THEODORE E. WOODWARD AWARD

SPARE ME THE POWERPOINT AND BRING BACK THE MEDICAL TEXTBOOK

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ABSTRACT

A tutorial for 4th year medical students revealed absent long-term retention of microbiology and infectious disease facts taught during the 2nd year. Students were suffering from the Ziegarnik effect, the loss of memory after completion of a task. PowerPoint lectures and PowerPoint notes combined with multiple-choice questions may have encouraged this outcome; this teaching format was also associated with minimal use of the course textbook. During the subsequent year, active learning techniques, Just-in-Time Teaching (JiTT) and Peer Instruction (PI) were used, and instructors specifically taught from the textbook. Essays and short answer questions were combined with multiple-choice questions to encourage understanding and recall. Performance on the National Board Shelf exam improved from the 59th percentile (2002–2004) to the 83rd percentile (2005), and textbook use increased from 1.6% to 79%. This experience demonstrates that strategies incorporating active learning and textbook use correlate with striking improvement in medical student performance.

As a specialist in the field of infectious diseases, I have constantly worried about what Time and Newsweek magazines have heralded as the “End of the Antibiotic Era”. On many hospital wards, as well as in many clinics, broad-spectrum antibiotics have become the antipyretic of choice. The consequence of indiscriminate use of antibiotics has been the rise of highly antibiotic-resistant “super bugs”. How could I prevent this seemingly inevitable rise of pathogens resistant to all anti-infectives? I decided to take a more active role in teaching infectious diseases to our fourth year medical students. Each week I held a one and a half hour tutorial. As the springboard for our discussions, I decided to use the same cases that I had presented to my students

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during their second year microbiology course. I was surprised to discover that of the 30 students I tutored over a two year period, not one remembered any of the cases I had discussed during the second year, and many failed to remember the key points of my lectures. I realized that they had not retained the facts I had taught them during the second year. Furthermore, many had great difficulty applying their basic science knowledge to clinical practice, and many students had difficulty synthesizing data and problem solving.

This experience raised serious concerns about my preclinical teaching methods, and I began to ask myself why I had no meaningful impact on my students’ ability to acquire knowledge. My experience suggested that students were suffering from the Zeigarnik effect, a phenomenon first described by a famous Russian psychologist Bluma Zeigarnik (1). Dr. Zeigarnik was attending a dinner with a large number of people at the table. She observed that as the guests made their requests, the waiter wrote nothing down. He took all the orders and delivered each course exactly as each guest had requested. Dr. Zeigarnik was amazed by the waiter’s incredible memory, and after the meal she asked the waiter if he could repeat all the orders. The waiter shrugged his shoulders, and reported that he no longer remembered their orders; he had moved on to the next table.

How were other preclinical instructors and I inadvertently encouraging the Zeigarnik effect? I now realize we had failed to apply the 7 basic principles of good teaching:

1. Encourage contacts between students and faculty
2. Develop reciprocity and cooperation among students
3. Use active learning techniques
4. Provide prompt feedback
5. Emphasize time on task
6. Communicate high expectations
7. Respect diverse talents and ways of learning

Other recommendations by teaching experts include emphasis on higher-order thinking and learning, and the importance of emphasizing key concepts and principles. The deep study of a small number of topics is preferred over a large number of discrete facts. This approach allows students to fully understand the methods of inquiry and analysis in a specific field (2).

PowerPoint lectures were the primary format used for teaching our microbiology and infectious diseases course. Many have suggested that the misuse of PowerPoint slides and PowerPoint based notes has become a major impediment to learning (3). This format fails to ad-
dress any of the seven major teaching principles, because PowerPoint slides were originally derived from military and business presentations, and were not intended for active teaching. As a consequence of bullets, subcategories and distracting animations, the format often overrides content, leading to confusion, rather than clarity. Lectures often lack spontaneity, because the presenter too often reads the slides verbatim. To cover all the required material, slides become cluttered, and because the average slide contains 40–50 words that can be read in 10–15 seconds, presentations require large number of slides, fragmenting the lecture. Furthermore, these presentations interfere with a true conversation between the lecturer and the audience, resulting in speaker-dominated presentations. Such presentations encourage a passive and inattentive audience. Further compounding the problem, lecturers in their attempt stem the information overload experienced by medical students, create PowerPoint handouts and acquiesce to an informal or formal understanding that tests will only cover these summaries. This formula encourages students to simply memorize facts long enough to recognize them as the correct answers on multiple-choice tests, creating the ideal conditions for the Zeigarnik effect. Instructors need to keep in mind the adage. “You can’t fool yourself that because you lectured, it was learned” (4).

