

Encouraging Metacognition through Mandatory Exam Review

Pamela L. Connerly

Indiana University Southeast, Biology Department, 4201 Grant Line Rd., New Albany, IN USA
(pconnerl@ius.edu)

Some of the most memorable and exciting experiences in teaching occur when students grasp what they need to change in their approach to learning, make that change, and sharply improve their understanding and performance. Yet, simply describing good study practices in class is not sufficient to inspire all students to work harder and smarter to learn the important concepts. Students are often receptive to feedback after underperforming on exams, but they are not always willing to seek out help and advice from the instructor. I have designed an Exam Intervention Policy that requires students to meet with me and complete a quiz and exam review process if they score a C- or lower on an exam. Having a policy ensures that all students at-risk of not achieving the C required for biology majors at least have a conversation with me about exam preparation techniques and exam-taking skills. Assessment of the effectiveness of the intervention is ongoing. In this mini workshop, I will present details about my policy and lead a discussion with attendees on their techniques, reflections, and suggestions for helping students improve their study processes and exam success.

Keywords: exam review, metacognition, classroom management

Introduction

Exam scores are important. While they are neither equivalent to student learning nor the best way to assess student learning, they often make up a large percentage of final course grades. Exams are ubiquitous and an easily quantifiable method of measuring various aspects of student understanding. However, understanding is not the only factor that contributes to good exam scores. Students often describe themselves as “bad” test-takers, when they may not have tried very many methods to improve their performance. As instructors, we have useful information to share about exam preparation and strategies, but students do not often seek out our advice. I have developed an exam intervention policy that requires students with low exam scores to meet with the instructor to open the door for meaningful dialogue about exam preparation.

Many Factors Contribute to Good Exam Performance

Many factors contribute to good exam scores including, but not limited to class attendance, good note taking, reviewing notes outside of class, previous success on exams, knowledge of effective test-taking strategies, comfort with vocabulary, ability to focus during exams,

adequate study time, effective self-quizzing, group study, sufficient sleep and nutrition, and positive emotional state.

During the course of a semester, students may be able to improve on some of these factors, but others may either take too long to change or may be beyond the student’s direct control. As instructors, we often offer help to students in a general way when we post exam scores and return exam papers. We expect students to come to us for assistance so that we can share our knowledge and expertise on content information and on effective test preparation. However, many students do not seek out this help and end up struggling with repeated low exam scores, but still hold out hope for extra credit points to save their course grade.

Interventions Described in the Pedagogical Literature

Students can benefit from a variety of instructor-initiated interventions to improve course performance. Instructors may allow students to correct errors on their exams to earn back points (Hamilton, 2003) or engage in detailed discussion of good study techniques (Gadzella et al., 1977). However, coming to talk with instructors, a situation that would best allow instructors to learn about specific student issues and offer tailored advice, can be anxiety-provoking for students (Perrine and King, 2004).

One way to alleviate that anxiety is to arrange for meetings with groups of students outside of office hours (Chung and Hsu, 2006), but this method is not well suited to exam review because of privacy concerns. There is data that suggests meeting directly with instructors benefits not only content knowledge to improve exam scores, but also students' ability to navigate the complexities of college life for better success (Skyrme, 2010). With all of these advantages to meeting with instructors, we are still left with student reluctance to initiate the meetings.

Requiring Student/Instructor Meetings

The solution I am investigating is to require students to meet with the instructor. I have utilized the power of extra credit points to motivate students to attend

meetings and complete follow-up work on exams, and I have also threatened to take away points if students do not at least come to meet with the instructor. I will present here the syllabus text I use to describe the Exam Review Process and follow it with practical descriptions of how the process works and some preliminary data on how it is working in the Notes for the Instructor section.

