

# Asking questions, testing improves student learning of new material

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Jason Chan asks questions throughout his class lecture to help students learn the material. Credit: Christopher Gannon, Iowa State University

Jason Chan makes a point to periodically interrupt his lecture and ask students a question about the material they've covered. The associate professor of psychology at Iowa State University does this to regain

students' attention, but more importantly, to enhance their ability to learn new information.

Researchers know the retrieval process is beneficial for new learning and a new meta-analysis by Chan and his colleagues confirms that but found there are limits. The research shows the frequency and difficulty of [questions](#) can reverse the effect and be detrimental to learning. It also is not enough to simply ask a question; Chan says students must respond to see a positive effect on learning. The work is published in the *Psychological Bulletin*, an American Psychological Association journal.

"Frequency is a critical factor. There appears to be a trade-off in how often you [test](#) students," Chan said. "If I [lecture](#) nonstop throughout class, this lessens their ability to learn the material. However, too many questions, too often, can have a detrimental effect, but we don't yet know exactly why that happens or how many questions is too many."

The answer to that question may depend on the length of the lecture and the type or difficulty of the material, Chan said. Given the different dynamics of a class lecture, it may not be possible to develop a universal lecture-to-question ratio. Regardless, Chan says testing students throughout the lecture is a simple step instructors at any level and in any environment can apply to help students learn.

"This is a cheap, effective method and anyone can implement it in their class," he said. "You don't need to give every [student](#) an iPad or buy some fancy software—you just need to ask questions and have students answer them in class."

Chan, Christian Meissner, a professor of psychology at Iowa State; and Sara Davis, a postdoctoral fellow at Skidmore College and former ISU graduate student, examined journal articles from the 1970s to 2016 detailing more than 150 different experiments for their analysis. The

researchers looked at what factors influenced the magnitude of this effect, when it happens and when the effect is reversed.



Students use an app-based program to respond to questions during Chan's class.  
Credit: Christopher Gannon, Iowa State University

## **Why testing helps**

There are several explanations as to why testing students is beneficial for new learning. The researchers evaluated four main theories for the meta-analysis to examine the strengths and weakness of these explanations from the existing research. The data strongly supported what researchers called the integration theory.

"This theory claims that testing enhances future learning by facilitating the association between [information](#) on the test and new, especially related, information that is subsequently studied, leading to spontaneous recall of the previously tested information when they learn related information," Meissner said. "When this testing occurs, people can better tie new information with what they have learned previously, leading them to integrate the old and the new."

Learning new information requires an encoding process, which is different from the process needed to retrieve that information, the researchers explained. Students are forced to switch between the two when responding to a question. Changing the modes of operation appears to refocus attention and free the brain to do something different.

A majority of the studies in the analysis focused on college students, but some also included older adults, children and people with traumatic brain injuries. The researchers were encouraged to find that testing could effectively enhance learning across all these groups.

"Memory retrieval can optimize learning in situations that require people to maintain attention for an extended period of time. It can be used in class lectures as well as employee training sessions or online webinars," Davis said. "Future research could examine factors that can maximize this potential."

**More information:** Jason C. K. Chan et al, Retrieval potentiates new learning: A theoretical and meta-analytic review., *Psychological Bulletin* (2018). [DOI: 10.1037/bul0000166](https://doi.org/10.1037/bul0000166)

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