Lecture 11: Alternatives to the Lecture

Richard B. Power
the
eleventh
LAST LECTURE

By
Richard B. Powers
ALTERNATIVES TO THE LECTURE

There are several things I've learned about teaching that I would like to pass on. They are definitely not the last word in techniques or methods—they consist of some ways of teaching and some ways of thinking about teaching that I've discovered over the past 20 years, and simply because I'm presenting this last lecture should not lead you to think of me as an experienced person—an experienced teacher—one who is looking for a better idea. As an experimental teacher, I have taught the introductory course quarter after quarter for 17 years at USU without getting bored. The secret is that I'm not teaching the same course.

Now, of what relevance is this to you, the potential teacher? You see, I have you in mind as my audience tonight. Can you make sense of my teaching experience and make a decision to become a teacher? I'm not sure. I can only tell you of some of the techniques I used that work for me and expose some of the myths that I believe cause a great deal of mischief in education. I trust that you will also see that I have fun teaching—I enjoy sharing ideas and provoking thought—and hope that you will see the possibilities for you to use your skills to teach and have fun too.

The Beginning Lesson

Like most professors, I had almost no training in "how to teach" and assumed that all one had to do to teach was to tell students what was currently correct about the field and their eager minds would devour this information with gratitude. Fortunately for me and for all...
There are several things I've learned about teaching that I would like to pass on. They are definitely not the last word in techniques or methods--they consist of some ways of teaching and some ways of thinking about teaching that I've discovered over the past 20 years. And simply because I'm presenting this Last Lecture should not lead you to think that this is a finished product talking. I think of myself as an experimenting person--an unfinished teacher--one who is looking for a better idea. As an experimenting teacher, I have taught the introductory course quarter after quarter for 17 years at USU without getting bored. The secret is that I'm not teaching the same course. With new students every quarter, evolving subject matter, and new ideas to try, how could the course remain constant?

Now, of what relevance is this to you, the potential teacher? You see, I have you in mind as my audience tonight. Can you make sense of my teaching experience and make a decision to become a teacher? I'm not sure. I can only tell you of some of the techniques I used that work for me and expose some of the myths that I believe cause a great deal of mischief in education. I trust that you will also see that I have fun teaching--I enjoy sharing ideas and provoking thought--and hope that you will see the possibilities for you to use your skills to teach and have fun too.

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the students I would have tortured by continuing in my virginal assumptions, a good teacher and friend, Jack Michael, told me to "try a new procedure developed by Fred Keller. It's better than relying solely on lectures and you can get help from students in running your classes." I liked this last part a lot because I was headed the next day to a new job that required, among other teaching requirements, teaching a large introductory class. Since I had no training about how to teach and had almost no experience in the classroom, I had no qualms about trying out a "new and innovative program." One of the neat things about young professors or young anything for that matter is that they don't know enough not to try out new ideas. This is another reason why I'm addressing this lecture to students. At any rate, this is how I learned about the Personalized System of Instruction (PSI) developed by Fred Keller and others (1968).

The Personalized System Instruction (PSI): Goodbye Teacher....

I want to tell you enough about this method of instruction so that you will be interested in learning more about it and perhaps trying it--not only because the system has worked so well for me, but because it contains the germs of a revolution in the way teaching might be done in higher education. Even if you do not agree with some of PSI's assumptions, I think you will agree that it provokes the proponents of the status quo into examining their assumptions about education and grading practices, and this is a good thing.

My friend and fellow crazy at USU, Gordon Flammer, has written about his experiences with PSI (1971) and has nicely captured the essence of this method with this phrase: "Learning as the constant, time as the variable." What does this mean, and how is it implemented?
A. Mastery of the material

The student should master one unit of material before proceeding to the next unit. Why should a student pass a unit or a course with a "C"? What on earth does this mean? That she understands only some of the material? Or understands it in a vague, fuzzy way? Won't this cause trouble for her later, especially when earlier concepts are central to understanding current concepts?

Well, what about individual differences, I hear someone objecting. Some students are brighter than others, some have more preparation than others, some have other obligations such as jobs or families, etc. Yes, quite right. If we have a criterion of 80% correct on quizzes before moving to a new unit, this means that some will pass with less effort than others for whatever reason. This brings us to the second component of PSI.

