As educators, we are continually designing new methods and procedures to enhance learning. During this process, good ideas are frequently generated and tested, but the extent of such activities may not be adequate for a full manuscript. Nonetheless, the ideas may be quite beneficial in improving the teaching and learning of physiology. Illuminations is a column designed to facilitate the sharing of these ideas (illuminations). The format of the submissions is quite simple: a succinct description of about one or two double-spaced pages (less title and authorship) of something you have used for the classroom, teaching, lab, conference room, etc. You may include one or two simple figures or references. Submit ideas for inclusion in Illuminations directly to the Associate Editor in charge, Stephen DiCarlo (sdiarlo@med.wayne.edu).

HOW TO BE A BAD TEACHER

Your next lecture is tomorrow; however, you have not planned your lectures in advance or prepared for your classes because you do not feel the need to do so. You have been teaching all of this material for many years, so you believe that you can give your lectures impromptu, without preparation. In fact, you think that impromptu lectures are the only way you can keep your facts straight and include all of the important details because you have a memory like an elephant, don’t you?

You never bother to update or change faded overhead transparencies or correct spelling mistakes in your PowerPoint slides. That is because teachers assess students, but students never assess teachers. So why bother, who will notice, it is not really worth your time and effort.

You strongly believe that providing information is your major responsibility, so write as many notes and include as much information as possible. You also read straight from your notes so as not to miss any critical points and load your listeners’ brains with lists and lists and lists of facts. You never ever look at their faces or make eye contact to know if they are listening or even alive. Instead, you turn to face the blackboard, with your back to the students, and speak to and for yourself. This, you believe, is the only way you command all the attention you need.

It is critically important that you never ask your students any questions or check to determine whether they have understood the concepts. Why bother? They have been listening to you drone on and on, and, obviously, they must have understood. Certain things must be taken for granted. Furthermore, if a student stands up and asks you a question, you should tell the student, “Your question does not make sense to me,” “This is too difficult for you to understand at this level of education,” or “Only postgraduates need to know about that.” Or, you may respond with the simplest answer “You don’t have to know that because we will not ask that question on the exam.” However, the best alternative is to fly off on a tangent and give an answer for an entirely different question without stopping for the next 5 minutes since it takes that much time for someone to forget the question s/he just asked. For heavens sake, do not let anybody realize that you do not know the answer. It is way too dangerous.

In the rare event that a student suggests that s/he did not understand your response or that you might be wrong, do not ever waste time explaining your answer. How could you be unclear? How could you be wrong? You can not possibly be unclear or wrong.

If you are presenting a lengthy lecture, do not ever include a 5-minute break because time is precious; do not waste a second. Continue talking for as long as you can. Do not stop until you are exhausted and cannot speak any more.

Never, ever provide a summary of what you have said during your lecture because summaries are the only way that even the most attentive student can faintly register what you have been discussing over the last hour.

At the end of a series of lectures, do not obtain feedback from your students because this is the only way you will know how well you have been doing. You know you are an excellent educator. You also believe that teaching is a “feedforward” process and there is no absolutely no need whatsoever for improving your performance with feedback from your students. Furthermore, students do not provide unbiased reviews of your performance because they are afraid that you’ll vent your anger during their oral exam.

In the laboratory, it is possible that students demonstrate independent thinking and improve on something that has been taught and discover something truly interesting. In this situation, the students may have questions about concepts that you may not understand. It is important that you never let this happen! It can be dangerous if students learn beyond what you have been teaching. If this happens, everyone will realize that you are no longer capable of teaching.

If, by chance, your students are interested in alternate sources of information for their study, make it clear that there is nothing beyond the blackboard, the white chalk, the overhead transparency, and the lecture notes you wrote 5 years ago (or earlier when you were a student). Never suggest alternate sources of information, because this will provide them with an opportunity to cross check what you have taught, and that is quite risky. For example, they may learn and know more than you and your next class may be twice as difficult.

If you have been doing well on all these points, there is no doubt that you will be an outstanding role model for your students. And you will be promoted to the position of professor soon.

