BIOCHEMISTRY AND MOLECULAR BIOLOGY EDUCATION
Vol. 31, No. 1, pp. 52–56, 2003

Problem-based Learning

The Problem with Problem-based Medical Education

PROMISES NOT KEPT

Received for publication, August 12, 2002, and in revised form, August 27, 2002

Robert H. Glew‡

From the Department of Biochemistry and Molecular Biology, University of New Mexico School of Medicine, Albuquerque, New Mexico 87131

More than a decade after a student-centered, problem-based learning (PBL) was implemented at many medical schools in the United States and other countries world wide, the debate about the merits of PBL medical education continues to embroil its proponents and those who favor the more traditional lecture-based approach to learning. The author, while believing that the premise of PBL medical education is still valid, is disappointed that poor implementation of PBL has compromised its potential. Several reasons that may explain why PBL has failed to live up to its promises and expectations include: first, inadequate support of the curriculum from basic scientists who either do not support the concept itself or who place much greater value on research than on teaching; second, poor oversight and inadequate assessment of the PBL curriculum on the part of administrators and faculty charged with its implementation; and third, excessive reliance on insufficiently knowledgeable or motivated clinician educators to teach basic science information and principles in the latter years of the curriculum. This essay is intended to stimulate discussion and analysis of the extent to which PBL medical education has failed to deliver on its promises.

Keywords: Problem-based learning, medical education, curriculum, clinician educators, basic scientists.

Around 1990 the craze for student-centered, problem-based learning began sweeping through United States medical schools like wild fire through a parched Colorado forest. Its promoters and advocates thought they had re-invented medical education. Like most plans, on paper it looked great. But, in my judgment, twixt the cup and the lip, between the design and the implementation, there have been many a slip. I myself became a strong advocate for the shift away from the lock-step, 25-lecture per week didactic medical curriculum to one in which most of the class time was replaced by small group tutorials in which students largely taught themselves through the pursuit of learning issues identified and articulated during the tutorial sessions built around clinical problems and scenarios and where students were encouraged to ferret out the appropriate basic science knowledge for themselves. Certainly, while basic science learning should be clinically relevant, the clinical vignettes ought to illuminate relevant pathophysiologic mechanisms and principles [1].

It is generally accepted among medical educators that the amount of biochemistry, for example, that students are expected to learn in a PBL[1] curriculum is significantly less than that learned in a more traditional course of study [1]. Acknowledging this fact means that we cannot teach it all and that the content of a core PBL curriculum must be selective. I endorse Cohen's recommendation [2] that the core should be constructed jointly by basic scientists and clinicians. However, I do not agree with Rajan [3] who believes that much of basic science education is unnecessary for the majority of physicians and who, while not mentioning PBL specifically, seems to favor a "science lite" approach to medical education. I reject this view and believe, as Dennick does [1], that the basic sciences are the fundamental building blocks in the foundations of medical education and that not only are the basic sciences required to understand many of the disciplines that underpin medicine but that such knowledge is also required in clinical practice. Otherwise, doctors will practice by algorithm, nomograph, and pattern recognition.

I am in accord with proponents of medical PBL, such as Wood [4] in England, who are convinced that students learn more effectively if the knowledge and skills they acquire are embedded and contextualized in relevant real life, problem-based situations and regard PBL as an effective learning mode and an active process of personal cognitive construction. This implies that the individual student is ultimately responsible for their own learning.

The intent of this essay is to stimulate productive discussion and analysis that will mobilize the support and provide the oversight that PBL initiatives at United States medical schools will need if they are to survive and meet the grand expectations and promises they raised a decade ago. The author of this piece does not reject PBL; rather,

‡ To whom correspondence should be addressed: Dept. of Biochemistry and Molecular Biology, Rm. 249 BMSB, School of Medicine, University of New Mexico, Albuquerque, NM 87131. Tel.: 505-272-2362; Fax: 505-272-6587; E-mail: rglew@salud.unm.edu.

