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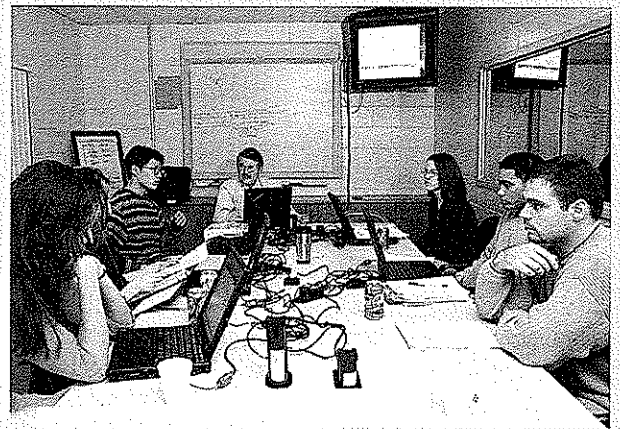
## Uniting Basic Science and Clinical Know-how: Solving the Problems of Problem-Based Learning

BY DAWN ANTOLINE

“It is amazing to see light bulbs go off in students’ heads when they first apply their basic science knowledge to a clinical case and learn to ask questions that lead to a diagnosis,” says Dona Harris, PhD, associate dean of faculty development and professor of family medicine at Mercer University School of Medicine in Macon, Ga. “The students jump into the clinical problems from day one, and as seniors, they feel prepared for their residencies – they even feel that they can teach medicine.”

Dr. Harris speaks of problem-based learning (PBL), which she and many others say greatly enhances the medical education experience. North American medical schools have employed PBL techniques for over 30 years, and most offer a PBL experience, predominantly in a single class or as a journal club.<sup>1</sup> Relatively few, however, use PBL as a curriculum-wide technique, and fewer still use PBL during the basic science years, typically the first two.<sup>2</sup>

A dearth of research on PBL partially accounts for this. Most studies have relied on



Wake Forest med students learn in PBL groups. Here (l to r) are class of 2003 students: Angela Bartley, Jody Robinson, Galaxy Li, Louis Kucera, PhD (group facilitator), Holly Westall, Ed Smith, Steven Greer.

observational data, and many measure only subjective variables, such as student satisfaction or faculty opinion of a new program.<sup>3</sup> Not much data have been published on PBL-associ-

ated costs, the most effective way to organize and implement PBL, or the long-term value of PBL as a tool to teach basic science. However, the research indicates that once they become acclimated to the PBL environment, most students respond positively to it and feel well prepared for

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David Lipschitz, MD, PhD, renowned geriatrics expert from the Univ. of Arkansas



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### Problem-based learning

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clinical work and residencies.

The University of New Mexico Medical School (UNM) surveyed its first-year PBL students and found that they feel well prepared in comparison to their peers and more confident in their clinical years due to PBL experiences, according to Summers Kalishman, PhD, Director, Office of Program Evaluation, Education, and Research there. PBL advocates hypothesize that the teamwork, self-directed learning, and research skills developed in PBL will accompany students throughout their careers.<sup>4</sup>

To examine the innovative ways that they are tackling the recognized challenges of PBL, APS spoke with administrators and faculty at four schools who have integrated PBL firmly into their first- and second-year medical school curricula.

### Hybrid Programs and Other Innovations Bridge the Gap

Does PBL improve learning, especially during the basic science curriculum covered in years one and two? Interviewees reported mixed results on their students' basic science performance on the USMLE.

Both Wake Forest University School of Medicine (WFU), in Winston-Salem, N.C., and the University of Missouri at Columbia School of Medicine (MU) have published studies comparing the USMLE step I and II scores of their PBL students to traditional curriculum students. Neither reported notable differences—positive or negative—in these scores.<sup>5</sup>

However, experts attest to a variety of skills—such as self-directed learning and the ability to work well in a team of physicians—that are taught by PBL and not readily apparent from USMLE scores. Still, integrating basic science knowledge into such a diffuse learning environment can be challenging. One way that schools are addressing this problem is through hybrid programs combining PBL sessions with related lectures.

UNM instituted PBL as a parallel track

to its traditional lecture curriculum in 1979. Twenty years later, faculty merged the two parallel tracks into a single program featuring traditional lecture classes that complement the clinical problems discussed in groups.

“Why not fuse these two developed tracks to create a richness in our educational program,” reasons Stewart P. Mennin, PhD, Assistant Dean of Educational Development and Research at UNM. The key to a hybrid program, UNM administrators have found, is balancing the lecture and PBL material so that everything works together to help students learn basic science and its applications.

### Snapshot: Problem-Based Learning<sup>6</sup>

- ❖ Teaches evidence-based medicine in a student-centered format
- ❖ Small groups of students research and analyze clinical cases
- ❖ Experienced facilitators guide the analytical process
- ❖ Cases are open ended and often presented incrementally

“Our curriculum is synergistic,” explains Ellen M. Cosgrove, MD, Senior Associate Dean of Education at UNM. “The PBL tutorial process helps prepare students for lectures by having them define key questions. They go to lectures more prepared to listen and learn the material.” She cautions, however, there must be careful correlation of the material presented in problems and in lectures. “It defeats the purpose of PBL if the lecture gives away answers to all of the questions in the case.”

