unconscious, automatic (Type-1) processing mode responsible for creative *insight* (i.e., the "Aha" phenomenon) while diminishing conscious, deliberate (Type-2) *analytic* processing. We tested this hypothesis in an online study in which 299 participants completed the Adult ADHD Self-Report Scale to assess ADHD symptom severity and attempted to solve a series of Compound Remote Associates problems to assess insight- versus analytic-based problem-solving. Individuals with the highest ADHD symptom severity relied more on insight than analysis compared to those with the lowest symptoms. Both the extreme high- and low-ADHD symptom groups outperformed those in the middle of the distribution to yield a U-shaped curve, suggesting that strong and weak executive function facilitate different pathways to solution while moderate executive function is less effective. Regression analyses suggest that stronger ADHD symptoms diminish analytic solving while enhancing insight solving, explaining the U-shaped curve. These findings support previous research which suggests two routes—and profiles—for creative problem solving: deliberate analysis versus spontaneous insight, the latter associated with stronger ADHD symptoms.

1. Introduction

Although highly creative individuals have been characterized as distractable, inattentive, and impulsive (Li et al., 2022; Radel et al., 2015), symptoms of ADHD (Faraone et al., 2024), research on a possible connection between ADHD and creativity has yielded inconsistent evidence (Hoogman et al., 2020). This potential link, if present, is important because it would verify a common stereotype about creative individuals and elucidate mechanisms underlying individual differences in creative cognition. We tested this hypothesis by examining the relationship between ADHD symptom magnitude and one manifestation of creativity: *insight* (i.e., the "Aha!" phenomenon; Kounios & Beeman, 2014).

1.1. Creativity and ADHD

Creativity is commonly defined as the generation of ideas or products that are novel and contextually appropriate (Runco & Jaeger, 2012). Prominent accounts posit that such products result from complementary cognitive processes: unfocussed associative processing versus focused, goal-directed thinking (Chrysikou, 2019; De Dreu et al., 2024) which roughly correspond to the Type-1 versus Type-2 process distinction (Evans & Stanovich, 2013).

Creativity is often classified as divergent versus convergent (Zhang et al., 2020). Divergent-thinking tasks require an individual to generate as many ideas as possible in response to a prompt. Convergent-thinking paradigms require a participant to produce the single best solution; for example, in the Compound Remote Associates task used in this study (CRA; Bowden et al., 2005), the solution is a single word that can combine with three other given words to form familiar compound words

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or phrases. Both divergent- and convergent-thinking tasks involve creativity because they require a person to generate nonobvious ideas.

The divergent/convergent distinction is between the types of tasks used to measure creativity rather than the types of processes involved. Individuals participating in a convergent-thinking task may generate many potential solutions, as in a divergent-thinking task, before selecting one as the best. Conversely, the generation of multiple ideas during a divergent-thinking task may involve repeatedly – and convergently – solving the same problem, as in sampling without replacement. The generation of ideas in both types of tasks could, in principle, occur by insight or analysis (defined below), although this has not yet been demonstrated empirically for divergent-thinking tasks.

While ADHD-related executive-process deficits can reduce performance on tasks that depend on cognitive control, the "leaky" attention and reduced inhibition associated with weak executive processing can facilitate creativity by enabling greater breadth of ideation leading to the discovery of remote, nonobvious associations (Carson et al., 2003; White & Shah, 2011; Zabelina et al., 2016).

A recent review of studies examining the relationship between ADHD and creativity suggests that the effects of ADHD depend on task type and symptom severity (Hoogman et al., 2020). Although that review noted that many of those studies were underpowered, they found that in 22 of 31 studies of divergent thinking, individuals without a formal diagnosis of ADHD but who had moderate ADHD symptoms tended to generate more original responses than did non-ADHD controls. Studies using convergent-thinking tasks found no relationship between ADHD and problem-solving. More recently, a larger study supported these conclusions, finding significant, but weak, correlations between divergent-thinking measures and self-reported ADHD symptoms (r-values: 0.16 to 0.22) but no significant relationship between ADHD and convergent-thinking performance (Stolte et al., 2022).

1.2. *Insight and analysis*

Hoogman et al. (2020) noted that previous studies of the relationship between convergent-task creativity and ADHD may have failed to find such a relationship because those studies examined solution rates without accounting for possible differences in the underlying processing modes participants used to generate solutions. They speculated that individuals with and without ADHD may differ in their reliance on insight versus analytic processing modes.

Analytical problem-solving involves conscious, deliberate (Type-2) processing of problem elements, whereas insight is characterized by unconscious, automatic (Type-1) processing leading up to the sudden emergence of a solution into awareness as an "Aha!" experience (Evans & Stanovich, 2013; Kounios & Beeman, 2014). While both insightful and analytic processing modes can yield correct solutions, certain tasks are more conducive to insight, especially those involving ill-structured problems that require a nonobvious response or shift in perspective (Kounios & Beeman, 2015). Even across trials within a task, insight and analysis are associated with distinct behavioral and neurocognitive signatures (Jung-Beeman et al., 2004; Kounios et al., 2008; Oh et al., 2020; Salvi et al., 2015, 2016). Moreover, individuals differ in a trait-like predilection towards one processing mode over the other, reflecting the contribution of stable individual differences in brain activity (Erickson et al., 2018). Studies also suggest that individuals with poorer attentional control, a greater tendency to mind-wander, or who are subjected to manipulations that reduce executive function (e.g., alcohol intoxication, time-of-day) are more likely to achieve insights (Amer et al., 2016; Wiley & Danek, 2024).