B. Remedial instruction and retesting

Obviously, if a teacher demands that the material be mastered by every student and we acknowledge that students differ in ability and preparation, then it follows that provision must be made for remediating and retesting. In Keller's original program, this feature of the system was accomplished by self-pacing. The student simply showed up at a testing center when ready and took the test. If the student passed, she was congratulated and given study material for the next unit. If not, a "retake" was recorded and the person giving the test helped the student with any difficulties she may have had with the material. But what if the student fails again? Keller answered with, "so what?" Eventually, the student will pass at the desired level of understanding, and isn't this what we, as teachers, are interested in?
I hear another objection. Won't this lead to students taking tests many times over each unit, and, with 150-200 students, won't this be impossible without help? Yes, right again. This takes us to the third component of PSI, the student proctor.

C. Student proctors

Student proctors are, I think, the heart of the PSI system, for they are what make this system possible. Proctors are chosen from students who have taken the class before or from volunteers in the class itself. The proctors man the testing center, score quizzes, give feedback and encouragement, and otherwise help in running the class. In my course, proctors volunteer from class and are given the responsibility for about 10 students whose records they maintain across the quarter. Proctors must pass their quizzes at a higher level than the rest of the students (90%) and must be ready to grade their group's quizzes by Wednesday of each week. For the extra hours they put in, they are given a small salary (points toward their grade), have the fun of helping others, and learn the material very well because they teach the concepts that they have just learned.

Where is the lecture in all this? If some students are at different phases in the learning of the material, won't the lecture be inappropriate for most because some will have passed the current unit and others may be struggling with units earlier in the course sequence? True, and this is why the stress is on the written word in the PSI system, the last important feature of the system.

D. Lectures as motivational

If the students are at different "places" in the course sequence, then lecturing over a single topic is inappropriate as a way of providing critical information. The only function of lectures in PSI,
according to Keller, is as a source of motivation—to interest a student into thinking or reading more about a topic. As I write this, I am struck by the "outrageousness" of this idea. Lectures that motivate! This may be the most radical notion of the whole system. In fact, Keller only admitted students to lectures if they had passed a given number of units. In other words, he operated under the quite rational premise that one should be prepared to listen to a lecture—that the concepts and ideas discussed would have more excitement and meaning if the audience had reached a certain level of understanding prior to the lecture.

How professors would have to change if they adopted a motivational view of lectures! Perhaps the lecturer might have to do some work with his/her voice, try moving around the audience rather than stay frozen in one place, study theatre arts to increase the sense of the dramatic, and so forth. Certainly the lecturer would have to watch the audience more closely for signs of disinterest and be willing to try different techniques to enhance interest in the listeners. He might even find himself studying the successful evangelists on the sly to see how it is that they get so many of the faithful to listen to them with such rapture. Fortunately, there are teaching methods besides lecturing which can be learned easily and which may not require such a radical change in personal teaching styles as learning to be flamboyant.

More Individualizing: Applying What You Learn

The PSI approach, with its use of proctors and remediation, engages students in their education more heavily than is typical in most large classes. Even more involvement is provided with a self-management project. Here the opportunity for learning occurs in the
important realm of self-knowledge. Students select a personal problem of theirs and, using the principles they are learning about, spend about six weeks attempting to change that behavior in a desired direction. Problems chosen by them have ranged from the relatively insignificant (nailbiting) to the relatively (bulimia), and from the mundane (improvement of study habits) to the creative (increasing time spent conversing with wife).

As a lab exercise it can't be beat. The student puts into practice the principles of conditioning and learning that are being taught and does the lab as both experimenter and subject. From a motivational standpoint the lab works simply because it is difficult not to be interested in your own problems. Most importantly, I believe the lab works because of the freedom to choose the problem, to change problems if one discovers a problem of more personal significance, and to discuss strategy and goals in a weekly give-and-take session with the TA or the instructor. All of these factors make it likely that the student will "own" the project. When this happens, students discover that the improvement on their graph is what maintains their interest and effort—not the points earned for participating nor any other reward system they may have used at the start of the project. They conclude that, with a little help in applying some principles of psychology, they were able to change a problem of importance to themselves. A lesson not easily forgotten!

Assumptions Challenged

The description of PSI seems reasonable with each component a necessary part of the overall system. It does not strike one as controversial. Why then did I characterize PSI as fomenting revolution
in teaching? There have been two changes in my thinking about teaching
and grading from that of the naive graduate student 20 years ago that
were instigated by my adoption of this technique. The first is that I
am interested in having students learn, but am not at all interested in
evaluating them. An apparent contradiction. If students pass the
requirements for the course at the criteria established by me, then
they have mastered the course and deserve an "A." This "A" means only
that. It certainly does not mean that he/she is "better than" some
other group of students with labels of "B" or "C." Hold on! Doesn't
this undermine the very foundation of conventional grading practices in
which students are compared to each other according to some criterion
such as the normal curve? Yes, it does. Another objection from the
back of the room. How will we separate the "bright" students from the
"not-so-bright" without differential grades? This is a problem of
evaluation and one that I am not overly interested in. If a personnel
manager from IBM asks me about a student, I can provide some relevant
information perhaps. IBM may have to develop evaluative tests if they
want to make distinctions on the basis of IQ scores. But again, that
is a problem for IBM. It really does not matter very much to me that
one student passed all the weekly quizzes on the first try, while his
friend required an average of three takes for each quiz. It seems to
me that my job is to provide the conditions in which both can reach the
goals of the course.

