'The Problem' As Metaphor in Teaching

by Linda C. Hodges

"I have a problem." If one statement could be said to characterize a teacher's life, this might be it. Countless students have used this sentence as an entrée to my office, as an excuse to stop and chat as I hurried from commitment to commitment, or as the beginning of a tearful advising session. As I reflect on my career, I realize that The Problem is a rich metaphor for life in academe, one that has both the most exciting and the most ominous overtones. It symbolizes the intellectual life, the creative endeavor, the stuff that fills our dreams and stimulates our waking. But if we examine the metaphor closely, its connotations are often the darkest when applied to our teaching. Having a problem in one's research is motivating; having a problem in one's teaching is, well, a problem.[1]

How we envision The Problem in teaching reflects in many ways how we think about the process of teaching and where we are in our own development as teachers. In this article I explore the idea of The Problem as it plays out in academe, using my experiences as a backdrop for a broader perspective. Along the way, I open up issues of how students learn

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and of what professors believe about teaching at different stages of their careers. Finally, I offer a way to use this metaphor to envision our teaching as the enticing and enriching challenge that it is.

I spent much of my early professorial career teaching problems—quantitative manipulations and derivations that had one right answer. Chemistry courses abound with quantitative problems, which too often are, unfortunately, devoid of any content that students find relevant to their own lives and experiences. I remember being told when I was a chemistry student that if I could work the problem I understood the underlying concepts, and as a chemistry professor I passed this axiom on to my students. I didn't believe it as a student, and I began not to believe it as a professor.

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As a conscientious and caring teacher who wanted students to succeed, I became a master at helping students learn how to "work problems." This guidance included helping them recognize parts of a problem. "So if you're asked the pressure of six grams of helium at 25 degrees Celsius in a one-liter container, what are your givens, what information do you know?" I then led them to discriminate between relevant and irrelevant information, "Does it matter if it's helium or hydrogen?" and choose the correct equation to solve the problem, "You want to know pressure, you have temperature and volume, what equation gives the relationship between all of these?" I showed them the trick of thoughtfully and correctly canceling units (a strategy that my mathematician colleagues rightfully abhor), and presto! Students could score well working problems on tests.

But I began to realize that some students were quite able to insert numbers into equations in a logical way to complete calculations, a process we call "plug and chug," without any understanding of underlying principles. Early in my career I explained this phenomenon as arising from the disconnect between the content of the problem and students' lives. Really, how many people *care* what the pressure of helium is under certain conditions? The problem posed didn't engage students emotionally, and thus, the tactic encouraged students to take the mechanical approach of simply dealing with the task at hand. And, since there was always just one right answer, students viewed their role as finding the answer the teacher wanted in the most expeditious way possible. But suppose one could design problems based on real-world challenges, prob-

lems that captured students' interest, and invited them to explore a multitude of options? Wouldn't having students work on those kinds of problems guarantee learning?

I realized that I was enthralled, as are most academics, with the idea of The Problem as a thing in itself. Although helping students learn content is an integral part of college-level teaching, the inspiring part of the process is helping students to think and question, to *problematize*, in a sense. The idea that learning is problem-solving is appealing to me, and as I contemplated the menu of pedagogical strategies that seemed to offer the key to learning, one approach came to the fore—problem-based learning (PBL). PBL involves students working in groups, learning content while solving a real-world, "messy" problem. The strategy arose in the medical school arena, where it is still a very popular approach and has spread to classes in business, law, and to the general undergraduate curriculum.

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As a biochemist, I recognized that my field was rife with issues from nutrition and medicine that would allow students to learn biochemical content while at the same time answering a compelling question. I could ask questions such as, "Does aspartame pose a significant health risk?" or "What advice should a genetic counselor give potential parents, both of whom carry the gene for sickle cell trait?" An attractive feature of PBL is that students work in groups to determine the key questions involved, and collect the information needed to come to a decision. The group must come to a consensus based on a critique of the data available. This process requires students to exercise judgment, recognizing and drawing on their own values. Thus, PBL seemed the logical pedagogical strategy for cultivating critical thinking in students.