1.3. *Overview*

ADHD involves decreased (Type-2) executive function (Faraone et al., 2024). Insight relies more on unconscious Type-1 processing than Type-2-dependent analytic processing (Chesebrough et al., 2024; Stuyck et al., 2022). Individual differences in executive function, indexed by ADHD symptom magnitude, could therefore underlie both ADHD-related deficits and enhanced creative insight, potentially providing the "missing link" relating creative problem-solving and ADHD. We therefore tested the hypothesis that individuals with stronger ADHD symptoms should show greater reliance on insight compared with non-ADHD individuals in a standard task used for assessing insightful versus analytic solving. We also report a U-shaped function relating overall problem-solving performance to ADHD symptom magnitude that results from individual differences in the balance between insightful and analytic solutions.

2. Methods

2.1. *Participants*

The subjects ($n = 299$ after exclusions) were undergraduates. This was the number of participants that we were able to test during the four academic terms available for data collection. (For demographics see Table SM1 in the Supplementary Materials.) They participated in this online study for course credit. All were native English speakers, ages 18–33, who agreed to obtain adequate sleep the night before testing. Students were excluded if they reported any diagnosed psychiatric condition (other than ADHD) or if they had any known brain damage from illness or injury. Participants agreed to avoid alcohol or recreational drug use for 24 h prior to testing.

Consistent with prior research (c.f., Oh et al., 2020), we excluded sessions produced by subjects who: reported medication use; did not complete the study; attempted fewer than 10 CRA puzzles; participated twice; exhibited extreme rates of solving with just insight or just analysis (i.e., greater than 98% solutions achieved with one processing mode, suggesting routinized, bad-faith responding); or whose solution rate was less than 5% (indicating bad-faith participation). Multiverse analyses (Steegen et al., 2016) showed that the results were insensitive to plausible alternative exclusion rates. Trials were included in the analyses only when (a) the spacebar was pressed, indicating the time of solution, and (b) a solution was entered.

2.2. *Materials*

2.2.1. *ADHD symptoms*

ADHD-symptom magnitude was assessed with the ASRS 1.11, a World Health Organization clinical instrument consisting of 18 questions with 5-point Likert scales pertaining to hyperactivity and inattention (Kessler et al., 2005). We used version 1.11 rather than the ASRS-5 because it has more questions that provide additional information (Ustun et al., 2017). Participants rated ADHD symptom frequency over the past 6 months (1 = never or rarely, 5 = very often). We assessed symptom magnitude with the total score based on all 18 items rather than with the clinical threshold used to refer an individual for follow-up formal diagnostic evaluation because the threshold method is biased towards classifying people as having ADHD (Chamberlain et al., 2021).

We also computed separate scores for inattentive and hyperactive ADHD based on the items relevant to those subtypes. The subtype scores were highly correlated ($r = 0.70$, $p < .001$), so we did not analyze them further.

2.2.2. *Dispositional insight*

One possibility is that participants judge more of their solutions as resulting from insight rather than analysis because they believe themselves to be insightful. To measure self-perceived insightfulness as a potential confounding factor to be controlled for in the statistical analyses, participants completed the 15-item Dispositional Insight Scale (DIS; Ovington et al., 2016). Participants reported their agreement or disagreement with statements on a 7-point Likert scale.

2.2.3. Positive and negative affect

Insight is facilitated by positive mood (Subramaniam et al., 2009), We therefore administered the Positive and Negative Affect Scale (PANAS; Watson et al., 1988) to assess baseline mood as a potential confounding factor. The PANAS is a 20-question scale that asks participants to rate the degree to which a subject has felt a particular emotion within a specified timeframe (1 = very slightly or not at all, 5 = extremely). Given that ADHD is a persisting condition, we instructed participants to report their average mood over the previous 2 weeks. Results of mood analyses reported below therefore reflect longer-term trends rather than momentary effects of mood on problem-solving.

2.2.4. Medications, health conditions, sleep

Participants reported whether they used any medication that impacts cognition and any neurological conditions or learning disabilities. They were also asked whether they had difficulty concentrating at the time of testing due to tiredness.

2.2.5. CRAs

Sixty Compound Remote Associates problems, a standard assessment of insightful versus analytic solving, were drawn from published norms (Bowden & Jung-Beeman, 2003). Each CRA consists of three words that are all associated with a fourth word that forms a common compound word or phrase. For example, *aid/rubber/wagon* has the solution “band” (as in *band-aid*, *rubber band*, *bandwagon*). These were presented in three 20-problem blocks with breaks of up to 2 min between blocks. Solutions and response times were recorded.

2.3. Procedure

Subjects participated in one 1-h online session via Pavlovia.org. After providing demographic information, they filled out the PANAS followed by the DIS. Then, they viewed an instructional video that provided standard criteria for distinguishing between solving with insight and analysis: suddenness and awareness of how they solved the problem (Erickson et al., 2018; Becker et al., 2025.) The insight judgment procedure has been validated by many studies for nearly three decades and has been shown to reflect cognitive (e.g., Kounios et al., 2008; Salvi et al., 2016), psychophysiological (e.g., Salvi et al., 2015), and neural (e.g., Becker et al., 2025; Erickson et al., 2018; Jung-Beeman et al., 2004; Oh et al., 2020; Subramaniam et al., 2009) differences associated with insightful and analytic judgments. To accurately measure solution time, participants were instructed not to take extra time to verify their solution to a problem before pressing the response button.

Participants completed 3 practice CRAs followed by 60 experimental CRAs (Fig. 1) or as many as they could within the allotted hour. Then, they completed the ASRS.

