

## PROMISING PRACTICE

# Implementing Collaborative Mock Exam Review

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## ABOUT THE AUTHORS

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Exam reviews are a common offering within and across courses, often supported by departments, learning centers, and success centers. However, the majority of typical exam review formats follow the lecture or direct-teach format, with instructor-centered re-teaching or problem-solving as the mode of review. In lieu of this traditional and more passive offering, Balch (1998) found that students of all academic ability benefitted from *active* practice exam reviews and outperformed those who participated in typical exam reviews. In these *active* practice exam reviews, students spend time in the review actively solving problems, developing solutions and answering exam-style questions rather than passively receiving answers or watching an expert solve ques-

tions. Cranney et al. (2009) also saw positive gains in student outcomes based on the testing effect of repeated quizzing and testing, as opposed to re-study.

Retrieval practice, which pertains to the act of recalling information without assistance (such as use of materials or other aids), has been extensively investigated in such seminal papers authored by Karpicke and Roediger (2008) and Karpicke and Grimaldi (2012). These researchers provided evidence for the positive impact of retrieval practice to learning gains as opposed to the common practice of repetitive study time. These researchers also demonstrate that the use of retrieval practice, on even high level and complex questions, can have the largest impact on overall learning. But without structure provided by the university, department, or faculty, this message may be lost; Felder and Brent (2016) encouraged faculty to provide opportunities for students in their courses to practice active retrieval, detailing that desirable difficulties will improve current course outcomes and also future success.

One faculty and one staff member from our university who collaborated on this study attended the University of Kansas session presentation at the American Society for Engineering Education (ASEE) Annual Conference in 2019. The session centered on the use of a new type of the active practice exam review—collaborative mock exam reviews offered for historically difficult introductory math and science courses (Shew et al., 2019). This type of innovative exam review combined the characteristics of an active practice exam review and retrieval practice described above. The structure of the collaborative mock (or practice) exams included three parts:

1. Students worked alone for 30 minutes on the mock exam, just as they would on the actual exam (time for retrieval practice as well as active problem-solving).
2. Students collaborated with their peers for the second 30 minutes of the mock exam (time for collaboration and active problem-solving).
3. Trained volunteer peer educators discussed the mock exam problems for the final 30 minutes of the mock exam session (time for review and instruction).

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As many of the required introductory courses for our electrical and computer engineering students also report high percentages of Ds, Fs, Qs (drops), and Ws (withdraws), we opted to pilot this type of intervention in our Introduction to Computing course. The course had less than 100 students registered and was taught by the aforementioned faculty collaborator who had attended the ASEE 2019 session, and the collaborative mock exam covered all the content that students needed to review before the actual upcoming exam. While the collaborative mock exam problems were different from the problems on the actual exam, the level of difficulty of the questions matched closely. The staff collaborator had access to the learning center's drop-in tutoring center, which fit the total number of enrolled students—more than the expected number of attendants. While Shew et al. (2019) used volunteer peer educators, we were able to leverage department-sanctioned engineering undergraduate and graduate teaching assistant (TA) support for the course to manage the collaborative mock exam review.

The collaborative mock exam reviews occurred each Sunday before the actual exam (which took place the following Thursday). Information on the collaborative exam review (date, time, location) and structure were conveyed to students via in-class faculty announcements, Canvas announcements and reminders from the TAs, and promotional slides. The collaborative exam reviews occurred in an active learning space where students sat at moveable table/chair combinations of eight facing each other and movable white boards around the room. Students arrived at the room and signed in then put away phones, calculators, and any study materials about 10 minutes prior to the collaborative mock exam review. Exams were distributed to students and after a short set of instructions, our collaborative mock exam session was divided into three parts as follows:

1. Students used the first 30 minutes to work alone on exam problems, just as they would an actual exam. To simulate retrieval practice, they were not allowed to use any resources, notes, textbooks, et cetera. The TAs provided no assistance at this time other than clarifications, and they circulated the room to simulate proctoring the exam just as in the actual testing environment.
2. In the second 30 minutes, students were given agency to work with other students at their tables and highly encouraged to collaborate and share their ideas, work, and any solutions generated. Again, TAs did not provide any assistance at this time and circulated the room to encourage collaboration and discussion.
3. In the third section, the TAs placed themselves around the room at stations—individual moveable white boards with 1-2 exam problem numbers listed—and spent 10-12 minutes solving the problems while providing in-depth explanations.

Students rotated around 3 stations; each station had 1-2 problems detailed and explained. This period was usually a total of 45 minutes, but students were able to stay until all their questions were answered.

The mock exam was made available online to all students soon after the completion of the collaborative mock exam review. Students were asked to complete the mock exam and submit it as a homework assignment, but only for a completion grade. Those who did not attend the session did not receive the specific intervention of the collaborative mock exam review. In total there were three mock exam sessions, one each for the three midterm exams.

The staff member collected attendance records for each collaborative mock exam review, end of course grades, and GPA and SAT scores. A survey consisting of 15 questions was administered one week after the actual exam but before students received their actual exam scores. The survey collected such data as students' names and university identifier numbers, how they heard about the exam review, their feedback on each part of the collaborative mock exam review, and the students' determinations of how participating in the review possibly impacted their actual exam performance and/or changed their study habits.

As mentioned earlier, traditional exam reviews are prevalent but there is little research or evidence assessing any learning gains provided by this passive review method. We have outlined a potentially more promising form of the exam review—the collaborative mock exam review—which we believe positively impacts students in the following ways:

1. The implementation of the collaborative mock exam review 4 days prior to the actual exam allows a self-assessment for students on what they do and do not know as well as ample time for remediation of missing content or study/practice.
2. The structure of the collaborative mock exam review provides an opportunity for retrieval practice in an exam-like setting, which is an activity many students do not implement on their own study time yet has been shown to provide the largest learning gains when used.
3. The structure of the collaborative mock exam review requires students' active participation in solving problems and answering conceptual questions, which has also been shown to improve overall grade and course outcomes (Balch, 1998), (Cranney et al., 2009).
4. The structure of the collaborative mock exam review provides opportunity for collaboration between students, where they explain and instruct their fellow peers, which can benefit all parties.

We saw positive student feedback on both the implementation and the structure of the collaborative exam review, with about 60% of enrolled students participating in all three collaborative mock

exam reviews. Encouraged by the results, our future plans include quantitative and qualitative analysis to understand impacts of the collaborative mock exam reviews on students' grade outcomes, as well as students' motivations for and perceptions of participating in the collaborative mock exam reviews.

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