Lessons Learned

A teaching method helps students

By Tom Schaffner

Ask any educator what's the best way to teach students and you may get a hundred different answers.

The American Society of Radiologic Technologists writes the curriculum for the various radiology modalities, while the Joint Review Committee on Education in Radiologic Technology enforces that these curricula are taught to ensure the program's accreditation.

Although there is a standard curriculum for teaching, instructors have leeway and discretion on how they impart this knowledge to the students. Some instructors may teach a course through straight lectures, some through interactive experiences, while others may teach the materials through distance learning.

With so many choices, how can teachers select the right method to shape the minds of the next generation? There are plenty of choices, but one teacher is making sure that his students learn as much as possible.

SELECTING A STAFF

Ronnie Lozano, MSRS, RT(T), is the program chair and assistant professor for the radiation therapy program at Texas State University, San Marcos. His department consists of three full-time faculty members, all registered radiation therapists with extensive experience.

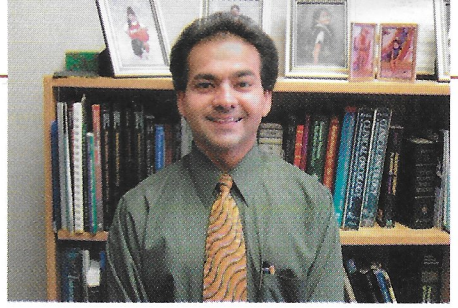
In the beginning of the program, Lozano planned each semester as he went along. "I would like to say that we picked our favorite courses and decided to teach the curriculum that way, but that's not what happened," he says. "I planned each semester as I developed the program. I scouted for resources as the needs or opportunities to teach presented themselves."

In his first year with the program, Lozano used several adjunct faculty members for courses he could not teach himself. "I then found the type of instructor that I really valued as we became established in the central Texas area. I hired one member specifically to be the clinical coordinator based on her extensive experience as a director of several cancer centers during her career," Lozano says. "Another instructor was recruited because of her experience in dosimetry."

Currently, most of the curriculum is taught without adjunct instructors, but they are called on to teach the courses that the staff does not feel qualified to handle. "I want to provide our students with the best learning experience possible, so it's important to realize our limitations and bring in people who have mastered the material, who are able to deliver the courses with depth and rigor and in a manner that provides a good learning experience," Lozano says.

FINDING MEANING

"My favorite course to teach is radiobiology," says Lozano, who took over the course from an adjunct instructor. "It's an extremely important course in our field. You have to teach it in a way that ensures the students find real meaning in the material."



Ronnie Lozano, MSRS, RT(T)

Since radiobiology consists of scientific theories on cells, DNA, micro-structures of tissue and organs and radiation physics that involve the linear energy transfer (LET) of various types of radiation, Lozano says the information is typically presented based on data, numbers and graphs. "The graphs alone have various formats," he says. "For instance, there are several 'curves' presented: the cell survival curve, the tissue response curve and the cellular reproduction curve. It is really easy for the student to lose interest and fail to really understand the content delivered in a radiobiology course. It's important [to understand this information] because radiobiology is the basis for what we do in radiation therapy."

Material associated with something meaningful will help the learning process. "That material will register for long-term memory and will even stimulate a hunger to learn more," he says. "This is what I do when I deliver the content for the course. It has taken me three years to collect various illustrations and pictures to help make the connection between scientific terms like 'LET' and 'RBE,' the concept of why the patient will get diarrhea after irradiating the small intestine or why the patient will lose his or her hair after a certain dose. This is what I have a real passion for – taking something like a chart, table or graph and making a connection so the student associates the material with what they see in the clinic during treatment and seeing a light turn on in their facial expression."

INTRODUCTIONS

On the first day of class, Lozano describes the course to his students, passes out the syllabus and course schedule and then reads a few lines from a book he found during graduate school titled *Active Learning: Creating Excitement in the Classroom* (by Charles Bonwell and James Eison, ERIC Digests, 1991).

The reading cites a study on student retention and comprehension where a modified lecture format included pausing during the lecture to allow discussions among the students to clarify information. In the study, the students were also asked to write down everything they could remember from the lecture for three minutes (free recall). Twelve days after the last lecture, the students were given a multiple-choice test to measure long-term retention. The difference in mean scores from a control group and the test group was large enough to make a difference of up to two letter grades.

"I read the main points of this section to the class," Lozano says, "then I ask them, 'How would you like to improve your grade by two grades?'" The lowest grade Lozano has given in one of his classes in three years was an 85; the majority of the grades are in the 90s.