[1] The abbreviations used are: PBL, problem-based learning; PIE, Practical Immersion Experience.

his position is that poor implementation of problem-based curricula has grossly compromised its effectiveness and kept it from reaching its potential.

In a full-bore PBL curriculum the number of lectures medical students have to attend might be only half a dozen or so. The students are initially presented with a dilemma or problem and must define and learn the basic science facts and concepts to accurately discuss and solve the problem. The lectures are intended to define the scope of a domain of study rather than convey a dense and specific corpus of biomedical facts and principles; in a pure PBL curriculum, the students would get the details on their own by developing their learning issues. Professors were no longer instructors or teachers; in the new vernacular, they were designated facilitators, guides, or education coaches. The innovative student-centered paradigm was supposed to transform medical students from scriveners and scribes of detailed factoids one could find in textbooks into eager life-long learners. It remains to be seen if this has turned out to be the case. I have often wondered how you might test to determine whether a PBL curriculum is turning out doctors who are life-long learners. I have often wondered whether, conversely, before the wholesale implementation of PBL and when medical students were taught the old-fashioned way, United States medical schools were turning out doctors who were opposed to life-long learning. In the old pre-PBL days, were medical schools producing doctors who were averse to keeping up on new knowledge? After graduation, did doctors who had been taught the old-fashioned way go through their medical careers practicing medicine by relying only on what they had learned in medical school in thousands of boring lectures taught by experts who burdened and tortured them with endless facts and excruciatingly detailed metabolic pathways and pathophysiologic mechanisms?

In 1990, I was a true believer. PBL was the only way to go. I thought it would empower medical students, give them a stake in their own education, and humanize the learning process. No longer would egocentric specialists control what medical students learned; through the tutorial process the students themselves would discover what they needed to learn and how they would acquire that knowledge. I was such a true believer that I wrote a pro-PBL essay that extolled the virtues of student-centered, tutorial-based medical education [5]. Several students have informed me that after reading that essay they turned down offers of admission to traditional medical schools and elected to matriculate at one medical school or another whose curriculum was of the PBL variety. Each time a student acknowledges that my essay directed them away from a medical school with a traditional (2 years of basic science, 2 years of clinical), I have wished I had waited until I had had more first-hand experience with our intensive PBL, student-centered, tutorial-based curriculum before writing that article. What changed my attitude?

I have since soured considerably on the innovative, largely lecture-free, and "science-lite" PBL curriculum at the medical school that employs me, not because it isn't a good idea, but because many of the promises and commitments from faculty and administrators that were required to make it work failed to materialize. What were the kinds of evidence suggesting that the PBL curriculum was grossly under-performing? First, on occasions where I have had discussions with 3rd- and 4th-year medical students about patients they were seeing during clinical rotations, I was both surprised and disappointed by how shallow their knowledge was of the basic biology that underlies the illnesses of their patients. Even more disconcerting than their apparent knowledge deficits was their general lack of interest in matters pertaining to pathophysiology and their poorly developed ability to reason their way through a problem from basic principles. This deficit in basic science knowledge was especially evident as early as the 2nd year when students are normally assigned to their Practical Immersion Experience (PIE) sites where they gain clinical experience, usually in a clinic on one of the Native American reservations or in some other rural area in the State. Toward the end of the PIE experience, each medical student is assessed by a faculty member, usually a clinician on the faculty of the School of Medicine, or less commonly, as in my case, by a Ph.D. in one of the basic science departments. Most students, in fact, do receive a formal "satisfactory" or "passing" grade for the 12 weeks they spend in PIE. However, in most of the PIE assessments I have conducted over a 10-year span, I have been dismayed by the fact that many of the students seemed to know about as much about human biology as a high school student who had just completed an Advanced Placement biology class. So my guess is that the 3rd- and 4th-year medical students that I referred to above had not just forgotten basic science information they had once learned in earlier phases of the undergraduate medical curriculum; they had probably never acquired this knowledge in the first place.

