

Portable brain-mapping device allows researchers to 'see' where memory fails

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Bioengineering Professor Hanli Liu, left, and Alexa Smith-Osborne, associate professor of Social Work, discuss their work with student veterans who have Post Traumatic Stress Disorder. Credit: UT Arlington

UT Arlington researchers have successfully used a portable brain-mapping device to show limited prefrontal cortex activity among student veterans with Post Traumatic Stress Disorder when they were asked to recall information from simple memorization tasks.

The study by bioengineering professor Hanli Liu and Alexa Smith-Osborne, an associate professor of social work, and two other collaborators was published in the May 2014 edition of *NeuroImage: Clinical*. The team used functional near [infrared spectroscopy](#) to map [brain](#) activity responses during cognitive activities related to digit learning and memory retrieval.

Smith-Osborne has used the findings to guide treatment recommendations for some veterans through her work as principal investigator for UT Arlington's Student Veteran Project, which offers free services to veterans who are undergraduates or who are considering returning to college.

"When we retest those student veterans after we've provided therapy and interventions, they've shown marked improvement," Smith-Osborne said. "The fNIRS data have shown improvement in brain functions and responses after the student veterans have undergone treatment."

Liu said this type of brain imaging allows us to "see" which brain region or regions fail to memorize or recall learned knowledge in student veterans with PTSD.

"It also shows how PTSD can affect the way we learn and our ability to recall information, so this new way of brain imaging advances our understanding of PTSD." Liu said.

This study is multi-disciplinary, associating objective brain imaging with neurological disorders and social work.

While UT Arlington bioengineering faculty associate Fenghua Tian is the primary author assisted by bioengineering graduate research assistant Amarnath Yennu, collaborators of the study include UT Austin psychology professor Francisco Gonzalez-Lima and psychology

professor Carol North with UT Southwestern Medical Center and the Veterans Administration North Texas Health Care System.

Khosrow Behbehani, dean of the UT Arlington College of Engineering, said this collaborative research is "allowing the researchers to objectively measure the changes in the level of oxygen in the brain and relate them to some of the brain functions that may have been adversely affected by trauma or stress."

Numerous neuropsychological studies have linked learning dysfunctions – such as memory loss, attention deficits and learning disabilities – with PTSD.

The new study involved 16 combat veterans previously diagnosed with PTSD who were experiencing distress and functional impairment affecting cognitive and related academic performance. The veterans were directed to perform a series of number-ordering tasks on a computer while researchers monitored their brain activity through near infrared spectroscopy, a noninvasive neuroimaging technology.

The research found that participants with PTSD experienced significant difficulty recalling the given digits compared with a control group. This deficiency is closely associated with dysfunction of a portion in the right frontal cortex. The team also determined that near infrared spectroscopy was an effective tool for measuring cognitive dysfunction associated with PTSD.

With that information, Smith-Osborne said mental healthcare providers could customize a treatment plan best suited for that individual.

"It's not a one-size-fits-all treatment plan but a concentrated effort to tailor the treatment based on where that person is on the learning scale," Smith-Osborne said.

Smith-Osborne and Liu hope that their research results lead to better and more comprehensive care for veterans and a better college education.

More information: [www.sciencedirect.com/science/...
ii/S2213158214000618](http://www.sciencedirect.com/science/.../S2213158214000618)

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