"I discuss radiobiology with the students a year later, as seniors, during a registry review course," he says. "I find that the students still retain much of the information."

MASTERING THE EXAM

Another technique Lozano uses to help his students better understand the curriculum is something he calls the "mastery" exam. According to *Active Learning*, one way to increase learning is to include an immediate mastery test of the covered material.

In their study, the book's authors traced the "forgetting curve." On average, students had immediate recall of 62 percent of the presented material. Recall declined to 45 percent after three to four days and fell to 24 percent after eight weeks. If asked to take an exam immediately after the lecture, the students retained almost twice as much information, both factual and conceptual, even after eight weeks.

Testing Patterns

Ronnie Lozano, MSRS, RT(T), ARRT, has developed a course packet that consists of essential material to support each chapter he covers in class. The statements are written with blanks that must be filled in. The student finds the information within the text chapter and/or during Lozano's class lecture. "I call these 'open-book assignments,'" he says. Each assignment is due at the beginning of the next class after he has completed the chapter. The course work is evaluated as follows:

- *Open-Book Assignment (15 percent):* The student will be required to complete a written assignment for each chapter. The purpose of the assignment is to ensure that the student stays on schedule with the textbook reading material and comes to class prepared for each lecture. It also emphasizes the objectives of each chapter. The assignments will be due at the beginning of the next class day after completing the chapter lecture. Ten points will be deducted from the assignment for each day late.
- *Free-Recall Quiz (10 percent):* The student will be given five minutes after each lecture to write down everything they can remember. The purpose of this quiz is to utilize immediate recall of information presented.
- *Chapter Essay Exam (15 percent):* The student will be required to complete a short essay exam at the end of each chapter. The purpose of the essay exam is to influence the focus of study toward learning and assuring an understanding of critical concepts of the material and minimizing mere memorization of terms and statements.
- *Four Major Exams (40 percent):* A major exam will be provided after every three or four chapters.
- *Final Exam (20 percent):* The final exam will be comprehensive.

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"This really got me excited," Lozano says. "The key words are 'factual' and 'conceptual.' Radiobiology is filled with conceptual information that I get excited about. Finding a way to have students master this was really worth a try."

Lozano also illustrates from the book that exams make students study, but more importantly, the type of exam students expect influences how they study or the focus of their study. For instance, if studying for a multiple-choice exam, the student may not attempt to acquire a general view of the material; rather he or she may try to learn facts or memorize statements.

"This tells me that if I want the student to master the conceptual material, I should provide essay-type exams and test them immediately after the lecture," he says. "What it comes down to is that I keep the students busy recapping and restating what I deliver after each lecture. This is done in varying formats. Each type of test or quiz is weighted differently."

THE COURSE

Lozano's radiobiology course encompasses 10 chapters with each chapter taking two class sessions to complete. "Students expect what I call a 'recall quiz' at the end of the first part of the chapter," he says. "This serves to make sure students are attentive and provides me with feedback to make sure I am coming through clearly."

The recall quizzes also provide Lozano with an opportunity to correct any misconceptions on a continual basis and provide the students an incentive to attend every class. "I recommend that the students read the chapter ahead of class, so that my lecture supports what they read or provides clarification. I deduct points only if the student turns in a paper that is far below the level of content submitted by the class as a whole or if they miss the class."

Lozano with his students

When each chapter is completed, Lozano administers what he calls a "chapter-end essay exam." The exam consists of four or five questions that require the student to discuss, illustrate, label and compare information from the chapter. "I am looking for quality

On the Front Lines

Educators discuss their teaching methods

The Participants:

- Eileen Maloney, MEd, RT(R)(M), FASRT, professor of radiography at Passaic County Community College, Paterson, N.J.
- Debra J. Poelhuis, MS, RT(R)(M), director of health careers – West, Montgomery County Community College, Pottstown, Pa.
- Cynthia Shillingsburg, BA, RVT, RVS, instructor and clinical coordinator of cardiovascular technology, department of diagnostic imaging at Jefferson College of Health Professionals, Philadelphia

RT Image: How do you prepare for a class?

Maloney: Before the semester begins, I prepare a course syllabus, which I consider a contract between the student and myself. It includes a lecture outline, test and exam schedule, grading criteria and details on class assignments. Then I review my class outlines and update any material as required. I have been teaching for 30 years and still look forward to a new semester.

Poelhuis: No matter how many "first" days I have, I always spend a lot of time making sure that I present myself in a very organized manner and with as much enthusiasm as possible. I want the students to feel special to be there, and I try to convey that I will be there for them as much as they need me.