Additional evidence that the PBL curriculum is not delivering sufficient basic science knowledge came from the students themselves. Many medical students in the final year have volunteered that they perceive they are being graduated with an inadequate grasp of basic science information. Some of these same students have gone so far as to express resentment about the failure of the PBL curriculum to give them a strong foundation in the basic sciences, asserting that this significantly compromised their performance on United States Medical Licensing Examination Parts 1 and 2 and made them less attractive candidates in the National Residency Match Program. Not infrequently students approach me with a request to set up an individualized basic science learning program. Some defenders of PBL dismiss the bitterness of such students on the dubious grounds that "all medical students on graduation day are intimidated by the prospects of starting their residency and doubt whether or not they know enough to take this next giant step in their medical education and training."

My third reason for believing that our PBL students are basic science-deprived derives from my having attended a number of lectures that were presented to 1st- and 2nd-year medical students by clinicians. In most instances, the clinicians emphasized material I would have expected students to have learned during their clinical rotations rather than during the precious few lecture-based venues in the first 18 months of the curriculum when rigorous basic

science content should have been emphasized. Compounding this problem was the fact that about 70% of the lectures during the early phase of the curriculum were taught by clinical faculty, not Ph.D.s with expertise in the disciplines being covered. For these reasons, my lack of confidence about PBL-style medical education as I see it being applied is so great that I doubt that graduates of the present program have the necessary basic science foundation that will permit them to become life-long learners and physicians who are able to understand and evaluate tomorrow's molecular advances in medicine.

Thus, it seems to me in retrospect that the new paradigm shift in medical education that was launched about 10 years ago was done without the financial and human resources needed to allow it to live up to its expectations. This failure has impacted most negatively on medical students, not the faculty of medical schools that have substituted a PBL program for a traditional curriculum.

From my own 12-year experience with PBL-style medical education, I see two outstanding reasons for why it has largely failed to deliver as promised: one fault lies with the clinical faculty who had, at the outset, agreed to infuse basic science material extensively into the more clinical years of the curriculum; the other fault lies with the basic scientists who, for the most part, never embraced the concept or philosophy of PBL-based medical education and who, in fact, reacted with much passive aggressiveness to the mandate of the medical school dean that they adapt themselves to a tutorial as opposed to lecture-style approach to learning. Let us take a closer look at how clinician-M.D.s and basic scientists, most of whom are Ph.D.s, have compromised the promise of an inquiry-based approach to education.

With regard to the clinical faculty specifically, in my judgment the main detriment to PBL has been the enormous pressure on doctors in the core university hospital, where most undergraduate medical education takes place, to provide care for patients and enhance revenues for the institution. I know of instances, for example, in which clinician educators attended only 20% of the tutorials they had agreed to facilitate, and in those they attended they were often called away to answer a page or report to clinic. At other times the clinician educator confused one student with another, assigning the wrong names to final student evaluations.

It was an unfortunate coincidence that in the early 1990s, just about the time that PBL was being introduced into the curriculum at medical schools across the country, in some places modestly and in others extensively, economic distress caused teaching hospitals to demand that their clinical faculty spend significantly more time seeing patients and increasing billing. To accomplish this goal, many medical schools created a faculty position called the clinician educator. According to the job description in the faculty handbook, a clinician educator is supposed to divide most of their time between patient care and teaching medical students (and residents). They are also expected to engage, to at least a modest extent, in "scholarly work"; however, the expectations in this regard are usually specified so briefly and non-specifically as to be meaningless. The truth of the matter is that clinician educators are often promoted to the next higher academic rank without consideration of their scholarly output, including scholarship in their teaching activities. Unfortunately, the truth is that at the medical school where I am employed, of the hundreds of clinical faculty hired since the position of clinician educator was created, all but a handful have been clinician educators who act almost totally in the capacity of clinician and hardly at all as educator. In fact, most clinician educators will readily confess to being so busy seeing patients that they have little opportunity to educate medical students.

