

Neuroscience study reveals new link between basic math skills and PSAT math success

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(Medical Xpress)—New research from Western University provides brain imaging evidence that students well-versed in very basic single digit arithmetic ($5+2=7$ or $7-3=4$) are better equipped to score higher on the Preliminary Scholastic Aptitude Test (PSAT), an examination sat by millions of students in the United States each year in preparation for college admission tests.

In findings published today in *The Journal of Neuroscience* (www.jneurosci.org/content/33/1.abstract.pdf) research led by Daniel Ansari, Associate Professor in Western's Department of Psychology and a principal investigator at the Brain and Mind Institute, showed by utilizing functional magnetic resonance imaging (fMRI) on high school seniors that there was a significant link between their brain responses while solving extremely basic, single digit calculation problems and standard scores on the PSAT.

"The surprising thing here is that we found both a positive and negative relationship between [brain activation](#) during the very elementary, single digit arithmetic tasks and how well they did on the PSAT test, which measures advanced, high school level math skills," says Ansari, Canada Research Chair in Developmental Cognitive Neuroscience.

Students that scored better on the PSAT math tests generated greater positive activation in a brain region in the left side of the brain, called the supramarginal gyrus, which is known to be linked to fact retrieval, while students that scored lower, produced more activity in an area in the

right side of the brain, called the intraparietal sulcus, which is involved in quantity processing and more effortful problem solving.

"Essentially, this means that those high school students that don't do so well on the PSAT use more problem solving strategies when they are doing very elementary sums and subtractions," offers Ansari. "If you are a high school student and you are using [brain circuits](#) that we know are associated with fact retrieval and fluency, we see evidence that you are also going to score better on the math portion of the college admission test. There is a clear link between fluency and high level abilities – being fluent at basic math counts."

This new knowledge is important from a math education perspective, concludes Ansari, because traditionally, debate rages between the "drill and kill" style approach versus more conceptual, problem-solving based pedagogy, but it is now clear that both methods are important in elementary education. These findings suggest that the way in which the [brain](#) is organized for single digit arithmetic calculation predicts performance on more complex math skills, illustrating the critical role that arithmetic fluency plays in building mathematical proficiency among students.

Given that the evidence is correlational, future studies following children from early elementary school through to high school will be needed to shed light on the specific ways in which acquisition of basic arithmetic fluency influences the learning of the kinds of skills tested by the PSAT.

Provided by University of Western Ontario

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