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MERIT-BASED REARRANGEMENT OF STUDENTS FOR BETTER INTERACTIONS

We at Melaka Manipal Medical College (Manipal campus) have an integrated curriculum. The maximum student enrollment is 150 students per admission. However, the number of students per class varies from 125 to 150 students per year. The students joining the program have no university experience. They join this program after completing high school. In the first year, the students learn Anatomy, Physiology, and Biochemistry. The curriculum includes lectures, practical classes, and tutorials. The class of 150 students is divided into smaller groups of 25 students per group for dissections of cadavers and for small group tutorials. Earlier, the grouping was conducted according to the students’ roll numbers. This method of grouping presented several concerns. For example, in each group, some students dominated all of the interactions. These students dominated all of the interactions and activities. In this situation, these students answered most of the questions, performed most of the dissections of the cadavers, and dominated the majority of the activity. There were a few students who did not show much motivation. They were shy to answer questions and often stood silently behind others during dissections. Their interactions with their peers as well as their tutors were poor. To overcome this problem, and to improve student-student and student-teacher interactions, we rearranged the groups according to the students’ academic performance. Specifically, the students were ranked based on their scores on all exams up to the midterm. Group 1 included the academically weakest students, and group 6 had the academically strongest students. Groups 1 and 2 included many of the students who stood away from the dissection table and remained silent during small group discussions. After the redistribution, we observed better interactions among the members of the groups. Each group contained students of almost equal understanding of the subject. With this redistribution, tutoring was more effective as tutors taught students who were at almost the same level. The academically weak students were encouraged to interact with their group members and to dissect the cadaver. The redistribution helped these students to overcome their reluctance to answer questions during the tutorials as all the members of the group were of the same level. Once this system was introduced, the students knew their strengths and weaknesses and they started interacting with their peers and teachers better, and the scores improved in the subsequent examinations. For example, the mean scores in the block exams were 79.5 ± 1.83 before and 97.1 ± 1.63 after the redistribution (P = 0.0001). A questionnaire was given to the students to understand their opinions of the redistributions. Only 20% of the students did not like the redistribution. However, the 20% agreed that there was an improvement in their examination scores. This method redistribution caused an uneasiness; however, it did improve exam performance.

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OPEN-BOOK TESTS AND STUDENT-AUTHORED EXAM QUESTIONS AS USEFUL TOOLS TO INCREASE CRITICAL THINKING

Open-book exams, sometimes used in courses more associated with math (1), have been touted as an evaluation method that promotes more active learning. Reported empirical benefits include the creative use of knowledge gained, “deep” probing of the study material, student self-evaluation of course material mastery, and an enhanced awareness of the learning process (1,2,4). Additionally, research evidence suggests that, armed with as many facts as possible, students stand the best chance of utilizing the highest possible levels of critical thinking (1–5). Limitations include excessive student time looking up answers, student anxiety due to exam rigor, a tendency not to adequately prepare for the exams, faculty spending too much time in exam preparation and grading, and faculty insufficiently trained or experienced in open-book test construction (1–4).

The lecture portion of the University of Dayton undergraduate Physiology course is taught to first- and second-year students pursuing majors in allied health, physical education, sport management, or exercise science and has no prerequisites. Student feedback and the above-mentioned literature suggested that the lecture portion of the course needed an evaluation structure that promoted more active learning. Class sizes between 25 and 50 students, with no graduate assistants or tutors, necessitated time-efficient grading. Accordingly, for a section of 42 students, we implemented the Open-Book Exam Student-Authored Question (OBESQAQ) evaluation approach. It included, throughout the semester-long course, three open-book/notes exams and, for homework, eight sets of student-authored exam questions. The exam and homework questions, developed by the instructor and student, respectively, were of the same specific multiple-choice format. The open-book, open-notes exam is the foundation for the evaluation portion of this undergraduate course. Given during the normal lecture time period, the exam consists of 10–12 multiple-choice questions and allows students to use any notes, references, books, or other hardcopy materials. Here is an example of such an exam question:

Select the correct response(s) by circling the corresponding letter. There may be more than one correct answer or there may be no correct answer, in which case circle nothing.

Under normal circumstances, the aorta (CORRECT ANSWERS = a, b, c, d):

a. Always maintains a pressure higher than that of the left ventricle except when the aortic semilunar valve opens.
b. Sees a flow rate equal to that of the pulmonary artery.
c. Always maintains a higher blood pressure than even the largest veins.
d. Has pressure limits that define systolic and diastolic pressures.