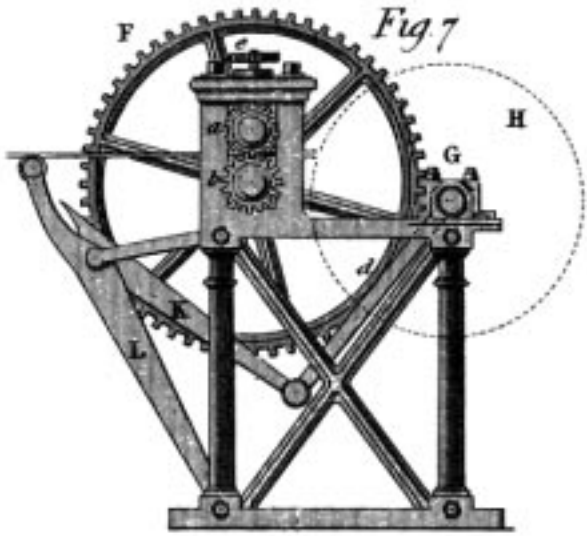
For me, PBL seemed to offer the key, the magic bullet of teaching. It encouraged the asking of real questions that impacted students' lives. Students surely would be emotionally engaged, excited, motivated; learning would just happen. I envisioned my role as facilitator, helping students engage in meaningful problem-solving, rather than my acting as a deliverer of content. I imagined helping students learn to discriminate and make critical decisions rather than unintentionally promoting their rote regurgitation of factual information. I visualized the vibrant interaction in the room as it came alive with voices sharing, challenging, and debating scientific and ethical issues, rather than merely hearing the echo

of my own voice. Students would not depend on me to tell them the "right" answer. They, too, would be enticed by The Problem.

In implementing this strategy, I found that many of my expectations were fulfilled. Students often seemed intrigued. They were forced to engage with the content through their role in the group. They seemed to gain new abilities to analyze and critique data, weigh evidence, and argue positions. So I was shocked when my student evaluations, semester after semester when using this approach, showed what appeared to be a Dr. Jekyll-Mr. Hyde reaction. Comments ranged from "I still remember concepts we discussed at the beginning of the fall semester. I really believe that all science classes should be problem-based learning" to "This was not an effective way to teach because she did not teach." Did these students share the same classroom? These comments came even from some students who received good grades in the class, so dismissing the negative remarks as coming from disinterested, unmotivated students was not a satisfying way of dealing with the issue. I found this dichotomy in student response disheartening and disillusioning.

I chose college teaching because I wished to make a difference in students' lives. Now I began to feel that my work did no more than act as a placeholder in students' intellectual development. My teaching itself had become a problem.

At this point, it would have been easy for me to join the ranks of cynical curmudgeons who are legendary on campus. We often dismiss these faculty members as old, passé, small-minded; they just don't get it. But in



a sense they do get it—they realize that the name of the game is surviving, both intellectually and emotionally. Facing what appears to be student indifference, or at least student unpredictability, in spite of our best efforts, giving day after day to what can almost seem a hostile audience, requires inner resources that are beyond many of us. Some special individuals seem to find joy in teaching at all costs; but for others of us, meeting the day-to-day challenge requires a strategy that allows us to engage without being consumed, and lacking that, we retreat to a safe distance and hide behind our armor.

Suppose, however, that we change our approach to classroom "problems," bringing our scholar's mind to the classroom. If we approach our teaching dilemmas as we do the perplexing intellectual questions in our discipline, what changes? As Lee Shulman would say, suppose we ask, "What is this a case of?"[2]

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Let's return to the first example I raised, the problem as a stimulus to learn content. Why is this not an effective way to promote conceptual understanding? What is this a case of? The easy answer is to say that some students just aren't thinking when they work problems. Interestingly, as we discover more and more about learning, it has been shown that the parts of the brain involved in reflective processes, such as generating conceptual understanding, and the parts involved in mathematical manipulations, are distinct.[3]

Certainly my goals, as those of other professors using quantitative problems in chemistry, were to help students learn how to analyze, evaluate, and synthesize information and to apply old ideas in new ways. Unfortunately, those outcomes are not natural consequences of having students work problems. Instead, solving problems is often a rote content manipulation. A recent study showed that university students who had solved more than a thousand problems in physics and scored well on tests of physics and mathematical problem-solving still had difficulty with conceptual tests, and that there was little correlation between numbers of problems solved and conceptual understanding.[4]

