

Now is the time to work on improving cognitive health, researcher says

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Marriam Mansoor (at left) observes Ben Katz (at right) demonstrate how to use the fNIRS brain-imaging machine, which Diana Devine, (at center) is wearing on her head. Credit: Felicia Spencer for Virginia Tech

Everyone knows that eating a balanced diet and exercising are important

to maintaining one's physical health, but what about one's cognitive health—the ability to think, learn, and remember? Staying physically and cognitively healthy are important, but a decline in both directly impacts one's mental acuity, and a decline in episodic memory may be an indication of early stages of dementia.

For over five years, Ben Katz has been studying executive function—working memory, inhibitory control, and [cognitive flexibility](#)—throughout the lifespan. How people stay sharp as they grow older and what happens to the brain during the [aging process](#) are questions the Virginia Tech researcher contemplates in his studies. According to Katz, the set of cognitive processes, which are involved in controlling and regulating thought and action, change over time and are affected by more than one factor throughout the course of development.

"I was a game designer for six years at an educational company in Austin, Texas, and later at a brain training company in San Francisco," said Katz, assistant professor in the Department of Human Development and Family Science in the College of Liberal Arts and Human Sciences. "It was at the second workplace that I started having a lot of questions about improving cognitive function. I learned that in order to answer those questions I would have to go back to school."

Katz, also an Institute for Society, Culture, and Environment (ISCE) scholar, has collaborated with other researchers to look at the various aspects of executive function including the effects of interventions such as cognitive training and noninvasive brain stimulation as well as the influence of individual difference factors such as age, social interactions, use of mobile technologies, and lifestyle.

One noninvasive brain study involved the use of a scanner to look at the neural mechanisms of the executive processes. "While people are doing a challenging task, we can see where the [neural activity](#) is using the

physical properties of oxygenated blood," said Katz. "A scanner uses the magnetic properties of the neural substrate, and we can identify which regions of interest might be involved in different interventions or experiences." With a [functional magnetic resonance](#) imaging scanner, Katz localizes where task-related activity is in the brain.

In another study, Katz used technology focused on the effects of direct current stimulation of the brain on social and economic cognition in older adults.

"This technology involves running a current through the scalp that hopefully reaches the cortex, potentially modulating our ability to assess neural resources during certain tasks," said Katz.

The question he is examining is whether the participants would make economic or social decisions differently, particularly those involving risk, after the noninvasive brain stimulation. When comparing the use of this technology in other research studies, Katz found that "it is less helpful within a single use, but it may be helpful over multiple sessions."

In collaboration with Brenda Davy and Kevin Davy, both from the Department of Human Nutrition, Foods, and Exercise in the College of Agriculture and Life Sciences, Katz and Brenda Davy looked at water consumption, because dehydration can impair cognition, and being better hydrated may improve cognitive function over time. The second study, conducted with Kevin Davy, featured the use of ketogenic supplements in middle-age and older adults.

"We found some promising evidence that the ketogenic supplements improved certain aspects of cognitive function, for example, executive attention," said Katz.

Interested in whether differences in race or ethnicity affect cognitive

functioning, Katz found there were nuanced effects related to social networks.

"One positive takeaway is that aspects of one's social network can be associated with better cognitive functioning, but it might work differently according to your cultural background. There is a rich tapestry of experiences and perspectives that people bring to these studies, and our relationships may be associated with both protective effects and risk as we age," said Katz.

Katz also is collaborating with Tae-Ho Lee, an assistant professor in the Department of Psychology in the College of Science, on one large study focusing on middle school students. They are building a math program for sixth-grade students to increase their executive function in a way that is relevant and meaningful to them and will connect with their interests. This research allows Katz to study cognitive function from an applied perspective.

"I think of the contextual factors that influence us over the course of life. People don't live in a laboratory environment," said Katz.

Having delved into the neural mechanisms of the brain's executive functions, Katz still has more to learn.

"There is not a silver bullet to maintaining cognitive function as you get older, but there may be a series of lifestyle changes or factors that we might be able to help facilitate that could help someone stay independent longer or stay sharp for as long as possible," he said.

What does Katz recommend to maximize one's [cognitive health](#)?

Maintain a [healthy diet](#), stay hydrated, get aerobic exercise, seek out novel means of cognitive engagement, get adequate sleep, maintain a

supportive social network, and reduce stress.

His last words of advice: "The time to get started maintaining cognitive function is today."

Provided by Virginia Tech

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