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Does solving insight-based problems differ from solving learning-based problems? Some evidence from an ERP study.

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Summary: We asked: “What are the similarities and differences in mathematical processing associated with solving learning-based and insight-based problems?” To answer this question, the ERP research procedure was employed with 69 male adolescent subjects who solved specially designed insight-based and learning-based tests. Solutions of insight-based problems were not related to the learning experience but rather to an “Aha!” moment. As learning-based problems, we employed tasks that require comparing the areas of geometric figures. The analysis was performed through the lens of mathematical performance in students who differed in the combination of levels of general giftedness (G) and excellence in school mathematics (EM). Alongside a quantitative analysis of the effects of EM and G factors on accuracy, reaction time, strength of the electrical potentials and their topographical distribution, we performed a qualitative comparison of the differences in the effects of EM and G factors associated with the two types of tests. We demonstrate that an analysis of the behavioral measures is insufficient and even misleading and argue that neurocognitive analysis is crucial for the understanding of the distinctions between mathematical processing associated with solving different types of problems. Analysis of the electrical potentials evoked when solving the two types of problems demonstrated that excellence in school mathematics affects learning-based problem solving but does not affect insight-based problem solving. Based on the observation of the increased activation of PO4-PO8 electrode site as related to G and EM factors, we further hypothesize that the ability to solve insight-based problems is a specific personal aptitude related mainly to general giftedness, while experience-based problem solving by experts involves insight-related components at the stage of problem understanding.

Classification: D50 C30 C80

Keywords: insight-based problem solving; learning-based problem solving; general giftedness; excellence in mathematics; neuro-cognition; event-related potentials (ERP)

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