

## News from the field

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### EDUCATION

#### Benefits of Math App

Berkowitz, T., Schaeffer, M. W., Maloney, E. A., Peterson, L., Gregor, C., Levine, S. C., & Beilock, S. L. (2015). Math at home adds up to achievement in school. *Science*. doi:[10.1126/science.aac7427](https://doi.org/10.1126/science.aac7427)

As the mother of three kids, I am always interested in research examining how I can support their education at home. A recent paper in *Science* examined the effects of using of a math app at home called Bedtime Learning Together.

The study involved distributing an iPad Mini to 587 families with first grade children from 22 schools in the Chicago area. App usage was tracked for a school year. The families were assigned to two groups. One group was the math activity experimental group and the other group was the reading activity control group. Both groups read passages and then answered questions about what they read. The reading and math passages differed in that the reading passages lacked numerical and spatial content. The key difference was the nature of the questions that the app asked about the passage. Unlike the questions asked of the reading activity control group, the math passage questions included geometry, counting fluency, arithmetic, fractions, and probability. The children's math achievement levels were tested at the beginning and the end of the school year and sorted as a function of how frequently the app was used. The results showed that higher usage math group significantly increased in math abilities by the end of the year relative to the reading group. The authors also examined the effects of app usage as a function of the anxiety toward math reported by the parents in a math-anxiety questionnaire at the beginning of the school year. Children with parents who scored high on the math-anxiety scale improved significantly

more on the math achievement scale when the app was used once a week relative to less than once a week.

This study adds to the limited research on the effectiveness of apps that purport to have educational benefits, concluding that this app does increase math ability. As a parent of a third and second grader, I have noticed that first graders (the age group tested) are rarely assigned math homework, even at top schools. The authors also pointed out reading and spelling are more often stressed to parents at this age, raising the question whether the app specifically benefits children or if assigning math homework requiring parent involvement explains the increased math ability. Perhaps an active control group, where children are assigned math homework requiring parent involvement, would show a similar improvement in math ability relative to an experimental group that used the app. The authors suggest the app may have been particularly effective at encouraging parents to work with children due to its design, suggesting that perhaps homework requiring parental involvement may not show similar benefits. I look forward to future research elucidating the role of educational apps to implement at home for my three children.—Dr. Ashleigh M. Maxcey

### VISUAL SEARCH

#### Visual Search Practice

Clark, K., Appelbaum, L.G., van den Berg, B., Mitroff, S.R., Woldorf, M.G. (2015). Improvement in visual search with practice: Mapping learning-related changes in neurocognitive stages of processing. *The Journal of Neuroscience*, 35(13), 5351–5359.

Visual search improves with practice, but relatively little is known about how this occurs. The challenge is that behavioral measures like reaction time and accuracy reflect the outcome of a series of processing stages; it is unclear at what point in

this neurocognitive sequence that practice exerts an influence. Clark et al. address this problem by looking to event-related potential components that index specific processing stages.

Participants completed five sessions of a simple visual search task with electroencephalogram recorded in the first and last. From this data, the authors extracted a series of event-related potential components known to index specific processing stages: the bilateral N1 (sensory processing), the N2pc (attentional selection), the CDA / SPCN (manipulation of visual information in memory), stimulus-locked LRP (response preparation), and response-locked LRP (response execution). Results showed an increase in bilateral N1 amplitude, reflecting improved sensory processing, but no latency effect on this early component. The N2pc, in contrast, was both faster and larger. This increase in the strength and speed of attentional allocation appeared to reduce the need for subsequent access to mnemonic representations of the stimuli, as evident in a smaller CDA / SPCN. Finally, both response preparation and execution improved, as seen in speeding of the LRP components. These results suggest that practice creates a cascade of effects in visual search, beginning with a benefit to sensory processing. Together, these ultimately increase the efficiency of search.

One future application of this technique that we find particularly interesting is the assessment of neurocognitive training. Interest in neurocognitive training has recently grown dramatically, both in research and everyday life (if you haven't yet, take a look at Nintendo's brain training games). These are marketed as a means of maintaining cognitive health, particularly during aging. Clark et al. introduce the use of ERPs in the assessment of such cognitive practice, opening the opportunity the evaluation of such commercial programs, and perhaps ultimately the development of games targeted to individual.—Dr. Christina Lavalley and Dr. Clayton Hickey

## ATTENTION

### Debates in Attentional Capture

Gaspelin, N., Leonard, C.J., and Luck, S.J. Direct evidence for active suppression of salient-but-irrelevant sensory inputs. *Psychological Science*. doi:[10.1177/0956797615597913](https://doi.org/10.1177/0956797615597913)

There has been considerable research examining the characteristics of attentional capture, with a great deal of this focus being directed towards the question of whether capture is primarily stimulus driven or goal driven. A new study by Gaspelin, Leonard, & Luck in *Psychological Science* provides evidence instead for a hybrid account wherein salient distractors elicit a signal that can influence attentional allocation, but said signal can be actively suppressed in a top-down manner as a function of task goals. To examine this signal-suppression hypothesis, the researchers used a novel paradigm which required participants to search for a target defined by a shape singleton—indicating whether a black dot appeared to the left or right of the target—in a display consisting of identically colored distractors and a salient distractor of another color. Probe trials were intermittently dispersed throughout the experiment which required participants to indicate the letters appearing on the target and distractor shapes. In an initial experiment in which attentional capture would be expected (participants search for a shape singleton and this singleton-detection mode increases the likelihood that the color singleton will also capture attention), participants were more likely to report letters appearing on the irrelevant color singleton relative to other distractors in the display. In a critical follow-up experiment, however, participants were required to detect a specific shape (a diamond or circle, counterbalanced across participants) as opposed to a singleton in a display consisting of four different shape types (one diamond, one circle, two squares, two hexagons). With a reduced motivation to attend to singletons, the question in this case was what the impact of a color singleton would be on the probe task. Participants were less likely to report letters appearing on the color singleton relative to other distractors in the display, consistent with the notion that the singleton was suppressed in a goal-driven manner. These results provide a potential resolution to the ongoing attentional capture debate by demonstrating the moderating effects of both bottom-up and top-down processes, and the specific conditions under which each process is likely to prove most influential Dr. Michael M. Dodd.