3. Results

3.1. Data analysis

Intercorrelations among the main variables are available in Table SM2 in the Supplementary Materials.

Since we did not initially know whether any potential effect of ADHD symptom magnitude on problem-solving would occur as a graded effect across the distribution of ASRS scores or whether it would occur only at the extremes of the distribution, our strategy was to first compare the distribution tails. We divided the distribution into 5 quintile bins based on their total ASRS scores. These bins are designated as Q1 (bottom quintile) through Q5 (top quintile). We divided the distribution into quintiles rather than, for example, quartiles because multiverse analyses showed that quintiles optimized the tradeoff between n per bin (for statistical power) and the distance of the observations from the median of the distribution (to maximize the distance between the extreme bins).

3.1.1. ASRS and insight

Mean numbers of correct solutions, errors, timeouts (i.e., trials without a response), and mean correct-response times per quintile-bin are shown in Table 1. To determine whether Q5 participants (those with the highest ASRS scores) solved CRAs with insight rather than analysis more often than Q1 individuals (with the lowest ASRS scores), we performed a 2(Q1 versus Q5) X 2(insight versus analysis solution-type) ANOVA on the number of problems solved correctly. This revealed a significant interaction (F[2, 244] = 3.49, p = .032, $p\eta^2$ = 0.03) but no main effects (Q1/5: F[2, 244] = 0.76, p = .47, $p\eta^2$ = 0.007; solution-type: F[1, 244] = 0.44, p = .51, $p\eta^2$ = 0.002). A post-hoc t-test showed that the Q5 group solved significantly more CRAs with insight than analysis (t(56) = 2.46, p = .034 (Bonferroni-adjusted), 95% CI [0.56, 5.54], Mdiff = 3.05, d = 0.33). This difference was nonsignificant for Q1 (t(68) = −0.32, p = 1.00, 95% CI [−2.49, 1.80], Mdiff = −0.35, d = −0.04) but trended in the opposite direction (Fig. 2a). A t-test comparing the Q1 and Q5 mean response-times yielded no evidence that the interaction effect was attributable to different speed-accuracy tradeoffs (t[1, 119.44] = −0.70, p = .48, d = −0.13).

To determine whether this Q1/5 X solution-type interaction is attributable to differences in mood (Subramaniam et al., 2009), the ANOVA was repeated as separate ANCOVAs that included PANAS-derived mood variables as covariates: total positive affect (PA), total negative affect (NA), positive-minus-negative affect (i.e., net positive affect or valence, PA-NA), and positive-plus-negative affect (i.e., affective arousal, PA + NA). The solution-type × Q1/5 interaction remained significant after including each mood covariate separately (F[2, 243] = 3.47–3.52, ps = 0.031–0.033). As before, the main effects of solution-type (F[1, 243] = 0.43–0.44, p = .51) and Q1/5 (F1, 243] = 0.76–0.77, p = .47) were nonsignificant. None of the mood covariates reached significance when entered individually, although Total PA (F[1, 243] = 2.81, p = .095) and PA + NA (F[1, 243] = 3.12, p = .079) showed

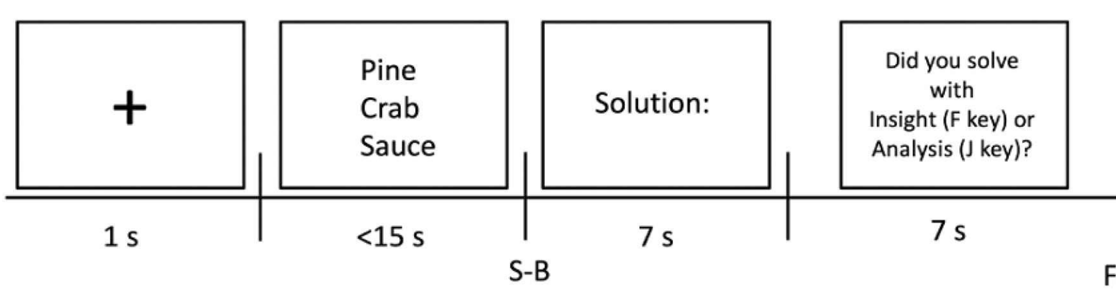

Fig. 1. CRA trial procedure. The preparatory prompt included a 1-s fixation cross. The CRA stimulus was then displayed for 15 s. When participants arrived at a solution, they pressed the spacebar (indicated by S—B in the figure), after which a “Solution:” message was displayed to prompt them to type the answer into a solution box. Then the “Insight/Analytic” message was displayed for 7 s to prompt them to press the “F” or “J” key to indicate which strategy led to the solution (indicated by F-J). (Figure adapted from Oh et al., 2020.)

Table 1
Task Performance (SD).