Are there ways to approach quantitative problem-solving that work better in promoting students' higher order learning? Undoubtedly. But these methods require an intentional, thoughtful approach by the teacher, and are not as trivial as showing students how to do problems. We teachers must provide cues for students that trigger the exchange of information between the calculating and the reflecting parts of the brain. For example,

teachers may design specific activities that promote students' abilities to link concepts to problem-solving.[5]

What then of the "problem" with PBL? Why don't students universally embrace it? What is this a case of? One obvious answer is to say that students are lazy. Hansen and Stephens proposed that students had a tendency to be passive and exhibit "social loafing" that in part contributed to their resistance to such student-centered pedagogies as PBL.[6] Certainly students—and we as well—often prefer to let somebody else do the heavy lifting when it comes to learning, especially in fields outside their interests. But the negative responses may also give voice to the struggle students naturally have in their intellectual development.

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William Perry studied this phenomenon over 30 years ago in his work with Harvard undergraduate men.[7] Later Belenky, Clinchy, Goldberger and Tarule re-examined these ideas in women learners.[8] Students typically enter introductory level science classes expecting to learn clear-cut facts, relying inordinately on the professor's authority, a right/wrong approach that Perry called *dualism* and Belenky, et al., noted as *received knowledge*.

Science to students at this phase of development is meant to provide right answers to issues. This observation may be particularly pertinent in using PBL, where students deal with questions for which there are no "right" answers. Craig Nelson points out that students may be troubled by the question, "How can knowledge be both uncertain and useful?"[9] Also, students feel uncomfortable trusting to their peers for knowledge in group learning activities, feeling that the professor, the recognized authority, is simply shirking responsibility. Nelson suggests that teachers provide structure and support for students when using these student-centered pedagogies, and even discuss some of these theories of intellectual development with students, especially in classes of more novice learners.

This reflective approach to teaching may be called *scholarly teaching*, and many of us practice it in certain situations. This method can be particularly helpful in such emotionally charged parts of teaching as reading our end-of-course evaluations or dealing with the recalcitrant student. Under those circumstances we often react defensively, angrily, and unproductively—and become frustrated and feel defeated. But at this point, rather than seeing an insurmountable problem, we can now see an

opportunity for our own development as teachers, a chance to explore what is known about student learning. Scholarly teaching takes this process one step further. Building on the work of others to identify potential solutions to problems, the scholarly teacher can adopt strategies and incorporate changes that address these issues.[10]

The recurring dilemmas of teaching are a rich chance for a deep intellectual engagement with our teaching. Taking it to the next level is what we refer to as the *scholarship of teaching and learning*. According to Lee Shulman, scholarly teaching becomes the scholarship of teaching when: "it becomes public, it becomes an object of critical review and evaluation by members of one's community, and members of one's community begin to use, build upon, and develop those acts of mind and creation."[11] Now the problem becomes The Problem. Not only can we address a nagging teaching issue through the process of research and experimentation with strategies, but we can also document our efforts, collect and interpret the results of our endeavors, and share our work with others. By so doing, we benefit from the collaborative network of other scholars of teaching and add to the growing body of knowledge, advancing the practice of teaching.

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Shulman has argued for a serious investment in the scholarship of teaching and learning on the basis of three criteria: the professional obligation associated with being an educator; the pragmatic need for our work as educators to improve our practice and meet our responsibilities to students; and the policy imperative of the developing market for higher education.[12] This rationale is certainly worthy; but I would like to offer a less altruistic motivation, one that touches each of us personally. I see the scholarship of teaching and learning as one more step on a teacher's path, one that can reinvigorate our practice intellectually and sustain us emotionally.

Douglas Robertson proposed a developmental model of professors' perspectives on their teaching that captures some of the ideas I have presented and allows us to develop a new rationale for the scholarship of teaching and learning.[13] He proposes that we as teachers may move through phases in our beliefs about teaching in which each succeeding stage encompasses and expands upon the previous one. We move from viewing the teaching and learning process as centered on the teacher driving the dynamic, to focusing solely on the learner's needs, to recognizing

the interconnectedness of teacher and learner.