Whenever I present these ideas at a convention or workshop, I
frequently encounter resistance. "So, you are the one behind all this
grade inflation?" "How will we decide who gets into graduate school?"
"Grades will have no meaning, so won't students will stop working for
them?" These are typical questions. I believe people reacting this way assume that we accurately measure something real and unidimensional with grades. But a little inspection exposes this as nonsense. When we look at a 3.67 GPA, the numbers impress us. We are accurate to two decimal places, so it must be an important and meaningful number. How foolish! For instance, when we look more closely at the record summarized by a 3.67 GPA, we might discover that one of the "A's" was received because this student was a persistent complainer. The professor simply could not stand any more complaining and so gave her an "A" instead of the "B+" she "deserved." We also notice that the student withdrew from difficult classes more frequently than her peers, but this is not part of her GPA.

More generally, don't we know that courses differ immensely in difficulty and the requirements necessary for a good grade? Don't we all know an instructor who says, "I only give X number of "A's" a quarter, no matter how many are in the class or how 'good' the class is?" Don't we all suspect that grades dispensed in some departments are way too high? I'm sure you can come up with your own examples to show that traditional grading systems are not commensurate across professors, departments, colleges or universities. Why then persist in the myth that we are measuring some unidimensional characteristic? What exactly are we evaluating with the current uses of the GPA?

The second revolutionary idea spawned by PSI took longer for me to discover than ideas about grading practices, but it has perhaps more implications for constructive change in higher education. This idea is that students, even the lowly freshmen, have much more to contribute to their education and to the teaching process than I ever imagined.

Most of the students who volunteer as proctors are freshmen and
over 90% of them have turned out to be excellent helpers. They take
their responsibilities seriously, putting in much more than the two
hours required for manning the testing center. They end up caring
about their charges and worrying if any are having trouble. For
instance, some hold special tutoring sessions for foreign students or
for others having trouble; others call up their students if they
haven't seen them for awhile, asking why they haven't been in class.
There is no way I could begin to do these extra things with a class of
200 students! And all of them help me perform better each quarter by
giving me feedback about problems and ways to revise the course. I'm
convinced that this extra and very personal attention helps make the
class of 200 students feel less overwhelmed and more responsive than in
the typical large class. Proctors know that they do indeed help run
the class and that their help is indispensable. It seems to me that
part of a college education should allow students to discover that they
can do something real and meaningful.

I know that when I started teaching I was skeptical of this notion
of increasing student responsibility. After all, what does a freshman
know? He or she is still an irresponsible adolescent, whose only
remarkable attribute is his/her boundless ignorance, true? We look at
their grammar and study habits and throw up our hands. Perhaps some of
their passivity and "lack of motivation" comes from the fact that our
expectations are too low—that we don't expect that they can be given
any real work and do a competent job. Could it be that they are simply
responding to our expectations?

I remember the time in graduate school toward the end of my tenure
when I was growing a bit weary of taking still another course, and the
professor, in a fit of pique over a student's question, said, "The student is just like a pigeon; you don't expect it to think, you simply reinforce the desired behaviors." This remark incensed me at the time and I wondered at the silliness of the notion that I was not expected to think now, but that in a few months with a degree in hand, I could suddenly start thinking.

Although I don't believe that many of us would subscribe to the idea of the "student as pigeon," I do feel that we do not have enough confidence or trust in our students to give them more meaningful educational experiences. We spend too much time designing and correcting multiple-choice exams which test the students' recall of facts. Most of us are aware that what we really want to do is to teach and test understanding of important principles and procedures. However, this may require teaching in ways that don't rely on the traditional lecture approach and one simply doesn't have the time to grade essay tests with a class of 200 students. And so we stay with the method that was used on us. It's simpler and gives us time to write grants and do important research.