What about textbook use? The course director listed a course textbook and asked lecturers to include reading assignments from this text. However, the minimal expectations of the students (memorize the content of their professors’ notes) would be expected to discourage the reading of the textbook. Why would students “clutter” their minds with additional textbook material, when the material was not being covered on their tests? A survey of our Medical School Bookstore sales for the past 3 years corroborated this prediction. Very few students were buying the textbook (Figure 1). In fact, in 2004 <2% of students purchased the book. In place of the textbook, most students were buying small paperback books containing mnemonics and other tricks for memorizing the names of different pathogens and diseases. These books lacked substantive details and made “Cliff Notes” look like major master works. Were these findings unique to our university? Data provided by medical bookstores from the Northeast and Far West showed identical trends. Review of sales statistics at our bookstore revealed similarly poor sales of textbooks for the majority of first and second year courses, indicating that this trend also was not specific to our microbiology and infectious disease course.

How could these worrisome trends be reversed? How could we apply the basic 7 principles of good teaching with such a large number of
students? Our scientific colleagues in physics, mathematics and biology had already created solutions: Just-in-Time Teaching (JiTT) and Peer Instruction (PI). Just-in-Time Teaching requires the instructor to create two basic warm-up questions related to the topic to be covered in class. These two questions are always followed by the third more open-ended question: What didn’t you understand about the material? Or if you understood everything, what did you like or dislike about this lesson? Students are required to email their answers to the instructor at least 2 hours before class. The instructor reviews the answers and tailors his or her class discussion to reflect the areas of misunderstanding. Answers that typify areas of misunderstanding, as well as ideal answers are shared with the students during class. Because the students have prepared prior to class, and the professor has addressed the areas of confusion during class, coverage of the topic is completed in the classroom (see http://www.jitt.org). Peer Instruction consists of lectures interspersed with basic conceptual questions, called ConceptTests, designed to expose common difficulties in understanding the material. Students are asked to form groups of 3–5, and after thinking about the answer individually for one minute, spend 2–3 minutes
discussing the best answer as a group. The group then electronically answers the multiple choice ConcepTest question. The instructor reviews and explains the reasoning behind both the correct and incorrect answers. This exercise forces the students to think through the arguments being developed, and enables them, as well as their instructor to assess their understanding of the concepts before they leave the classroom (see http://galileo.harvard.edu) (5).

In 2005, we incorporated JiTT and PI into our classes. The notes provided by the instructors no longer contained every PowerPoint slide, but instead consisted of key points. Instructor presentations followed the content of the required textbook and included figures from the book. The factual content of the presentations was decreased, and students were assigned specific pages in the textbook to fill-in additional details. Tests included material from the textbook as well as the instructors’ notes. To encourage more in depth studying and understanding, each exam included an essay question (6). Also in addition to the multiple-choice format, fill-in-the-blank questions were added to test the ability to recall specific facts and names.

What were the consequences of these interventions? Students were initially nervous about these changes, but within a week many had embraced these new learning methods. The consequences of these new strategies were dramatic in terms of microbiology textbook use. As compared to the previous year, there was a 45-fold increase in the number of books purchased (Figure 1, far right column) and a marked drop in the purchase of paperback books containing mnemonics. Most exciting, as compared to the previous 3 years, the results of their final exam, the National Board Microbiology Shelf Exam, improved by 24 percentile points (59th to 83rd percentile), the greatest increase of any class in the history of our medical school (Figure 2).

What can be concluded from this experience? Our interventions fulfilled the 7 consensus teaching goals. Peer Instruction, as well as Just-in-Time Teaching, enhanced contact between students and faculty, encouraged cooperative learning, required active participation, provided prompt feedback, and encouraged analytical thinking. The addition of new testing modalities allowed students with different learning styles to succeed. Most important our changes relayed high expectations for student participation and performance.

A major component of our intervention was establishing a curriculum that encouraged the use of textbooks. The dramatic rise in textbook use associated with the marked improvement in test performance in our class raises the possibility that textbook use may be a useful surrogate marker for curriculum quality. Although the internet can
provide excellent factual content, in order to benefit from our internet age, students require a solid framework of basic principles and facts that will place these specific details in context. The carefully edited textbook, written by acknowledged experts consistently provides this resource (6). The textbook establishes important and valuable standards and provides students with a permanent record of their learning. It is my belief that the survival of the textbook is critical for high quality medical education. If our students are misinformed, and lack a solid platform of understanding, they will be incapable of self-learning. The training of misinformed physicians would have dire consequences for American medicine.