WFU also employs a hybrid program, which was initiated in 1998. Cam Enarson, MD, Senior Associate Dean at WFU, reports that PBL provides an “overarching frame for the curriculum.” Each week begins with a PBL case that students discuss and research in their PBL groups in order to identify key learning issues. Students work on the case throughout the week and tie the PBL material to their other course work—lectures, labs, clinical skills classes, even public health studies. At the end of the week, the PBL group meets again to complete the case by drawing on the knowledge gained in class and through individual research.

To extend the learning opportunities for each case, new information is added on Friday—perhaps a new symptom for the case patient, or a follow-up visit 10 years in the future.

“Our faculty have been great about collaborating and organizing their teaching topics to fit this model, resulting in a highly integrated system of classes that complement each other,” Dr. Enarson reports.

Even schools with a uniformly problem-based curriculum are experimenting with adding a lecture component. Mercer, which has had a problem-based basic science curriculum since its inception, added an experimental lecture component to its seven-week neurology phase last year, explains Sebastian R. Alston, MD, Associate Professor of Pathology. “Instead of the usual problems, students were given faculty directed lectures. The goal of this was to see if such a component would help student learning.”

Another novel component that one institution is utilizing to incorporate PBL techniques is a long-term research project. While this is an integral part of other professional degree programs, only eight North American medical schools require a research project—and UNM is one.

UNM students develop a project idea, research and gather data, and present a final product to a professional audience, explains Teresita McCarty, MD, Director of Assessment there. Researchers at UNM call this process of “generated new medical knowledge” the “ultimate PBL experience.” Furthermore, 50 to 60 percent of projects address concrete problems in the community, augmenting the students' experience with true-to-life medical situations.

Students can receive a faculty commendation at graduation for submitting their project to a peer-reviewed journal or presenting it at a national conference, and many students report that the experience helped them obtain one of their top residency choices.

### What Are the Costs?

Increased costs and the allocation of that

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### Problem-based learning

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precious resource of faculty time are also points raised against adoption of PBL. None of the experts interviewed cited financial cost as inhibiting factors to their PBL programs. In fact, Dr. Alston points to a study done by his colleague Robert S. Donner, MD, Professor of Pathology at Mercer, that concluded PBL is actually more cost efficient than traditional programs for class sizes up to 60 students. Above this class size, the need to hire more faculty members and tutors becomes a relevant cost concern.<sup>7</sup>

The experts interviewed here did attest that PBL takes much more faculty time than a lecture-based curriculum, but they unanimously agree that the depth added to the students' experiences justifies the cost.

To reduce the PBL burden on faculty members while maintaining small group sizes and quality, MU uses fourth-year medical students to tutor first- and second-year students, reports Michael Hosokawa, MD, Associate Dean for Curriculum and Professor of Family Medicine at MU. Student-tutors report to a faculty member, but require minimal training because of their extensive experience learning in the PBL environment. According to Dr. Hosokawa, "we just stand by to offer the students support if they run into problems."

Student-tutors' basic science knowledge is often more current than that of professors, he continued. Also, student-tutors tend to take on a mentoring role with the students in their problem group, guiding them through the difficulties of the medical school curriculum.

WFU has also had success with non-faculty tutors: radiology fellows.<sup>8</sup> These tutors perform as well as or better than faculty tutors, with respect to facilitating group discussions, according to a student survey. The researchers hypothesize that

the radiology fellow-tutors were more willing to direct the students' learning as opposed to providing answers to the students because they lack expertise in some topics. One problem with the student-tutor model, Dr. Hosokawa explained, is that it requires students to grade other students. In fact, evaluating student performances is challenging, even in the faculty tutor model.



**Dona Harris, PhD (L) and Sebastian R. Alston, MD (R)** from Mercer University School of Medicine.

### Factoring PBL Into a Formal Evaluation System

How can you comprehensively evaluate a student's basic science knowledge while remaining true to the PBL format?

Mercer University has dealt with this by designing a three-part exam, administered at the end of each subject unit, that assesses problem-based and basic science skills cumulatively. First is a traditional board-style exam of around 200 multiple choice and essay questions. An oral exam follows, where a student must analyze and present a case to faculty graders. Finally, the faculty facilitator assigns a tutorial grade, based on group work criteria such as attendance, participation, information-gathering skills, and analytical ability.

"I think this is fairly unique to Mercer, at least in the way we use the oral exam," Dr. Alston explains. "It is thought that board exams don't test all of the knowledge and skills gained in problem based-learning, so

this oral exam tests problem-solving and analytical skills." These three parts are taken cumulatively, at the end of the year, to determine the student's grade.

### The Common Denominator

One trait that this diverse group of interviewees has in common is a palpable love of teaching, and a concern that their students are prepared for a successful and enjoyable career in medicine. Perhaps the PBL teaching format works better for faculty who truly love this component of their professional duties.

"I was filling out a form to renew a state license," jokes Dr. Alston, "and I looked at the contact hours I had written down that I was available for students, and I said to my wife, 'they aren't going to believe these are my hours.' The vast

majority of what I do is education-oriented, and much of this is related to the students. I just love teaching, and I think the low faculty turnover rate here signifies that education is a priority at Mercer." ♦

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