Shillingsburg: Curriculum development is an ongoing process – responding to things that were effective and things that were not. Information must always be current and consistent. I am constantly integrating multimedia techniques (Web-based supplements and upgrading PowerPoint presentations).

RT: Describe a typical first day of class?

Maloney: If it is a freshman class with new students, I have the students pick a fellow student's name out of a hat. For 15 minutes, the students get to know each other and introduce themselves to the rest of the class by giving a short background on themselves. Then I introduce myself and give a short background. We usually do this over coffee and donuts. If it is a class where I already know the students, we get right down to business by reviewing the course syllabus so they all know what is expected of them.

Poelhuis: I introduce myself and tell them about my professional background and about my personal life, so that they know that I, too, have a family, a house and a life outside of school.

Shillingsburg: I discuss the syllabus, including requirements, grading policies and criteria, attendance, objectives and course pace. The first assignment requires the student to identify a maximum of three to five course goals. This gives students the opportunity to reflect and encourages them

answers, so this is when I expect the student to generate complex graphs to define certain points related to the graph and to discuss the associations we made in class to actual patient results to therapy."

At this point, Lozano might ask his students to associate the effects of decreased dose rate to fractionated radiation therapy. "The students must have read the chapter by this time and must ask for clarification during class if they expect to do well on this exam."

This exam is worth more than the free recall quiz (see "Testing Patterns"), since the students are required to prove that they really understand the material via the essay exam immediately after hearing the lecture. "The concentration is on a specific focus or topic," he says. "They just had an opportunity to seek clarification if needed. This is much better than mixing these types of questions with material from three separate chapters. We focus on one thing at a time and really strive to master it. [The students] may see the same material again formatted on a multiple-choice exam."

Lozano explains to his class that any good test taker can do well on a multiple-choice test, but still learn only a small amount of information. "I can make associations with words and memorize statements and pass this type of test when I study for it like that," he says. "Despite that fact, I still have a 50-question multiple-choice exam at the end of three chapters."

Although Lozano admits these major exams do not show mastery of content, he says they do cover a great amount of material and provide an assessment of learning of the general material, such as definitions and relationships.

"The students really get serious after I am finished explaining how they will be learning radiobiology," Lozano says. "It keeps them on their toes. But after an adjustment period of a few weeks, they get used to it. I like to think of [this learning process] as having them rise to my expectations. They do well for the most part. This is how I have blended concepts into a delivery format that I think works quite well."

— Tom Schaffner is the editor in chief of **RT Image.** *Questions and comments can be directed to tschaffner@rt-image.com.*

Left to right: Eileen Maloney, MEd, RT(R)(M), FASRT; Debra J. Poelhuis, MS, RT(R)(M); Cynthia Shillingsburg, BA, RVT, RVS

to plan. This very basic learnng contract is revisited at the end of the semester to determine if the identified goals were met.

RT: Do you have a certain style of teaching?

Maloney: For most of my classes I still use a straight lecture technique using PowerPoint or transparencies, questioning the students throughout the lecture.

Shillingsburg: I use a variety of [styles]: motivational, engaging, use of Socratic discussion, role playing, critical thinking activities involving differential diagnosis, artifact or equivocal findings, simulated morbidity and mortality class conferences and discussions. I also provide the students with ongoing feedback and reviews.

RT: Do you have a different style of teaching when students have difficulty learning the materials?

Maloney: We have a peer/tutor program, which provides tutoring to the students by their fellow classmates. The tutors are paid for their services by the college.

Poelhuis: I try to use a variety of methods. I am big on using PowerPoint because I think the visual aspect aids in learning during class. I use small-group learning and also call on the students to explain concepts to their peers. I offer tutoring sessions and give the students worksheets as practice tools.

Shillingsburg: Often adult students doubt their abilities to learn due to past experiences. I try to encourage and really build self-esteem that will empower them to succeed. I take the time to get to know them and use examples they can relate to in class discussions. Most importantly, they need progressive feedback to identify and discuss problems and guidance in step-by-step solutions.

It is important to bring new things into the learning environment to help the student having a hard time learning. Innovative technology to complement instruction and new skills and strategies for obtaining knowledge give them a feeling of possibilities and new perspectives of themselves as a learner.

RT: What advice do you give your students about the job market and working in the "real world"?

Maloney: I tell them to maintain their professional standards no matter what the circumstances are in their work environment and that we are recognized as professionals by the work we do.

Shillingsburg: I tell them about things that are important: work ethic, giving something back to the profession, being accountable and reliable and always remaining a team player. They should continue to learn formally and daily, as well as to develop their inner motivation and desire to learn, apply new knowledge and test the waters.

— T.S.