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Mathematical cognition: individual differences in resource allocation.

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Summary: Individuals scoring higher in tests of general cognitive abilities tend to perform better on novel and familiar mathematical tasks. It has been scarcely investigated how this superior mathematical performance relates to the amount of cognitive resources that is invested to solve a given task. In this study we propose that, on novel tasks, individuals with high cognitive abilities outperform less able individuals, because they allocate a higher amount of resources. On familiar tasks, however, individuals with higher abilities profit from more efficient processes compared to individuals of lower cognitive abilities. We tested this hypothesis by administering to 11th graders a geometric analogy task not practiced at school and an algebraic transformation task comprising operations that are routinely required during mathematical courses. General cognitive abilities were measured with Ravens Advanced Progressive matrices (fluid intelligence), the d2 (focused attention) and KAI-N (working memory capacity). Resource allocation was measured by assessing pupil diameter during the problem-solving process. Performance on both the analogy and the algebra task was correlated with general cognitive abilities, especially fluid intelligence. In line with our assumptions, a positive correlation between fluid intelligence and resource allocation was observed in the novel geometric analogy task, whereas the correlation was not significant in the more familiar algebra task.

Classification: C30 C40 C80 M60
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