Short Description: Medical students must master a great deal of knowledge and skills in a short period of time. To better support students' self-regulated learning, intelligent study systems (ISS) provide learners personalized daily study recommendations using machine learning. Early data from pilot deployment of the Osmosis ISS at two medical schools suggest substantial initial use, differing needs by site, and key research questions regarding learners' and educators' long-term adoption of such unique and counter-normative learning technologies.

Abstract: Problem Statement
The knowledge and skills physicians in training must master and apply is large and rapidly changing, and learners' strengths and weaknesses can be dramatically different. It is unreasonable – and contrary to empirical data1-3 – to expect learners to constantly monitor their mastery of thousands of concepts and skills and select efficient, effective practice strategies to address gaps without considerable support.

Approach
With a grant from the National Board of Medical Examiners’ Stemmler Fund, the University of Illinois at Chicago (UIC) and the University of Central Florida (UCF) are piloting an intelligent study system (ISS) called Osmosis (www.osmosis.org):4 a Web- and mobile-device-based application which challenges students with individualized, brief, daily regimens of practice questions. All M1 students see common sets of practice questions shortly after learning experiences; e.g., in the days and weeks after a cardiac auscultation workshop, the system presents learners with heart murmur sound files to interpret. The system adapts how and when particular questions are revisited for each learner based on a continually-updating mathematical model of their knowledge or skill. By revisiting questions only when the system's algorithm predicts a learner is beginning to forget a concept, the system applies three highly-effective cognitive strategies: the testing effect, the spacing effect, and the mixed practice effect.5 The system also helps students identify appropriate practice questions for topics by text-mining curricular documents (e.g. lecture slides or handouts) and suggesting related questions and promotes students creating and sharing their own practice questions.

Lessons Learned
From enrollment in medical school in the Fall 2015 semester through January 18, 2016, at UIC, 175 of 196 M1 students had answered questions in the system 76,243 times (individual average = 436 answers). By contrast, at UCF, 90 of 120 M1 students had answered questions 14,631 times (individual average = 163 answers). We are currently conducting focus groups, interviews, and surveys to understand students' and course faculty's experiences over the two years of their preclinical education. Early challenges include ensuring quality of practice questions, encouraging students to use the system regularly, facilitating students' interactions in the system, and helping course faculty use the system effectively.

Significance
ISSs cut across individual courses and apply known principles of efficient, effective active learning, making them a potentially powerful tool for supporting integrated and robust mastery. Since they require both learners and educators to break deeply-ingrained educational habits, insightful implementation science will be needed to maximize benefits.

Level of Audience: Mid-career
Focus of Presentation: UME, GME, CME, Continuum


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