For reference, this approach has been used in introductory, sophomore-level, and upper-level courses, but the data presented here are based on multiple semesters using the exam review procedure in an upper-level Cell Biology course. The lecture-only course is offered every semester and has a class size limit of 24 students. From 2012-2015 the average DFW rate (percentage of students earning a D, an F, or withdrawing from the course) was 12.7%, with semester values ranging from 4.5% to 23.1%.

Student Outline

Exam Review Policy

Graded exams will be reviewed briefly in class. Any student may arrange to review an exam in depth either in my office or in the Student Development Center. Because a discussion about study and exam-taking techniques and detailed review of missed material on an exam are critical for improving poor exam performance, students who earn a grade of less than 72.0 on Exam 1 or Exam 2, will be obliged to formally review the exam. Two meetings with the professor and submission of a corrected exam and relevant quizzes can earn back 5 total points on the exam. (If a student scoring less than 72 on Exam 1 or Exam 2 does not complete at least one of the tasks, 5 points will be subtracted from the exam score.) Students who score above the threshold of 72, but below 77 can earn points up to a score of 77. Students who score above 77 are welcome to complete the specified tasks, but will not earn extra points toward the exam. In all cases, the student is responsible for scheduling the meetings with the professor.

Intervention	Due Date	Points
First Meeting with Professor	By the class period after the exam is returned	1.0
Quiz Review	One week from 1 st Meeting	1.0
Exam Review	One week from 1 st Meeting	2.0
Second Meeting with Professor	3 weekdays before next exam	1.0

At the first meeting, we will discuss current methods of preparing for exams, and performance on various aspects of the exam. We will also discuss the expectations for the quiz and exam review work.

The Quiz Review will include you describing for each question you missed your reasoning for the answer you gave, an explanation of why that answer was incorrect, and an explanation of why the correct answer is better. You will turn the Quiz Review in directly to me; paper and electronic submissions are both acceptable.

For the Exam Review you will use your notes and the book to correct all questions for which you earned half or less of the possible points (e.g. an incorrect multiple choice question, a short answer question you left blank, an essay for which you earned 4 of 8 points, etc.) For multiple choice questions, explain why you chose the answer you did and why the correct answer is better, similar to the quiz review. For short answer questions, you should give the correct answer in your own words, after consulting your notes and book. You will need to call the Student Development Center (812-941-2312, University Center South 203) to schedule an appointment to do your Exam Review during their normal business hours Monday through Friday 8 am – 5 pm. You may bring in notes and your book to assist you, but you may not write down, photograph, or otherwise copy questions from the exam to take away with you. The SDC staff will give you your graded exam and a blue book. You will number the questions you missed (or scored at or <50% of available points) in the blue book and write your answers there. There is no specific time limit for the Exam Review. When you are done, you will turn your graded exam and the blue book back in to the SDC staff and they will return them to me.

After you have completed and turned in the Quiz and Exam Reviews, schedule another meeting with me to discuss the review materials and alterations you have made in your study techniques and preparations for the next exam. Each step should be completed as soon as possible after receiving the graded exam so that changes can be incorporated before the next exam.

Students in previous classes have found this Exam Review Policy to be helpful. I am conducting pedagogical research to help determine the effectiveness of this teaching strategy.

Notes for the Instructor

How Does the Process Work?

Students with exam scores below a 72% (a C-) are required to meet with the instructor regarding their exam. If the student does not meet with the instructor, additional points will be taken off of the grade. Thus far, no student has ever failed to meet with the instructor. Late meetings and very informal meetings after class are acceptable when necessary. The student may go on to earn up to five extra points on the exam by completing several tasks that are designed to help convey ways to improve future test performance.

First Meeting with Instructor

The student is supposed to schedule the first meeting with the instructor, but some prodding by the instructor can be helpful. At this meeting, the instructor asks about how the student prepared for the exam and offers suggestions for improvements. This discussion may bring up learning disability issues that can be referred to the right office for formal assessment and help. More often, the importance of active methods to learn are emphasized: summarizing notes from the in-class slides instead of rereading them, asking and answering potential exam questions with a study partner instead of looking over the notes. Suggestions for time management and anxiety calming techniques can also be given. The instructor can also look over the exam with the student to identify particular areas of strength and weakness. Advice for approaches to multiple choice questions can be given, misunderstandings about certain content can be clarified, notes about appropriate depth and specificity of answers can be given. Additionally, the instructor explains the expectations for the remaining exam preview procedures. The student earns one extra credit point for completing this meeting.

