Retention of Biochemistry Knowledge in the First Year of Medical School Predicts LCME Step 1 Performance

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Introduction

Medical students are tasked with absorbing a vast amount of medical knowledge. But how much of that knowledge is retained (and how deeply), and how does retention predict performance on high stakes exams such as USMLE Step1? Here we retested students on biochemistry summative exam items 10.5 months after first sitting for the exam. We used the original multiple-choice format (cued recall), but also had students generate answers without seeing the answer choices (free recall), as a measure of depth of learning. We also examined whether knowledge retention predicts Step1 performance.

Methods

Second year medical students (N=45, 24 Females) reported to the same location of the original exam and used the same testing software. Students were tested (cued and free recall) on 50 of 104 questions from the original summative exam. The question stem was displayed with a text box below it to allow for free recall of an answer. After an answer was entered, the original multiple-choice answers were shown, and students selected the best answer (cued recall).

Example Item:

Diabetic patients with problems in controlling blood glucose levels are treated with several injections a day of insulin or a constant insulin infusion. Mature insulin has two peptide chains, Chain A and Chain B, that are held together by 3 disulfide bonds. Which [of the following] amino acids contains a side chain that is capable of forming this covalent linkage?

Remember/don't remember item from original exam
Free Recall: Try to think of an answer, even if it's only a guess" (Figure 1)
Confidence rating (1-4)
Multiple Choice options
Confidence rating (1-4)

Fig. 1. Word cloud of free recall responses to the example item.

Results

The original exam average for our sample was 87.2±5.5% (Figure 2). 10.5 months later the average was 53.9±9.6%, 62% of their original scores. Free recall rates were considerably lower (15.8±9.2% correct). Higher scores on the original exam predicted better retention of the material 10.5 months later (r=.289, p=0.057) and increased Step 1 (r=0.491, p=0.001) scores. Higher retention rates were associated with better Biochemistry MCAT performance (r=0.318, p=0.038) and with higher Step1 scores (r=0.422, p=0.006; Figure 3). Class rank + memory retention explained 55% of the variance in Step1 scores.

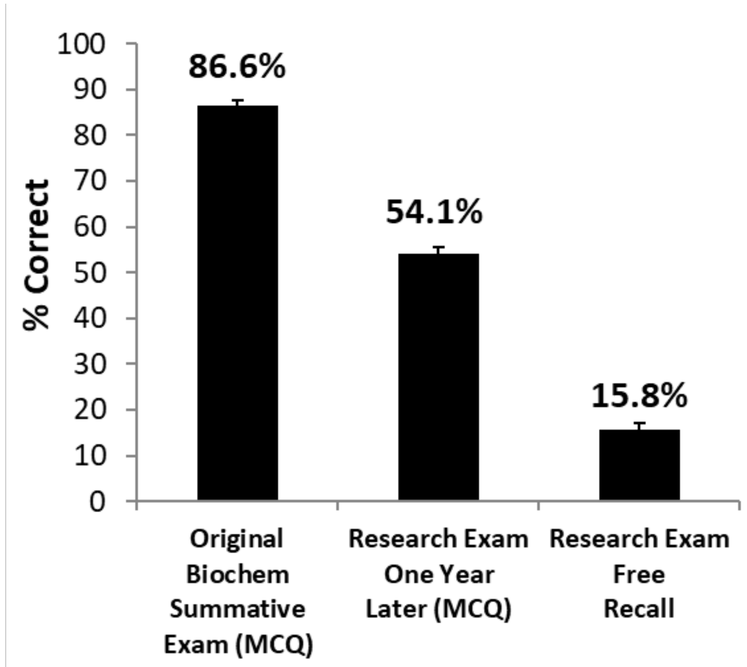

Fig. 2. After one year, students retained **62.2%** of the items from the original summative exam. Multiple choice questions (MCQs) = Cued recall; Free Recall = Fill-in-the-blank.

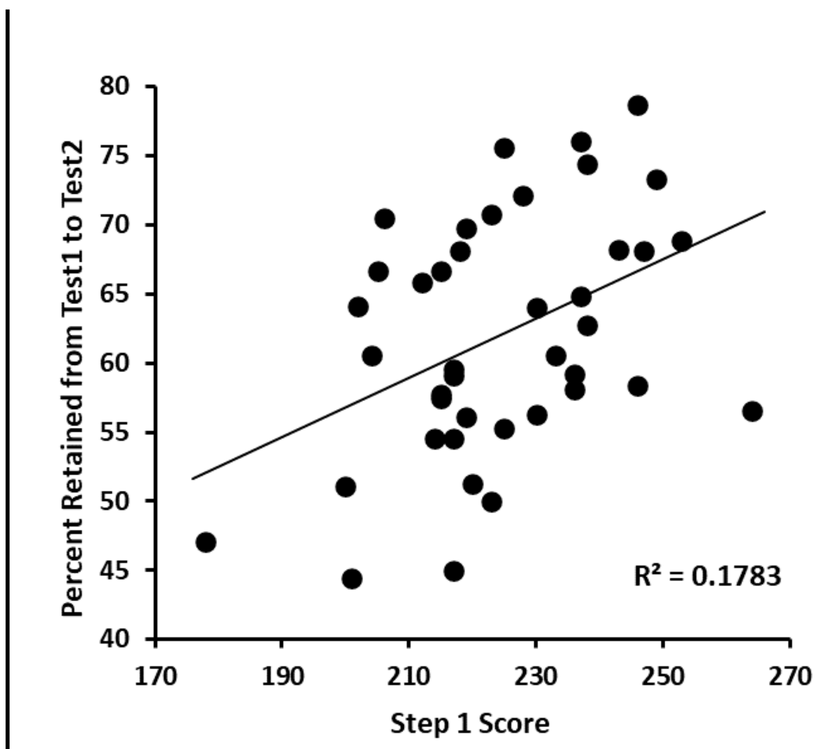

Fig. 3. Item difficulty (based on faculty ratings) negatively correlated with number of students getting an item correct.

Conclusions

Our findings suggest that differences in free vs. cued recall may provide insights about how deeply information is memorized, and they also highlight the importance of retention (not just overall performance or class rank) for predicting high-stakes test performance.

References: Wilhelmsson, et al. (2013). Long-term understanding of basic science knowledge in senior medical students. International Journal of Medical Education, 4:193-197; D'eon, M. (2006). Knowledge loss of medical students on first year basic science courses at the university of Saskatchewan. BMC Medical Education 2006, 6:1-6