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## **Stressing concepts and teaching in the classroom: A low-technology approach using concept tests and classroom polls**

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Electronic student response technologies can be used effectively to increase learning in the classroom. Although these systems are not terribly expensive, their purchase may be out of reach for many departments and institutions. Here we model a low-technology approach that stresses active learning, peer teaching, and testing student understanding of key concepts by using think-pair-share sessions and in-class responses to key concept-test questions.

Questions used in class are chosen carefully to emphasize a concept essential to understanding some aspect of geoscience in an introductory geology course. Each class involves the introduction of a key concept question or questions followed by: classroom polling by show of hands; a brief, written response defending a student's choice; discussion between two to three students; and a follow-up poll. This classroom activity is followed by an experiment, discussion, or lecture that demonstrates the question's correct answer.

In an example linking the layering of fluids by density with the layering of the Earth, two concept-test questions demonstrate the effectiveness of these in-class exercises. Polling showed that students increased their understanding of density layering through peer learning by increasing correct responses by 22 to 46%. Moreover, students extrapolated their understanding of density layering from simple fluids to Earth materials in a subsequent exercise when 88 to 100% of students chose the correct answer on first polling.

Generally, use of technologies in the classroom is commendable, but is not *essential* to learning because techniques that highlight active learning and concepts form the core of student learning. Low-technology approaches can provide many of the same learning outcomes and are available to all. Fundamentally, necessary components for student learning require only students, faculty, and viable teaching strategies.

Targeted session: T136, Electronic Student Response Technology in the Geoscience Classroom: Is it a Valuable Teaching and Learning Tool? National GSA, November 2000.