Exam Review

The student's graded exam is sent to an on-campus center where accommodated and make-up exams are routinely offered. The student must schedule a time and bring their book and notes with them to the center, where they are given a copy of their graded exam and a blue book. For multiple choice questions that were missed (where the correct answer is indicated during grading) that were missed, the student must explain their reasoning for giving the erroneous answer and explain why the correct answer is better. For any other question where 50% or fewer points were earned (mostly short answer), the student writes a complete new (accurate) answer. The student earns two extra credit points for completing the exam review.

Quiz Review

Students also review their answers on the two quizzes leading up to the exam in question. Keys to the quizzes are posted, so students are expected to explain their reasoning for incorrect answers and how they now understand the actual answer to be correct. Students complete this review on their own and submit it by email or on paper in a class period. The student earns one extra credit point for completing the quiz review.

Second Meeting with Instructor

After both the exam and quiz review is complete, and the instructor has had time to review the materials, another meeting is scheduled. The instructor inquires about changes to exam preparation leading to the next exam and clarifies any areas of confusion from the corrected materials. The student earns one extra credit point for completing the second meeting.

Is the Process Effective?

Impact on Further Grades in the Semester

Student grade data from Spring 2013 and Fall 2014 courses were used as a before intervention group (n=40) and student grade data from Fall 2015 and Spring 2016 were used as an after intervention group (n=44). Comparing the grades on an exam where the student scored less than 72% with the student's score on the next exam, the before group improved 10.1 points vs. the after group improving 10.6 points. The average final exam score for all individuals having one exam score of less than 72% were 75.3 for the before group and 78.0 for the after group. The average course grade for these students was 78.6 for the before group and 81.6 for the after group. Given the small sample size, statistical analysis was not attempted for this preliminary data. However, the trends appear to be going in the right direction.

Percentage of Students with Low Scores

More strikingly, an analysis of the percentage of students earning below a 72% on multiple occasions in the semester changed from 20% in the before-intervention group to 4.5% in the after-intervention group. This result suggests that while the intervention may not vastly improve the next exam, final exam, or course grade, it may very well help students keep above the 72% threshold. Meeting with the instructor to discuss improving study methods and content knowledge may be having a direct effect.

What Do Students Think of the Process?

An alternative explanation for why a lower percentage of students score below 72% on multiple exams is that students find the exam review process to be onerous and/or embarrassing, so they study sufficiently hard to avoid scoring less than 72%. For the two sections of the after group, student attitude data was collected by written survey. When students were asked “Is the Exam Intervention helpful, or a punishment or source of embarrassment?,” more than 60% said it was helpful, but about 25% said it was both helpful and potentially a punishment or embarrassing, and a few students found it to be not helpful at all.

Open-ended requests for comments revealed that several students who had the most negative attitude about the process were those who had not participated in it at all (they scored higher than 72% on all exams). Additionally several students mentioned that they had studied harder to be sure they did not score below the threshold value.

Positively, when asked to identify study techniques that were beneficial for exam preparation, students report similar techniques to those that are recommended. This finding suggests that many students in the class who have not been directly impacted by the exam review process are already utilizing effective study techniques.

Students who participated in an exam review reported that the exam review process was the most helpful (compared to meetings with instructor and quiz review). There was uncertainty about whether or not score improvement was directly related to the exam review procedure. Many students reported that they changed their study procedure by starting to study earlier, studying more, reviewing notes more, making a personal outline of the material, and developing personal possible exam questions. All of these techniques are encouraged during the intervention procedure.

