

Quizzes key to learning for middle school students

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(PhysOrg.com) -- Practice might not always make perfect, but a novel study of Midwestern middle school science students suggests it just might.

A new study by researchers at Washington University in St. Louis shows that [students](#) who received three quizzes on content questions before a unit test performed at the “A” level on those test questions, compared to a “C” level on questions that were not quizzed but still on the test.

WUSTL psychologists quizzed 8th grade science students over a broad range of science content across three different semesters, thereby allowing generalization to the results and the opportunity to “tease apart” the effectiveness of the three quizzes.

A first quiz (pre-lecture) was given before the teacher's lecture, say, on an anatomy unit; a second (post-lecture) was given after the lecture, and a third (review) spaced several days later and immediately before the unit exam.

The study was a follow-up of their previous study on [middle school](#) social studies students, and had never been done in middle school science classes before.

“Both in social studies middle school classes and junior high science classes we have shown that quizzing dramatically improves students’ performances on exam items related to the quizzes,” says Mark McDaniel, PhD, professor of psychology in Arts & Sciences.

“It’s important to note that if only the non-quizzed questions had been graded on the exam, the average grade would have been a 78, or C-plus. If only the quizzed items, the average score would have been 93.

“It’s many people’s observations that in middle school, we often see an achievement decline in science and waning student interest,” McDaniel says. “If you can do something as easy as quizzing to help increase students’ performance, maybe that will help boost their self-efficacy, and we’ll start seeing improvement.”

Results were published in the recent issue of the *Journal of Educational Psychology*.

Using questions included on the teacher’s past tests and which were going to be on subsequent unit and semester exams, the researchers used an educational software program aligned with a white “smart board” that records data and recognizes which student is making responses with hand-held clickers coded for each individual student.

The program even records aggregate data to see the spread of responses to the strictly multiple-choice questions.

The quizzes were deliberately “low stake,” accounting for a very small percentage of overall grade, and the students found the exercise “fun and something to look forward to,” McDaniel says. “They’d be disappointed to not see our research assistants conducting the quizzes. The teacher was out of the room, so she had no idea which questions were quizzed and which not. The kids loved the clickers.”

While a quiz is relatively easy, three quizzes may seem time-consuming, especially for teachers with five sections and 100-plus students to evaluate. Plus, some teachers are skeptical of the usefulness of quizzes. McDaniel and his colleagues sought to find the quiz most effective in boosting scores, and that was the review quiz.

“It became important to ask: Do you need all three, just two, or just one? You can get big benefits from just the strategically placed review quiz, and not just for that exam but for the semester exam down the road as well,” McDaniel says.

“The post-lecture was more effective than the pre-lecture quiz. The pre- and post- lecture quizzes aren’t very well spaced, but the review quiz is spaced out by several days. The result agrees with basic memory literature that spacing exposure to material produces better memory retrieval and retention,” McDaniel says.

The researchers evaluated the effectiveness of the different quizzes by reducing the number of questions in two semesters’ rounds of quizzing. In a unit on genetics, for example, in the first semester of study, six questions would be on each of the quizzes for each unit test throughout the semester.

In a second semester on a different unit, for example, in evolution, they would get subsets of the six questions in “watered down” quizzes; that is, questions one and two might be on the pre-quiz, three and four on the post-quiz, five and six on the review quiz.

This way students were still exposed to all of the quizzed material at different times in the quizzing process. In yet a third semester, a completely different group of students was quizzed in the same way but did not have a long-term cumulative (final) exam.

“Students got all the items, select subsets of the questions, but at different times,” McDaniel says. “This tested the value of each particular quiz on its own.”

McDaniel says that critics of his study might claim that the approach simply encourages rote learning. While he disagrees, calling the quizzing method “a learning device meant to build a core of knowledge at a student’s fingertips, from which problem solving and creativity might spring,” he acknowledges that some could interpret the quiz method as exercises in rote.

To address that concern, he and his colleagues tested subsequent groups of middle school science students and changed the overlap between quiz questions and exam questions.

For instance, for competition, a big concept in evolution, McDaniel and his collaborators designed a definition of the concept in quizzes but then asked an applications question in the unit test.

The sample exam question might be:

Squirrels and raccoons on Long Island going after the same nut supply is an example of:

- (A) natural selection
- (B) co-evolution
- (C) competition
- (D) none

Conversely, some quizzes asked the application question and the exam the definition one. The results of this work, currently under review, show that students are successfully making the leap between definition and applications, linking the two, and in effect are learning from the quizzing.

“We’ve been able to show that quizzing improves the learning of science concepts because the quizzes are improving performance on exam items that the students have never seen before,” McDaniel says.

Provided by Washington University in St. Louis

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