Another problem with a number of the clinician educators has to do with their attitude toward basic science material. It is commonplace for a clinician educator when confronted by a medical student with a legitimate fundamental question about metabolism or the physiology of the heart or kidney to react by dismissing the student's curiosity on the grounds "You will never in your career have to use that kind of information."

Being too busy to teach is just part of the problem with the clinician educator. The other problem with filling the ranks of the clinical faculty with clinician educators as opposed to tenure-track doctors who are seriously committed to research is that, by their own admission, clinician educators have not maintained and replenished their fund of knowledge in the sciences basic to medicine. Often clinician educators have complained to me that medical students are inclined to push them beyond the limits of their knowledge. Since few clinician educators I know have exhibited a deep interest in scholarly work of any kind, should we not regard the clinician educator title as an oxymoron? Most of the clinician educators I know are doctors, not educators: they see patients and make money for the teaching hospital, but they do not teach very much and do next to nothing in the way of research.

The ultimate effect of placing most of a medical student's education in the hands of clinician educators, especially in a PBL, student-centered curriculum, is that little in the way of basic science subject material is taught to them in the so-called clinical years of the curriculum. This deficit in basic science learning is compounded by the fact that, as alluded to above, the 1st year or two of our PBL curriculum is infiltrated with an excess of clinical subject matter at the expense of basic science concepts and principles. Thus, in many instances, medical students exit the 1st year or so of medical school not knowing very much hard science and enter into the clinical phase of their training where they are taught little about the sciences basic to medicine by clinician educators who are too busy or too ill-informed to fill in gaps in the basic sciences or revisit difficult, critical topics from the earlier phase of the curriculum where most of their basic science learning occurred.

The second major reason why PBL often fails to live up to expectations at medical schools where this student-centered approach to learning has been implemented is that insufficient numbers of Ph.D.s in the various basic science departments are committed to it. While a fundamental philosophical skepticism about PBL as a mode of teaching has certainly kept some basic scientists from embracing and supporting this type of curriculum, I do not

think it is the only reason. Another reason has to do with pressure to secure extramural grants that carry with them very large overheads and that pay a substantial portion of a faculty member's salary. Today, and perhaps it has always been the case, basic scientists are getting mixed messages from the dean: on one hand, the dean presses them to serve as mentors in PBL tutorials or as assessors of medical students who are doing a clerkship at some distant rural site or as leaders of a weekly get-together of students where issues pertinent to professionalism are discussed; at the same time, the dean strongly pressures the basic scientists to bring to the institution ever more grants with their attendant overhead and salary dollars. Exacerbating the situation is the fact that while many medical schools give substantial bonuses to basic scientists who bring in grants, rare is it to find commensurate rewards and incentives for faculty who teach and who do it well. The truth is, however, that the amount of teaching that most faculty in basic science departments actually do for medical students is exceedingly small by any standard. For example, from a recent quantitative analysis I conducted of the teaching obligations of basic scientists at the University of New Mexico School of Medicine (UNM-SOM), I discovered that the average number of hours a Ph.D.-basic scientist spent teaching medical students in a lecture hall or tutorial conference room was about 27 h per year. To place this number in perspective, consider that the faculty in the departments of chemistry and biology on this same campus, on average, teach more than 150 h per year. Thus, the average amount of teaching a Ph.D.-basic scientist provides in 1 year to medical students at UNM-SOM corresponds to less than a single three-credit course, hardly sufficient to warrant the term "burden."

Thus, the second major problem with PBL-style medical education is that Ph.D.-basic scientists, the faculty who ought to be the ones best suited to teach basic science topics to medical students, are not sufficiently committed to or involved in the teaching of medical students. Underpinning this assertion was the finding, derived from the same study referred to above, that more than two-thirds of the lecturing and tutoring in the 1st year and a half of the PBL curriculum at UNM-SOM is being provided by physicians, many of whom are clinician educators. It is fair to say that for many Ph.D.-basic scientists, the problem is deeper than just their general lack of enthusiasm for PBL-style education; that is, it is common to hear faculty in one of the basic science departments express outright hostility to our student-centered, tutorial-based curriculum. What one hears over and over again from them is anger in reaction to their perception that the curriculum, from the 1st day of the 1st year of medical school all the way through to graduation, has been hijacked by clinicians who, for the most part, are unqualified to teach the basic science matter of their particular discipline. Seeing themselves disenfranchised from the undergraduate medical education program, they react by opting out altogether. The pity is that such passive-aggressive behavior is invariably tolerated by the medical school administrators responsible for implementing the curriculum in all its dimensions.

