

disabilities. This result held for deaf, autistic, dyslexic, and language-delayed children. These excellent learning rates by the children with severe learning disabilities will aid in planning more ambitious reforms in the language-and literacy-facilitating procedures of educators, special educators, and speech language pathologists. In addition, across all educational domains Dynamic Tricky Mix strategies are powerful catalysts for moving any child from a "stuck" position toward truly rapid learning. We draw further implications from our rapid vocabulary acquisition intervention work with ordinary 4-year-olds. In this case we demonstrated that with twice-weekly sessions vocabulary growth across 5 months leaped forward compared with matched control children. Many children learned at the astonishing rate of 20 new lexical items per hour. By the use of pretest/posttest comparison data on cognitive processes we further demonstrate that the experimentally-caused leap in vocabulary had cascading effects on improved memory and related cognitive skills. Thus, rapid gains by the intervention children dynamically fed into their becoming better prepared for further rapid gains in language acquisition. In turn, this set of findings enriches accounts at the theoretical level of how so much language learning usually can be achieved in the preschool years. Likewise, in evolutionary terms these kinds of mutual enhancements between language progress and cognitive processing power may help elucidate periods when there are explosive rates of changes in *Hominin* cultures and in brain size and capacity.

**Keywords:** *Children's language advances, dynamic systems, educational interventions, language.*

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## **CORRELATIONAL ANALYSIS BETWEEN APPROXIMATE NUMERICAL ESTIMATE AND MATH ABILITIES: A STUDY WITH FIRST-GRADE SCHOOL STUDENTS**

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### **Abstract**

The number sense has two characteristics: subitizing – the immediate and error-free recognition of numbers from one to three, without counting – and the ability to discriminate between numbers with values greater than the subitizable ones. Without counting, this type of discrimination is done by approximate estimate, from which a numerical approximation system is inferred. Although the approximate numerical estimate is considered innate, it is influenced by factors such as the ratio between the sets to be compared, external factors, in addition to its increasing accuracy with age. This cognitive ability has been identified as a “predictor” for academic achievement in mathematics. The presented research aimed to investigate the existence of a correlation between the approximate number estimate and math skills in first-grade school children. The study was carried out with 34 children aged between six and seven years old. Their math skills were measured using the Test of Early Mathematical Abilities (TEMA-3), which was administered following the protocol, designed to measure general formal and non-formal math skills of children from 3 to 8 years-old. The approximate number estimate was measured using *Panamath* – a software that managed the discrimination task –, consisting of comparisons of several pairs of sets, indicating the largest. The exposure time of the stimuli was set at 1200 ms and the ratio of the difference between the sets was systematically varied. The results showed an ease of distinction based on the proportions of the sets in the numerical approximation system test. This study investigated the possibility of a correlation between performance in the number sense activity with those of mathematical skills, as it is assumed that the greater the child's sensitivity to differentiating the proportions between sets, the better his performance in solving the mathematical problems addressed, accordingly to previous studies. Even though the Pearson's correlation coefficient was 0.31 ( $p = 0.07$ , a little higher than accepted), the value indicates a moderate to weak correlation and a possible prediction in mathematical abilities based on performance in the numerical discrimination task, although there are other variables to consider in the mathematical development. The approximate number system test can be used as a tool to do and initial track of children who might experience problems in developing math skills.

**Keywords:** *Numerical estimation, number sense, math abilities, counting.*

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