Variable	Overall N = 299	Q1 N = 52	Q2 N = 59	Q3 N = 68	Q4 N = 55	Q5 N = 65
Correct						
Total	17.45 (6.35)	18.96 (5.76)	16.83 (6.92)	15.99 (5.97)	17.42 (6.24)	18.38 (6.49)
Insight	9.29 (5.11)	9.02 (4.89)	9.00 (4.79)	8.82 (4.66)	8.91 (5.41)	10.58 (5.68)
Analysis	8.06 (5.42)	9.90 (5.66)	7.73 (5.24)	7.06 (4.38)	8.42 (6.03)	7.65 (5.62)
RT (s)						
Insight	6.52 (1.86)	6.68 (1.96)	6.23 (1.86)	6.60 (1.87)	6.65 (1.99)	6.45 (1.68)
Analysis	7.82 (1.98)	7.68 (1.67)	7.53 (1.80)	8.07 (2.02)	7.73 (1.94)	8.02 (2.32)
# Errors						
Insight	4.96 (6.08)	4.75 (6.10)	6.15 (7.75)	5.21 (6.10)	3.76 (4.60)	4.80 (5.33)
Analysis	6.12 (6.22)	6.21 (5.77)	6.37 (5.69)	6.37 (5.81)	7.85 (8.58)	4.08 (4.50)
Timeouts	19.59 (11.26)	18.96 (10.82)	19.88 (12.46)	20.18 (13.16)	19.55 (9.65)	19.26 (9.76)

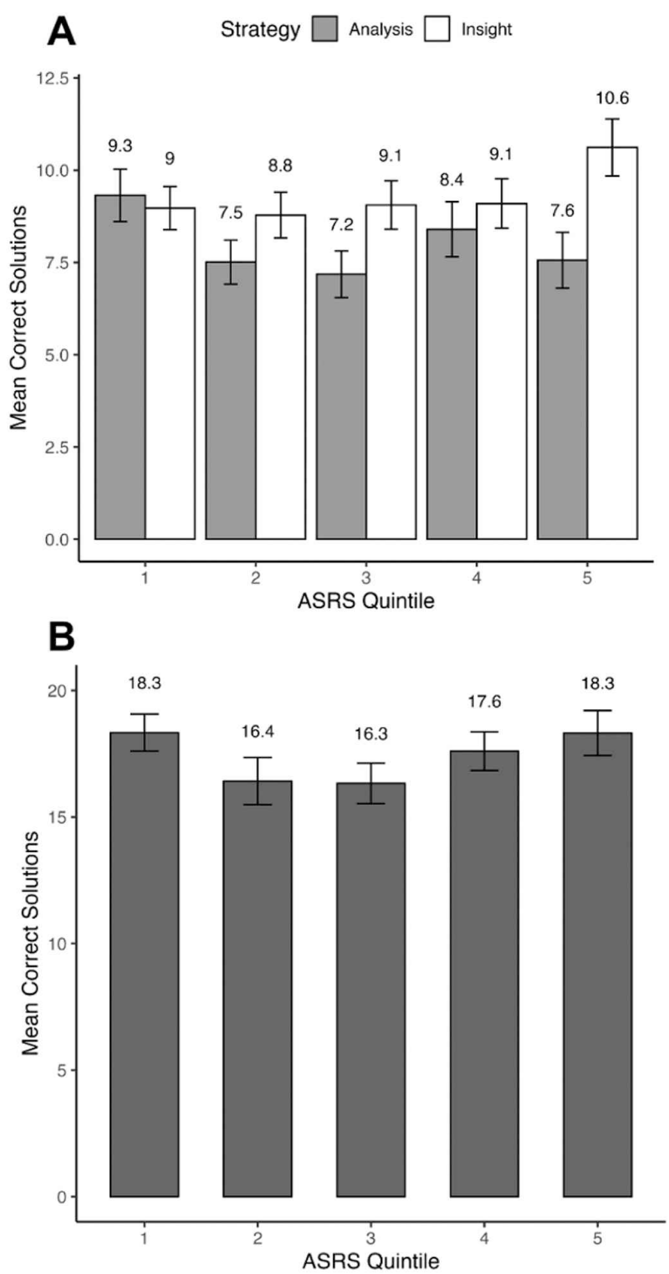

Fig. 2. (A) Mean correct solutions (± 1 SE) by solution-type (insight versus analysis) per ASRS quintile; (B) mean total correct solutions by ASRS quintile.

marginal trends suggesting a weak covarying relationship between ASRS scores and positive affect and total affect on the tendency to solve more CRA problems insightfully. Total NA, PA–NA, and DIS were nonsignificant ($F[1, 243] = 0.005$–2.42, $p = .12$–0.94). Again, the Q1/5 X solution-type interaction remained robust, while neither the main effects nor the mood covariates accounted for the effect.

To assess whether participants' self-perception of insightfulness could have influenced these results, we repeated this ANCOVA using DIS as a covariate. The Q1/5 X solution-type interaction was still significant ($F[1, 243] = 3.47$, $p = .033$), while the main effects of Q1/5 ($F[2, 243] = 0.75$, $p = .47$), solution-type ($F[1, 243] = 0.43$, $p = .51$), and DIS were nonsignificant ($F[1, 243] = 0.005$, $p = .94$).

In sum, although the participants in our sample reporting the strongest and weakest ADHD symptoms solved approximately the same number of problems, participants in highest-symptom group solved significantly more problems with insight than analysis compared with the lowest-symptom group. This effect was not attributable to differences in processing speed, mood, or self-perceived insightfulness.

3.1.2. Full-distribution ASRS analyses

Visual inspection of the relationship between the total number of correct solutions and the numbers of insight versus analytic solutions across all five quintiles (Fig. 2A) revealed that the function relating the total number of problems solved to ASRS scores appears U-shaped such that the lowest and highest ASRS groups solved more problems than the middle groups (Fig. 2B). Notably, the lowest performance is most evident in participants in the middle of the distribution. This observation was supported by an ANOVA which compared the extreme bins (Q1 and Q5) to the middle bins (Q2, Q3, and Q4), revealing a significant main effect ($F[1, 297] = 4.29$, $p = .039$, $p\eta^2 = 0.01$), indicating that performance differed between the tails and middle of the distribution. There was also a significant main effect of solution-type ($F[1, 297] = 6.32$, $p = .013$, $p\eta^2 = 0.02$), confirming that averaged across the full ASRS distribution, participants solved more items via insight than analysis (Table 1). The solution-type × group interaction was not significant ($[1, 297] = 0.004$, $p = .95$, $p\eta^2 < 0.000$), indicating that the difference between insight and analysis performance did not vary between middle and extreme ASRS groups.