One of the most significant consequences of having a PBL-based undergraduate medical curriculum in which Ph.D.-basic scientists and tenured or tenure-track M.D.s do relatively little teaching and where most of the teaching is left to clinician educators is that you risk training doctors who are inadequately educated in the sciences basic to medicine. It means graduating doctors whose foundation in basic science principles is so insubstantial as to leave them with deficits they will never repair. Lacking a strong grounding in the basic sciences, what sort of foundation will it be upon which these graduates lay the new knowledge that a PBL-style curriculum promises to make possible? If the outstanding deficiencies of PBL in a number of this country's medical schools are not promptly addressed and corrected, we will dilute the nation's pool of rigorously trained and educated physicians with ones whose education is woefully short on rigor and content and that was acquired largely by "shadowing" clinician educators for most of the 4 years they spent in medical school.

While one may argue whether the road back will require more traditional lectures, fewer tutorials, and more hours in the anatomy laboratory and less virtual medical education, what is undeniable is the need to greatly increase the involvement of basic scientists in the education of medical students. The majority of medical education in the 1st year and a half to 2 years of the curriculum should be the responsibility of Ph.D.-basic scientists who should be involved in the formal education of undergraduate medical students up until the day of graduation. Ph.D.-basic scientists at American medical schools earn considerably more than their counterparts on the undergraduate campus but do only about one-quarter the amount of teaching as their colleagues in the chemistry or biology departments. Isn't it time they earned their keep?

Finally, after the decade-long experiment with PBL-style education has had a chance to play itself out at dozens of United States medical schools, isn't it time to question the extent to which PBL has lived up to its promise of providing balanced, quality education? When you consider that an extensive literature seems to indicate that the PBL approach has worked well in many educational settings other than medical schools, you are left with the question of whether the disappointing record of undergraduate medical PBL has been due to some fundamental flaw in the philosophy behind PBL or if it is the result of a failure of proper implementation. For me, while the premise of PBL remains valid, if this promising mode of education is to have a future in our medical schools then deans, associate deans of medical education, and department chairs are going to have to find ways to greatly increase the involvement and commitment of all faculty, but especially basic scientists and tenure-track clinicians, in educating medical students. This will require much greater faculty input into deciding on what the core curriculum should be but also in lecturing and serving as tutors for blocks lasting, in some instances, for as long as 8–10 weeks. One way to increase faculty participation in the PBL curriculum is to have basic scientist-clinician pairs serving as co-tutors. As pointed out by Dennick [1], one sure way to enhance the teaching and learning culture among the faculty and students in our medical schools is to reward faculty who specialize in and develop their teaching. In

addition, medical school administrators need to do a much more thorough job of assessing PBL at their institutions. Based on recent interviews with faculty at half a dozen United States medical schools, my impression is that associate deans of medical education are not adequately assessing the impact and progress of PBL-style education. Instead of engaging in periodic quantitative assessments of the curriculum and sharing that data widely with students and faculty, administrators responsible for implementing and overseeing a PBL curriculum seem inclined instead to resort to sporadic focus groups as a means of monitoring the curriculum. Should health science administrators who do not publish perish? A few years ago I addressed this question [6] and concluded that the medical school deans and administrators who maintain control over curricular data are likely to be the least inclined of the academic staff to engage in critical scholarly analysis of such information. I believe it is time to analyze why PBL curricula in medical schools have failed to deliver on their promise to better educate physicians.

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