Learning methods are ranked

QUESTIONS AND QUIZZES TOP THE LIST IN NEW PRACTICE GUIDE FROM THE U.S. DEPARTMENT OF EDUCATION

By Carla Thomas McClure

What can research tell teachers about improving the odds that students will learn, remember, and apply academic skills and concepts? The U.S. Department of Education's Institute of Education Sciences (IES) asked a panel of experts to answer this question. After months of evaluating and summarizing the best available evidence, the panel has concluded that research offers some support for seven concrete strategies. The strategies with the strongest research evidence involve asking deep explanatory questions and using quizzes to re-expose students to key content. A discussion of all seven strategies and the research behind them is included in *Organizing Instruction and Study to Improve Student Learning: A Practice Guide.*

What is a practice guide?

Practice guides are systematically developed documents that combine research and professional judgment. They present practitioners with recommendations that constitute a "coherent and comprehensive approach to a multifaceted problem." Practice guides are common in the health care profession. IES released its first practice guide in July 2007.

How does IES develop its practice guides?

After selecting a topic of high interest to practitioners, IES convenes a panel of experts. The panel spends 6 to 9 months evaluating relevant research and drafting the practice guide. For each recommendation, the panel indicates the rigor of the evidence supporting it (e.g. strong, moderate, or low). Before publication, the guide

To increase learning and memory

- Ask deep explanatory questions.
- Use quizzes to promote learning.
- Space learning over time.
- Alternate between worked example solutions and problem-solving exercises.
- Combine graphics with verbal descriptions
- Connect and integrate abstract and concrete representations of concepts.
- Help students allocate study time efficiently

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EDVANTIA

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undergoes independent peer review and is revised as necessary.

What research was examined in producing this guide?

The panel examined research in cognitive science, experimental psychology, education, and educational technology. The focus was on instructional procedures and timing for increasing learning and memory. Much of this research was conducted within the past five years. The panel identified seven instructional strategies for increasing learning and memory, then applied IES guidelines to characterize the evidence for each strategy as having strong, moderate, or low rigor. Generally, evidence was considered "strong" if derived from randomized control trials, "moderate" if based on well-designed studies involving no randomization, and "low" if based on expert opinion supported by evidence not meeting the standards for the moderate or strong levels of rigor.

Which strategies show strong evidence of increasing learning and memory?

Two strategies are supported by strong research evidence: (1) Prompt students to pose and answer deep-level questions that require students to explain their answers and the thinking behind them. (2) Give short-answer and fill-in-the-blank quizzes at spaced intervals to re-expose students to key content and give them practice in retrieving information. (Note: Using pre-questions to introduce a new topic may also be a good strategy, but the research supporting that dimension of questioning was low.)

Which strategies are supported by moderate research evidence?

Four strategies are supported by moderate evidence: (1) Space learning over time by arranging homework, quizzes, and exams so that key content is reviewed several weeks or months after it is introduced. (2) Alternate between having students look at examples of solved problems and having students try to solve problems themselves. (3) Use graphics to illustrate key points in verbal descriptions. When possible, however, avoid having students view a graphic and written text at the same time. This can overload visual processing capacity. Presentations that combine audio and visual components work better. (4) Connect and integrate abstract and concrete representations of concepts. For example, point out which variables in a mathematical function are related to which aspects of a word problem.

Were any other strategies recommended?

The expert panel suggests that teachers should teach students to assess their own degree of learning and to allocate their study time accordingly. The rigor of the evidence base available to support this recommendation is, however, low.

How should teachers apply the panel's recommendations?

IES advises teachers to use the practice guide as a decision-making tool rather than a "cookbook." The panel writes that its recommendations most directly apply to grades 3 through 12 and are especially suitable for use with subjects that demand a great deal of content learning, such as science and social studies. Included in the guide are practical suggestions for overcoming potential roadblocks to putting recommendations into action.

Reference

Pashler, H., Bain, P.M., Bottge, B.A., Graesser, A., Koedinger, K., McDaniel, M., & Metcalf, J. (2007). *Organizing instruction and study to improve student learning* (NCER 2007-2004). Washington, DC: U.S. Department of Education, Institute of Education Sciences, National Center for Education Research. http://ies.ed.gov/ncee/wwc/pdf/20072004.pdf.

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The U.S. Department of Education Institute of Education Sciences has released two additional practice guides so far:

- *Effective Literacy and English Language Instruction for English Learners in the Elementary Grades*
- *Encouraging Girls in Math and Science*

These and future releases may be accessed online at http://ies.ed.gov/ncee/wwc/practiceguides