In many ways this model presents professors' views of teaching and learning as a continuum from a dualistic to a contextual perspective, much like models of students' intellectual development. We professors, too, struggle in changing our view of a right/wrong approach to teaching, and we grapple with ideas of shifting authority in the classroom.

Robertson's work shows that professors deal with transitions between their views of the teaching dynamic either by reverting back to comfortable, though unsatisfying, prior practices, or by changing direction. In either case, they often experience discomfort and some feelings of loss. But if we choose to acknowledge the multiple dynamics of our classrooms, the scholarship of teaching and learning can provide a way to cope with both the intellectual and emotional challenges associated with this complex environment. In essence, the scholarship of teaching and learning gives us a framework to help us reinvent our work.

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Three characteristics of the scholarship of the teaching and learning process make it particularly helpful in reshaping our view of teaching. First, it encourages us to change our perspective on how our teaching is related to students' learning. We begin to realize that although there is a definite correlation between these two events, they aren't related in a clear cause-and-effect manner. Obstacles to student learning may reside in emotional or intellectual barriers that are hard to fathom. This difficulty does not in any way diminish our responsibility as teachers. But it can help us recognize that teaching is a process and comfort us in those moments when we fall short of achieving our goal of reaching all students.

Second, this challenge itself then becomes an intellectual problem which lifts us out of frustration or despair and motivates us. Bringing our scholar's mind to the problem in student learning redirects our emotional energy into a positive channel. We methodically explore and document the multiple factors involved in the teaching-learning dynamic. The systematic collection of evidence and sharing that evidence with colleagues moves us away from emotionally biased anecdotal explanations for learning outcomes. Although we may not resolve an issue for a particular student, each attempt to find a new way to promote student learning results in some new insight that improves our own future practice. The hidden

factors to students' learning in our own classrooms become a bit clearer, and we increase our ability to reach more students more often.

Finally, when we not only explore how students learn in our own classroom, but also make our insights public in a way that invites critique, we gain a new way to envision our teaching effectiveness. As with other forms of scholarship, we no longer "reinvent the wheel," but add to a growing body of knowledge in the field. A problem in our classroom may provide an insight for a teacher in a classroom far removed. Our reach to students is extended even beyond the one-on-one effect that has always been so powerful. We can say with new fervor as Christa McAuliffe said so poignantly, "I touch the future, I teach."

The scholarship of teaching and learning is not for everyone, and it may not be for anyone all the time.

When we encounter the inevitable problem in our teaching, we can now embrace it as a reminder that teaching is perhaps the most intellectually and emotionally demanding process that academics undertake. We can then see the classroom experience as an archive of both our students' and our own lives and experiences, as a humane laboratory for delving into the intricate and complex processes of learning, and as a generative method for developing the future of education. The problem in teaching now becomes an opportunity for reflection, research, and renewal. The scholarship of teaching and learning is not for everyone, and it may not be for anyone all the time. But it offers a powerful model for redirecting our energies and revitalizing our practice, especially in those times when we face difficult transitions in our beliefs about teaching.

When I faced the realizations that my best teaching would sometimes fail and that no pedagogical approach would reach all students all the time, I came to a critical juncture in my own teaching. Was it worth the effort? How would I ever know that I had accomplished anything? Fortunately for me, I found a creative siren and emotional anchor in the scholarship of teaching and learning. I continue to examine my teaching, to listen to what my students say, both literally and through their work, to document my impressions with evidence, and to learn from research. And I still encounter new problems. But now, after I pause to clear my emotions, to collect my thoughts and draw a new breath, I ask with renewed energy, "Now what is this a case of?" nea

ENDNOTES

1 Randy Bass, 1999.

2 Lee Shulman in remarks made at Carnegie Scholar Institute, Palo Alto, California, June, 1999.

3 S. Dehaene, *et al.*, 1999.

4 Eunsook Kim and Sung-Jae Pak, 2002.

5 William J. Leonard, *et al.*, 1999.

6 Edmund Hansen and James Stephens, 2000.

7 William G. Perry, 1970.

8 M.F. Belenky, *et al.*, 1986.

9 Craig Nelson, 1997.

10 Pat Hutchings and Lee Shulman, 1999.

11 Lee Shulman, 1999.

12 Lee Shulman, 2000.

13 Douglas L. Robertson, 1999.

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