Follow-up ANCOVAs showed that this pattern is not attributable to differences in mood or dispositional insight. Across all models, the Q1 versus Q5 main effect remained significant ($F[1, 296] = 4.28$–4.30, $p = .039$), whereas none of the covariates were significant predictors of accuracy ($F[1, 296] = 0.03$–1.56, $p = .21$–0.86).

To further characterize the relationship between ADHD symptoms and problem-solving performance, we modeled the total number of correct solutions, correct insight solutions, and correct analytic solutions as continuous functions across the ASRS distribution. Given the U-shaped relationship in Fig. 2, we fit both linear and quadratic regression models. ASRS scores were mean-centered prior to regression analyses.

The linear function predicting the total number of correct solutions from ASRS scores was not significant ($\beta = 0.02$, $p = .72$). A model including the quadratic term of ASRS was a significantly better fit than the linear model ($F[1] = 6.10$, $p = .014$). In this model, the quadratic ASRS term significantly predicted total correct solutions ($\beta = 0.11$, $p = .012$, CI = [0.02–0.19]), while the linear term remained nonsignificant ($\beta = 0.03$, $p = .62$) (Fig. 3A).

3.1.3. Separately modeling insight and analysis

Given that individuals in the highest ASRS group solved significantly more problems via insight than analysis compared to the lowest ASRS group, we tested whether the quadratic relationship between CRA performance and ASRS scores reflected a trade-off between insight and analytic solutions

For insight solutions, the linear relationship with ASRS was positive and significant ($\beta = 0.11$, 95% CI [0.00, 0.23], $p = .05$). Adding a quadratic term did not significantly improve fit ($F[1297] = 1.73$, $p = .18$), and the linear effect remained significant ($\beta = 0.12$, 95% CI [0.01, 0.23], $p = .047$). We also examined the proportion of correct responses solved via insight (# correct insight solutions/total # correct solutions) to control for differences in overall performance. A similar pattern was observed: Higher ASRS scores predicted a marginally greater likelihood of correct insights ($\beta = 0.11$, 95% CI [0.00, 0.22], $p = .07$), with no evidence of quadratic curvature ($F[1] = 0.53$, $p = .46$) (Fig. 4B).

For analytic solutions, the linear effect of ASRS was negative and nonsignificant but trended in the predicted direction ($\beta = -0.09$, 95% CI [−0.20, 0.03], $p = .12$). Adding a quadratic term marginally improved fit ($F[1] = 3.32$, $p = .07$), with the quadratic coefficient trending positive ($\beta = 0.07$, 95% CI [−0.01, 0.16], $p = .07$) and the linear term attenuated ($\beta = -0.08$, 95% CI [−0.20, 0.03], $p = .14$). When expressed as a proportion of correct solutions that were analytic, the negative linear effect became stronger and statistically significant ($\beta = -0.12$, 95% CI [−0.23, − 0.00], $p = .046$) (Fig. 3B); the addition of a quadratic term did not improve model fit, ($F[1] = 0.54$, $p = .46$). This suggests that quadratic trends in the count of analytic solutions in mid-range ASRS scores may reflect individuals with moderate levels of executive control producing fewer correct solutions overall.

Although analyzing insight and analytic performance separately reduced statistical power because each score was based on fewer trials, the resulting models are consistent with the idea that the quadratic pattern in total correct solutions reflects opposing contributions from insight and analytic modes. This interpretation is supported by an increase in the difference between each participant's number of insight and analytic solutions with increasing ASRS (β = 0.12, 95% CI [0.01, 0.24], $p = .032$; Fig. 3C). As ASRS scores increase, individuals solve proportionally more problems via insight and fewer via analysis (c.f. Amer et al., 2015, Fig. 3). The dip in total correct performance at mid-range ASRS scores also appears to contribute to the overall quadratic form, indicating that these participants tended to produce fewer correct responses.

4. Discussion

4.1. Summary

The results supported our central hypothesis: although participants with the strongest and weakest ADHD symptoms solved approximately the same number of problems, those with the strongest symptoms solved more by insight than analysis, while those with the weakest symptoms solved insightfully and analytically at approximately the same rate. Thus, a tendency towards creative insight may be an affordance of reduced executive control associated with ADHD. Our findings support the idea that insight and analysis, which correspond to the Type-1 versus Type-2 thinking framework (Stuyck et al., 2022), are distinct processing modes that depend to different degrees on executive function, for which ADHD symptoms are a proxy (Chesebrough et al., 2024).