Is the Process Worth Trying?

Preliminary data suggests that the exam intervention process may improve student grades on exams and in the course. Data also suggests that students are less likely to score below 72% on subsequent exams if the exam review process is utilized. More data is needed to make strong claims in these areas. One aspect that I believe is important which I am not able to track relates to fairness. With this policy in place, every student scoring below a 72% is meeting with the instructor. In the past, that help was offered to everyone, but it could have been pursued more actively with some students than others, based on any number of unconscious biases. Having a policy in place regarding exam scores helps ensure that all individuals are treated equally, and help is very strongly encouraged for all individuals with grades under the threshold. The procedure

puts the responsibility of pursuing the process in the students' hands, though they do often require assistance.

Cited References

- Chung C, Hsu L. 2006. Encouraging students to seek help: Supplementing office hours with a course center. *College Teaching*, 54(3), 253-258.
- Gadzella BM, Goldston JT, Zimmerman ML. 1977. Effectiveness of exposure to study techniques on college students' perceptions. *The Journal of Educational Research*, 71(1), 26-30.
- Hamilton TM. 2003. Everyone deserves a second chance: using the day after the exam as a learning opportunity. *College Teaching*, 51(1), 21-21.
- Perrine RM, King AS. 2004. Why do you want to see me? Students' reactions to a professor's request as a function of attachment and note clarity. *The Journal of experimental education*, 73(1), 5-20.
- Skyrme G. 2010. Is this a stupid question? International undergraduate students seeking help from teachers during office hours. *Journal of English for Academic Purposes*, 9(3), 211-221.

Acknowledgments

Thank you very much to Dr. Beth Rueshoff for assistance in administering the survey regarding student attitudes toward the intervention and collecting informed consent forms. Thank you to Dr. Jacob Babb for facilitating a writing group in Spring 2015 where I learned to make time to write the IRB documents. Thank you to Indiana University Southeast Institutional Review Board chair Dr. Faye Camahalan for assistance in the process of applying for IRB approval. And most of all, thank you to all of my Cell Biology students for their desire to learn and their hard work.

About the Authors

Pamela L. Connerly is an Associate Professor of Biology at Indiana University Southeast, where she teaches Cell Biology, Molecular Biology, Biology Seminar, and Introduction to Biological Sciences. She also works with many talented undergraduate researchers to find and characterize novel bacteriophages that infect the bacterial host *Caulobacter crescentus* and related species.

Mission, Review Process & Disclaimer

The Association for Biology Laboratory Education (ABLE) was founded in 1979 to promote information exchange among university and college educators actively concerned with teaching biology in a laboratory setting. The focus of ABLE is to improve the undergraduate biology laboratory experience by promoting the development and dissemination of interesting, innovative, and reliable laboratory exercises. For more information about ABLE, please visit <http://www.ableweb.org/>.

Papers published in *Tested Studies for Laboratory Teaching: Peer-Reviewed Proceedings of the Conference of the Association for Biology Laboratory Education* are evaluated and selected by a committee prior to presentation at the conference, peer-reviewed by participants at the conference, and edited by members of the ABLE Editorial Board.

Citing This Article

Connerly PL. 2017. Encouraging Metacognition through Mandatory Exam Review. Article 28. In: McMahon K, editor. *Tested studies for laboratory teaching*. Volume 38. Proceedings of the 38th Conference of the Association for Biology Laboratory Education (ABLE). <http://www.ableweb.org/volumes/vol-38/?art=28>

Compilation © 2017 by the Association for Biology Laboratory Education, ISBN 1-890444-17-0. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the copyright owner.

ABLE strongly encourages individuals to use the exercises in this proceedings volume in their teaching program. If this exercise is used solely at one's own institution with no intent for profit, it is excluded from the preceding copyright restriction, unless otherwise noted on the copyright notice of the individual chapter in this volume. Proper credit to this publication must be included in your laboratory outline for each use; a sample citation is given above.