Because none of these answers can be directly retrieved from the book or class notes, the student is forced to integrate multiple terms and concepts such as pressures, flow rates, temporal relationships, and functions and must also tap his/her organization and information retrieval skills. Evaluation is rather simple: a point is earned for each correct response circled and/or each incorrect response not circled. This allows credit for mastery of each item, not an all-or-nothing prospect,
as is common in multiple-choice questions. Furthermore, with computer scoring, grading becomes expeditious.

Student-authored questions are the second element of the OBESAQ evaluation method. Students are required to develop, as homework, a sample test question using the same format as the exam question shown above with the addition of explanations of each response’s correctness. Despite the identical format, student homework questions are not used for our actual exams due to student inexperience. Our intent is to test students’ writing skills, creativity, and critical thinking and to use these exercises to aid them in exam preparation, an objective underscored in Ioannidou’s work (3). Here is an example of an excellent student-authored question with explanations (references to page numbers and figures are fictitious).

Skeletal muscle, unlike smooth muscle (CORRECT ANSWERS = b, d):

a. Functions under tensile and compressive forces generated by its fibers.

b. Cannot contract without neural stimulation

c. Usually generates a force of contraction that is equal to the resistance that must be overcome.

d. Can easily use ATP faster than it can resynthesize it.

EXPLANATIONS:

a. No, p. 290. Neither muscle type functions with compressive forces. Skeletal or smooth muscle can only “pull,” via tension, to exert their effects.

b. Yes, p. 308; Figs. 11–18. Skeletal muscle only contracts as part of a motor unit: the motor neuron and the muscle fibers it innervates. Smooth muscle, on the other hand, can be autorhythmic or innervated hormonally, so it must have the capability of contracting without neural stimulation.

c. No, p. 299. Skeletal muscle generally must exhibit much higher forces of contraction than the resistance that must be overcome because the insertion points are much closer to the axis of rotation than the resistance points. The up side of this design is speed of movement.

d. Yes, p. 309. Skeletal muscle, through recruitment of more muscle fibers and increased frequency of stimuli, can generate very large forces. The cost, though, is fatigue. Smooth muscle cannot be fatigued, but this is at the cost of being capable of very small forces of contraction.

Homework evaluation is divided into three categories: correctness, critical thinking, and writing. Excellent homework, then, is completely correct, draws on very high levels of critical thinking, is written succinctly with no grammar or punctuation errors, and tests the ability to think through the important and sometimes complicated concepts in physiology. Each is weighted equally, although any instructor can assign weights according to his/her preferences. Informal surveying of the class indicated that students spent ~1 h developing what would be considered an excellent question.

At the conclusion of the course, and before final grades were known, students conducted an evaluation of the OBESAQ using the standardized university evaluation survey. The more quantitative data suggested that the OBESAQ method offered some positive effects on critical thinking and writing skills as well as overall learning. Qualitative student comments, relevant to the course and not the instructor, are (by question, italicized) as follows:

- **What elements increased your knowledge and/or understanding?**
  - “Critical thinking skill and homework questions.”
  - “The homework assignments were challenging but helped in preparation for the exams.”
  - “The homework and all of the tests.”
  - “We were really forced to UNDERSTAND the material.”

- **What elements of this course need improvement?**
  - “Test questions were real hard...some extra credit?”
  - “This class is very challenging. A little too much for me.”
  - “Personally did not like open-book tests, too much time looking up answers.”

There were several other observations of the OBESAQ method worth expounding upon. First, it still allowed for computer scoring of exams via mark sense forms, a most desirable method for the usually large sections in undergraduate physiology. Test construction, however, is rather time consuming. Furthermore, the ideal questions must take into account not only textbook material but class lecture content as well. Only the instructor knows both. Second, the assignment of homework is quite simple: students develop one or two exam questions from each chapter. Third, evaluation, just like test question development, is time consuming due to the necessity of editing and correcting.

In conclusion, the OBESAQ evaluation method in undergraduate physiology appears to be beneficial for and well received by students. It may promote a higher level of critical thinking and increased emphasis on writing skills and be more conducive to expedient grading (computer scoring). It probably, however, requires more time for exam development and homework grading. Faculty assigned to teach a similar course might consider this approach to promote more active learning and emphasis on writing skills.

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