We also found a U-shaped relationship between ADHD symptom magnitude and participants' total number of correct solutions in which participants in the lowest and highest ADHD-symptom groups significantly outperformed the middle. This is surprising because we could have predicted that individuals with intermediate-strength executive skills might have both insightful- and analytic-solving modes at their full disposal and be able to solve more problems than individuals who have relatively stronger or weaker executive skills. Rather, our data suggest that intermediate-strength executive skills may not be conducive to full recruitment of either mode. Converging regression analyses suggest that the curvilinear relationship between ADHD symptoms and CRA solving may reflect anti-correlated trends: As ADHD symptoms increase, the likelihood of solving via insight rises while the likelihood of solving analytically decreases (cf. Amer et al., 2016, Fig. 3). These trends may cancel each other out when examining overall performance, potentially

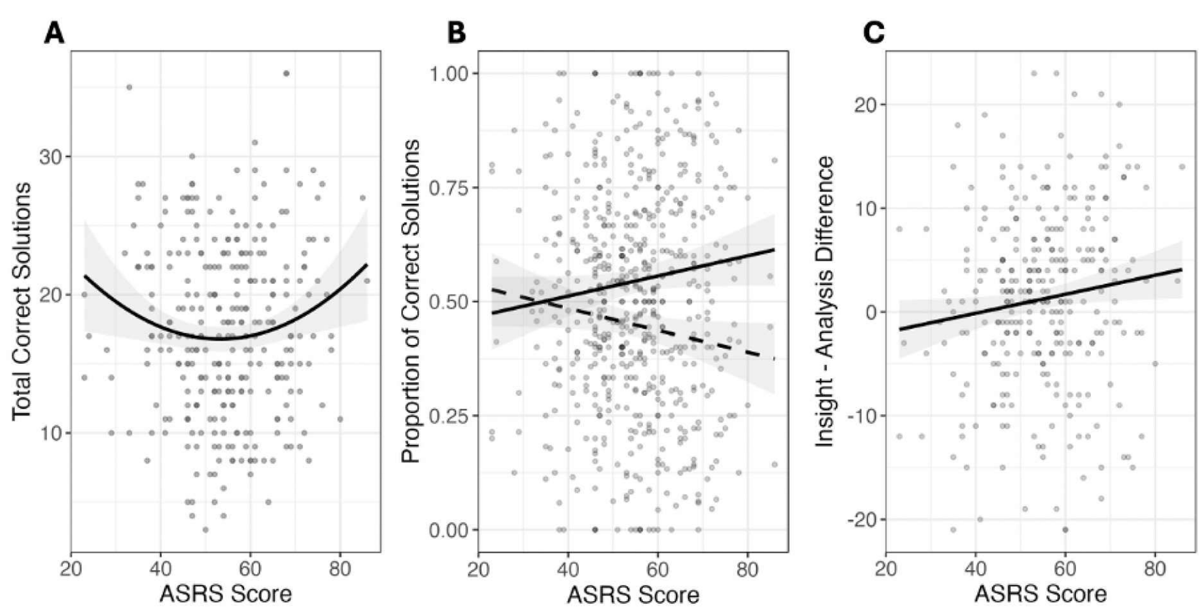

Fig. 3. A: Scatterplots with regression lines. A: best-fitting model (quadratic) relating the total number of correct solutions to ASRS scores; B: Linear models relating the proportion of correct solutions that were analytic (dotted line) and insightful (solid line) to ASRS scores; C: linear model relating the number of insight solutions minus the number of analytic solutions to ASRS scores.

explaining the null linear relationship between ADHD and convergent problem-solving reported in previous research (Stolte et al., 2022).

4.2. Conclusions and future directions

Prior work on the relationship between ADHD and creativity may warrant reinterpretation. The present finding of greater insightful solving in a convergent-thinking task in individuals with elevated ADHD symptoms suggests that previous work showing weak, but significant, correlations between divergent-thinking performance and ADHD may be due to more insight-based idea generation during divergent-thinking tasks rather than to ADHD-related enhancement of a distinct divergent-thinking faculty. Further research could explore this possibility by assessing insightful versus analytical solving in divergent-thinking tasks.

Importantly, it is the overall pattern of results rather than the magnitude of any single test that supports the robustness of our findings. Every analytic approach (bin-based ANOVAs, quadratic regression, linear regression on insight versus analytic trials, difference-score modeling) converged on the same conclusion: ADHD symptoms are associated with a shift in problem-solving style, with higher symptom levels corresponding to relatively greater use of insight over analysis, and with overall performance differences emerging primarily at the extremes of the symptom distribution. These are precisely the effects predicted by theory: we expected small differences in solution strategy and expected any performance differences to be localized to the tails of the ASRS distribution rather than across the full sample.

Nevertheless, our sample size, while large compared to most problem-solving experiments, provided only moderate power. Thus, replication with larger and more diverse samples, including participants diagnosed with ADHD, will be helpful for confirming the robustness and generalizability of our findings. This is particularly important for the observed inverted-U function which we did not explicitly predict. Furthermore, although our screening procedures excluded participants who reported ancillary neurological or psychiatric disorders linked to executive dysfunction, undiagnosed conditions may still have been present; future work should more directly assess how different sources of executive-function variation relate to creativity (Chamberlain et al., 2021). Finally, studies should examine whether the observed patterns extend beyond CRAs to other types of creativity tasks.

In conclusion, characterization of ADHD solely in terms of deficits misses the big picture (Schippers et al., 2022). Research into its affordances, particularly in creative fields, could reveal improved opportunities and life outcomes for ADHD individuals in a society that may not expect them to succeed (De Neys & Raoelison, 2025).

CRediT authorship contribution statement

Hannah Maisano: Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Data curation, Conceptualization. **Christine Chesebrough:** Writing – review & editing, Writing – original draft, Visualization, Validation, Software, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Fengqing Zhang:** Writing – review & editing, Validation, Supervision, Software, Formal analysis. **Brian Daly:** Writing – review & editing, Methodology, Conceptualization. **Mark Beeman:** Writing – review & editing, Validation, Methodology, Conceptualization. **John Kounios:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Methodology, Investigation, Formal analysis, Conceptualization.

