

Students remember more with personalized review, even after classes end

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Struggling to remember information presented months earlier is a source of anxiety for students the world over. New research suggests that a computer-based individualized study schedule could be the solution. The study findings show that personalized review helped students remember significantly more material on a tests given at the end of the semester and a month later.

"Our research shows that data collected from a population of learners can be leveraged to personalize review for individual students, yielding significant benefits over one-size-fits-all review," explains researcher Robert Lindsey of the University of Colorado, Boulder. "And this systematic, comprehensive review can be integrated into the classroom in a practical and efficient manner."

Their findings are published in *Psychological Science*, a journal of the Association for Psychological Science.

Lindsey and colleagues were interested in using computational models to predict the effect of spaced study on learning, but they also wanted to ensure the real-world validity of their work.

Collaborating with an eighth-grade Spanish language teacher, the researchers were able to collect data from 179 students over a semester. The students were responsible for covering a new chapter of their book each week and they were provided with an online flashcard app that allowed them to practice new vocabulary and phrases as well as to review

old material.

Unbeknownst to the students, the review material came in three different kinds of sets.

Some of the material was in a "massed" set, with questions drawn from just that week's chapter. Another set of material was "generically spaced," drawn from just the previous week's chapter. According to the researchers, massed practice was preferred by students and spaced review has been recommended by past research in learning and memory.

The third set of material, however, was drawn from any of the chapters that had already been covered, and was delivered to students based on an algorithm that predicted which material would be most beneficial to them to review. Similar to the approach used by online retailers to recommend products, the algorithm incorporated data from all of the students to determine which material any particular student might need to practice.

Lindsey notes that teachers typically don't have the time to set up a personal question set for each student, but the use of technology enabled this personalized review, yielding promising results.

On a cumulative exam taken a month after the semester's end, personalized review boosted performance by 16.5% over massed review and by 10% over generic spaced review. Importantly, personalized review proved most effective for material from the first few chapters of the semester—material that would have been easiest to forget after several months—boosting students' scores by an average of two letter grades.

"A relatively modest intervention—roughly 30 minutes per week of strategically selected review—can yield significant benefits in long-term

educational outcomes," says Lindsey.

Importantly, the personalized-question set proved most effective for the first five chapters of the semester – those chapters that would have been easy to forget after several months.

These results are promising, the researchers note, because they provide solid evidence for personalized practice over simple study strategies students and teachers have used in the past.

"It is surprising how resistant students generally are to review," Lindsey notes. "They see their job as to learn the week's new material, and feel that explicit review of old material is getting in the way of their learning. This experiment argues otherwise."

Based on the results of the study, the Spanish teacher restructured his own lesson plans the following semester to focus on cumulative exams.

Lindsey and colleagues plan to continue investigating which [review](#) strategies are most effective for improving [students'](#) long-term outcomes.

Provided by Association for Psychological Science

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