The above experience suggests that teachers should use conventional PowerPoint sparingly, encourage active learning and understanding, and reintegrate the medical textbook into the curriculum. Our goal must be to generate long-term memories, memories that can be eventually carried to the patient’s bedside. After all, isn’t that the purpose of a medical education?
ACKNOWLEDGMENTS

I would like to thank Dr. Robert Watson, Professor of Neurology and Senior Dean for Medical Education and Dr. Donna Duckworth, Professor of Molecular Genetics and Microbiology, University of Florida, for their many helpful ideas and suggestions. Also thanks to Dr. Richard Johnson, Professor of Medicine, Chief of Nephrology, University of Florida, who first alerted me to the Zeigarnik effect.

REFERENCES


DISCUSSION

Barondess, New York: Thank you very much, Frederick, I enjoyed that and I enjoyed Ron Arky’s talk also enormously, and I am certain I will enjoy Kelley’s. The effort that Ron referred to was a project at the New York Academy of Medicine to try to stimulate innovation in teaching the fundamental clinical skills. You’ve spoken primarily to the transmission of factual information and data. We have been concerned in this project with the clinical transaction. In the RFA that went to every American medical school, we said we’d like to give you some money to help you innovate in how you teach the acquisition of a proper sophisticated medical history, a detailed and nuanced physical examination on the capacity to reason from the data obtained by those two techniques. Please tell us what you are presently doing in each of the three, and what you do with the grant. We had 58 responses. No responding school was teaching clinical reasoning as an explicit skill. It was generally an osmotic event. You are supposed to stand near somebody or interact with people who did that and somehow filter it out. Clinical reasoning, I would submit, is the atrio-ventricular node of the clinical process, and in the process of educating medical students, it ought to be an explicit and very prominent focus. What you are teaching is obviously critically important, but helping that information to get to the care of patients through the clinical transaction is something we are doing, even worse in my judgment, than the kinds of things that you are interested in.

Southwick, Gainesville: I agree. I only had 12 minutes, so I couldn't go into all that our curriculum covered, and I actually ran over my allotted time. For each of my sessions, I start with a case, and near the end of each class I ask them to pick from a group of possible diagnoses. And in two days, we are going to have a panel of infectious disease consultants on the stage. I have given the students an unknown case, and we are going to discuss that case in great detail: what tests should be used and what is the most likely diagnosis? We will be using the electronic system to allow each group of students to commit themselves. So I think you can teach clinical reasoning, and the beauty of the
newer electronic systems is that you teach this skill to large groups. One major concern with a Problem-Based curriculum that Dr. Ron Arky discussed in his talk is labor intensity for faculty. I was actually on that New Pathway committee at Harvard, and when we finished our infectious disease problem-based cases, the head of the group asked, “Well now who wants to teach these cases next year?” Not a single person raised their hand, because it was so labor intensive that no one would have time for their research or any other commitments. So I think in experienced hands JiTT and PI can actually teach clinical reasoning, as well as impart long-term memories.

Wing, Providence: Fred, that was terrific, and the program is absolutely terrific. What was the evaluation of the students? Was there a shock value there?

Southwick: This is another issue that I did not have time to address, but I am glad you asked. We all know that all faculty are evaluated by the students. If you are coming up for tenure, or if you are coming up for promotion from associate professor to professor, your teaching scores are a very important component of your evaluation. Naturally, when there is change, students get unhappy. They can reflect that unhappiness in their scores and this is not missed by the faculty. Therefore, I accepted sole responsibility for all the changes in our course, because I am a tenured professor. What could they do to me? What happened? My scores were identical to previous years, however, the standard deviation was huge. They either loved me or they hated me. In the past, the student general course evaluations never mentioned my name. This last year, when the general evaluation asked: What did you like about the course? Dr. Southwick. I read all these wonderful comments to my wife and then I hung up the phone. Then I read further down the general evaluation forms. Following the question, What didn’t you like about the course? I found comments such as “Dr. Southwick is the worst teacher I have ever had in my life”. What I have subsequently learned from more seasoned educators is that once the students understand and expect a new teaching method, they do adapt, and they do become more positive. So, I am predicting this year, the course evaluations will improve, and my standard deviation will narrow, and I will also receive a better score. Professors should expect a barrage of harsh comments and negative evaluations whenever they make a major teaching change.