Informed consent

Informed consent was obtained from all participants involved in this study.

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Declaration of competing interest

The authors declare that they have no conflicts of interest.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.paid.2026.113660.

Data availability

The data and analysis code are available at https://osf.io/mx9u7/.

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Supplementary Materials for

ADHD Symptom Magnitude Predicts Creative Problem-Solving Performance and Insight Versus Analysis Solving Modes

ASRS-Score Distribution

The ASRS scores were normally distributed (Figure SM1). The range was 23-86 (out of 90). The ASRS bin-ranges were Q1: 23-46, Q2: 47-52, Q3: 54-57, Q4: 58-65, and Q5: 66-86. (The numbers of participants were not precisely equal across quintile bins because some scores fell on bin boundary values; quintile boundaries were automatically adjusted up or down.) Participant demographics are shown in Table SM1. Demographic information pertaining to age and gender was not collected from 91 participants due to a technical issue.

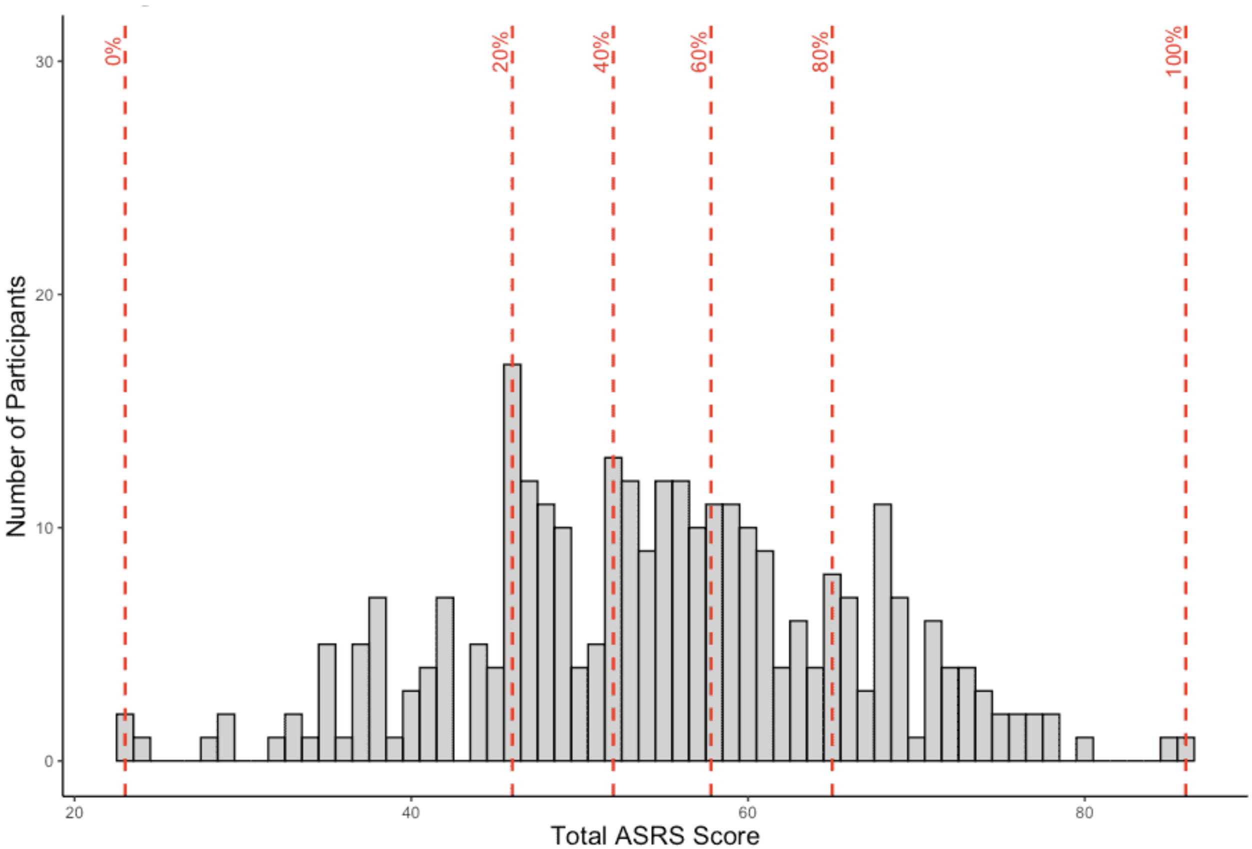

Figure SM1. The distribution of total ASRS scores for the 299 included participants.

Table SM1. Participant Characteristics (SD)

Variable	Overall N = 299	Q1 N = 52	Q2 N = 59	Q3 N = 68	Q4 N = 55	Q5 N = 65
DIS	22.01 (4.55)	20.52 (4.65)	21.25 (4.53)	21.87 (4.39)	22.69 (4.73)	23.48 (4.08)
Mood						
PA	27.02 (4.92)	25.98 (4.00)	25.53 (5.04)	26.81 (4.68)	27.64 (5.39)	28.89 (4.76)
NA	29.46 (4.64)	30.25 (4.25)	27.81 (4.65)	28.47 (4.08)	29.75 (4.86)	31.11 (4.68)
PA-NA	-2.44 (3.97)	-4.27 (3.34)	-2.29 (3.82)	-1.66 (4.35)	-2.11 (3.82)	-2.22 (3.94)
PA+NA	56.47 (8.70)	56.23 (7.54)	53.34 (8.91)	55.28 (7.64)	57.38 (9.52)	60.00 (8.59)
Differential Diagnoses	31 (10%)	0 (0%)	1 (1.7%)	12 (18%)	6 (11%)	12 (18%)
Gender						
Female	109 (52%)	20 (61%)	19 (46%)	22 (45%)	23 (58%)	25 (54%)
Male	93 (44%)	13 (39%)	22 (54%)	27 (55%)	15 (38%)	16 (35%)
Other	7 (3.3%)	0 (0%)	0 (0%)	0 (0%)	2 (5.0%)	5 (11%)
Unknown[1]	90	19	18	19	15	19
Mean Age	19.45 (2.45)	20.33 (3.15)	19.15 (1.20)	19.14 (1.77)	19.25 (2.55)	19.59 (3.12)
Unknown[1]	90	19	18	19	15	19

