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Exploration of Homework Timing on Student Performance

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Background
Research (Karpiche & Roediger, 2008) shows that retrieval practice enhances long-term learning. Completing homework problems is one form of retrieval; it requires active use of the material. Further, recent research (Roehler & Pashler, 2007) suggests that there is a retention relationship between two time intervals: 1) the time interval between initial exposure to material and later exposure to the material (Intersession Interval, ISI) and, 2) the time interval between the second exposure to the material and the testing of the material (Retention Interval, RI). More specifically, peak performance occurs when the ISI is 10% to 30% of the RI. This project tested the effect of spacing by shifting the timing of homework problems in two sections of an Engineering Mechanics course during the spring semester 2010. We were also interested in the students’ perception of the homework and how it affected their opinions of the material.

Hypotheses and Goals
The experimental group would show higher test scores than the control group. Both groups would show higher final exam scores than students in the Fall 2009 semester when there were fewer homework assignments and they were not regularly spaced. We were also curious whether students would differently perceive the value of the homework assignments depending upon the timing of the questions relative to when the material was covered in class.

Methods
Homework timing: Two sections of an Engineering Mechanics course (Mechanics of Deformable Bodies) were given alternating timing treatments for Exam 1 and Exam 2 across the two classes (N = 19 and N = 15).
• Experimental treatment: One-week delay between covering the topic and assigning the related homework (spaced based on exams occurring approximately every 5 weeks).
• Control: Homework assignments were associated with material presented that day in class.

For Exam 3, both sections were given homework problems associated with the material presented a week prior.

Final exam scores for Fall 2009 (less regular homework) and Spring 2010 were also compared.

Subjective Feedback: Three times during the semester students completed a 6-point Likert-scale feedback form (4 questions) asking about the perceived value of the homework. A score of 1 indicated strong disagreement with the statement given and a score of 6 indicated strong agreement with the given statement. All statements were positive.

Feedback results
Overall, students showed modest agreement that the homework assignments had value.

T-tests indicated that there was no significant relationship between homework timing and their perceptions.

Results: Impact on Grade
• A 2 (Exam 1 versus Exam 2) x 2 (delayed or synchronous) mixed ANOVA showed that there were no significant main effects or interaction; thus, homework timing did not affect exam performance.

After data was collected, we noticed that Objective 4 had homework assignments directly related to it, but Objective 5 did not. A 2 (Objective 4 versus 5) x 2 (delayed or synchronous) mixed ANOVA showed that there was no significant main effect for homework timing, and the interaction was not significant. But, there was a significant improvement in exam scores for Obj. 4 (with related homework problems) compared to Obj. 5 (no related homework problems), F(1,32)=10.35, p<.01.

Discussion
Karpiche and Roediger (2008) have shown that having to retrieve information repeatedly through testing, versus repeated encoding during extra study, will produce large positive effects on long-term retention of the material. By assigning the students mandatory homework problems, they were in essence testing themselves on the information. Although they were allowed to use their texts, notes and even work with other students, they went through the process of retrieving the information, not just encoding it. The benefit of doing this was a significant increase in exam scores.

The benefit of implementing a delay in the relative timing of the homework problems was not supported. There are two possible explanations.
• First, the impact of timing was reduced due to the lack of good alignment between homework problems and tested course objectives.
• Second, while the homework assignments were given with either synchronous or delayed timing, students were also given suggested problems with each assignment. Students could do these suggested problems as they went through the lessons or use them later when preparing for the exam. Thus, the timing of the suggested problems was not controlled, and could have masked the influence of the assigned homework timing manipulation.

Application and Future Research
Despite some in-class discussion of the importance of doing the homework, overall the subjective student feedback showed that they were relatively neutral or only slightly agreed with the benefits of doing homework.

The data, however, show a clear benefit of doing the homework on exam performance. Instructors should explicitly communicate (and use data to support) the relationship between the two, emphasizing it throughout the semester. By helping students become aware of factors that positively influence their learning, instructors can support student metacognitive awareness of their learning processes.

The significant impact of practice / retrieval but not timing suggests that retrieval is a more influential factor. However, the interaction between these variables should be more systematically studied using a more tightly controlled design. The previous studies cited only investigated these factors in isolation from each other. Understanding this relationship could have impact on the recommended timing of practice tests as well as homework assignments.

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