[1]Due to a technical issue 91 people did not receive questions on age and gender

Table SM2. *Correlation table of individual difference measures, CRA problem-solving style, and CRA performance*

Variable	M	SD	1	2	3	4	5	6	7	8	9	10
1. Correct Insight	9.29	5.11										
2. Correct Analysis	8.06	5.42	-.28** [-.38, -.17]									
3. Total Correct	17.45	6.35	.57** [.48, .64]	.63** [.56, .69]								
4. Total Attempts	28.44	9.44	.14* [.02, .25]	.20** [.09, .31]	.27** [.16, .37]							
5. Total Timeouts	28.15	11.2	-0.06 [-.17, .05]	-0.1 [-.21, .02]	-.13* [-.24, -.01]	-.91** [-.93, -.88]						
6. Total DIS	22.01	4.55	.12* [.01, .23]	-.11* [-.22, -.00]	0 [-.11, .11]	0.04 [-.07, .15]	-0.05 [-.16, .06]					
7. PA-NA	-2.44	3.97	0.08 [-.03, .19]	-0.01 [-.13, .10]	0.06 [-.06, .17]	0.01 [-.10, .13]	-0.05 [-.16, .06]	-0.05 [-.16, .07]				
8. Total PA	27.02	4.92	.13* [.02, .24]	-0.1 [-.22, .01]	0.02 [-.10, .13]	0.07 [-.05, .18]	-0.09 [-.20, .02]	.15* [.03, .26]	.47** [.38, .56]			
9. Total NA	29.46	4.64	0.07 [-.04, .18]	-0.1 [-.21, .01]	-0.03 [-.14, .08]	0.06 [-.05, .17]	-0.05 [-.17, .06]	.19** [.08, .30]	-.35** [-.45, -.25]	.66** [.59, .72]		
10. PA+NA	56.47	8.7	0.11 [-.00, .22]	-0.11 [-.22, .00]	-0.01 [-.12, .10]	0.07 [-.04, .18]	-0.08 [-.19, .03]	.19** [.07, .29]	0.08 [-.04, .19]	.92** [.90, .93]	.90** [.88, .92]	
11. Total ASRS	54.78	11.43	.11* [-.00, .22]	-.09 [-.20, .03]	.02 [-.09, .13]	-.06 [-.17, .05]	.03 [-.08, .14]	.23** [.12, .33]	.17** [.06, .28]	.23** [.12, .33]	.09 [-.02, .21]	.18** [.07, .29]

Note. *M* and *SD* are used to represent mean and standard deviation, respectively. Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation (Cumming, 2014). * indicates $p < .05$. ** indicates $p < .01$.

Sample Size and Analytical Considerations

Our analytic strategy intentionally targeted contrasts where meaningful ADHD-related differences were theoretically most likely to appear. Because prior studies consistently found weak or null relationships between ADHD symptoms and overall creative problem-solving on convergent thinking tasks, we reasoned that collapsing across all problem-solving strategies may obscure effects that emerge only when considering how people solve problems (insight versus analysis). We sought to examine the tails of the ASRS distribution, where shifts in strategy preference should be most pronounced. This approach is aligned with the theoretical model outlined in Amer et al. (2016) on the relationship between cognitive control and performance on tasks that benefit from diffuse attention. Having first examined our hypothesis in a subset of the highest and lowest ASRS bins, we extended our analyses to the full ASRS spectrum to characterize the broader relationship between ADHD symptoms and problem-solving performance across the entire distribution. We hypothesized that the apparently null linear relationship between overall problem-solving performance (i.e., total correct) would likely be composed of competing opposite relationships between ASRS and insight versus ASRS and analysis, in the observed direction. Given the logic of our hypotheses, we report the results of the ANOVA analyses first, followed by the regression analyses.

Because a central aim of the study was to compare ADHD symptom groups defined categorically (e.g., high versus low symptoms, or multiple symptom-severity bins), we estimated that detecting small but meaningful effects would require a total sample size of approximately 300–400, depending on bin size. Continuous analyses were estimated to require at least 200 participants to achieve sufficient power to detect small effects. We initially achieved a total sample of 398, meeting our target. A nontrivial proportion of participants did not meet inclusion criteria or performance thresholds. Following data collection, we also elected to exclude participants who reported current ADHD medication use, as the number of such participants was insufficient to include medication status as a separate factor. These exclusions yielded a final usable sample of 299, corresponding to approximately 60% power to detect small effects. Data collection was ultimately constrained by the practical limits of participant recruitment. Replication and extension efforts are currently underway. Although the final sample-size does not constitute a “large N” by conventional survey research standards, it is substantially larger than those of most prior studies examining ADHD and creativity. As noted by Hoogman et al. (2020), most previous work in this area has relied on samples of fewer than 100 participants. Our study therefore represents a meaningful increase in sample-size relative to the existing literature.