More Goodbye Teacher or Playing Games

A powerful but neglected teaching tool is the simulation/game. I'm aware of the research literature which shows that students taught a given lesson via the traditional lecture method and those taught via a simulation exercise do not differ on tests of facts, the cognitive domain. Changes in the affective domain, however, clearly favor the students exposed to the simulation/games. Now, of what value is this? I believe the best answer to this question is for you to listen to what happens in a typical play of the game "Starpower" (Shirts, 1969).
The Social Psychology class of about 35-40 students is told that they are going to play a bargaining game today instead of listening to another lecture, upon which there is a spontaneous cheer and everybody is suddenly in a better mood. The game director explains that each of the students will draw 5 chips from a bag of different colored chips without peeking. The colors have different values and the idea of the game is for each player to better their score through bargaining for a better "hand" of chips. There are only a few simple rules and students quickly get into the spirit of the game. The classroom soon takes on the atmosphere of a stockmarket.

After the first round, students post their scores next to their initials on the blackboard, and it appears that the scores can be easily grouped into a few categories: a few high scorers, somewhat more in the middle category, and most of the class in the lowest scoring category. The game director has the players sit in three groups according to their scores and hands out identification badges: squares, circles, and triangles for the high, middle, and low scoring groups respectively. At this point there is some mild and humorous name calling, but most players are looking forward to round two and a chance to improve their scores. The chips are drawn from the bags again, and round two begins.

An astute observer might notice that the squares (high scorers) don't do very much trading and quickly fold their arms, a sign to others that they are satisfied with their scores and don't want to trade. When the scores from round two are added to those from the first round, it is easy to see that not much is changed. One or two players may move up or down, but for the most part, the players' relative positions stay the same. In fact, the squares are typically
even further ahead than they were in the first round. At this point, the game director announces that because the squares have shown themselves to be master bargainers and generally adept at the game, they are hereby given the right to make the rules for the remaining rounds of play. Screams of protest emerge from the circles and triangles while the squares acknowledge the correctness of this announcement with smug approval. To placate the other groups, the game director gives them the right to submit three rule changes for the squares to approve. What happens?

As you might guess, the squares do not approve of any of the democratic rule revisions submitted by the other groups and, in fact, frequently do not bother to read them. They are having a devilishly good time thinking up rules favoring their group. A typical rule might be: "Squares have the right to inspect any circle's or triangle's chips at any time and confiscate any gold chips (the most-valued chip) as a tax." When the squares announce their rules, pandemonium breaks out and now the light-hearted bantering characterizing the beginning session is replaced by genuine anger and indignation. Players in the non-privileged groups cannot believe that their classmates would treat them like this and are ready to "do something" about the degenerate squares. About 80% of the time, the game ends at this point as the put-upon groups threaten to walk out of class, tear up the paper on which the rules are written, or otherwise refuse to cooperate in playing the game.

During the initial minutes of the debriefing, there is much mutual recrimination, with the squares calling the others "sore losers" and the other two groups screaming "fascists," "dictators," etc. As the
invective gives way to trying to explain and justify actions, some true insights begin to emerge. All now see that the game has little to do with bargaining and much to do with power, prejudice, and maintaining economic status. While the middle and lower classes suspect the squares cheated or that the game was somehow "rigged" in favor of the squares, the squares never suspect this and are genuinely amazed to learn that in the second round the drawings were heavily stacked in their favor. Some in this group continue to maintain that they "earned" their way into the squares because they were superior in the first round when the drawing was not stacked.

The lower classes feel betrayed frequently by one of their members who, by dint of much group sacrifice, moved into a better group but who "forgot his roots" when it came time to make the new rules. The lower class almost to a person believes that they would have behaved differently had they been in the squares. Of course the squares hoot this down—they know how strong the pressures are to go along with the majority and protect their status. Some in the squares point out that they did indeed try to help the other groups but, because of this group pressure, there was "nothing they could do," to which the triangles (lower class) reply with cynical laughter.

All of these rationalizations may sound very familiar to you, perhaps even hackneyed, but for these students it's as if they were discovering the structure of prejudice and power for the first time. In a way, many are discovering prejudice for the first time because they are feeling it directly. A student last quarter summarized it best: "I grew up in the 'square' (privileged) class. This is the first time I actually felt how the 'triangles' feel and saw what the 'squares' were doing!" No lecture, no telling about prejudice--no
matter how impassioned--can compare with the brief experiencing of
being discriminated against. The learner tastes prejudice and this
experience, in conjunction with a good debriefing, provokes
soulsearching. The set of beliefs and assumptions that the learner
"knows" about the world, others, and the self is reexamined and
sometimes revised.

Importance of Student-Initiated Learning

I realized as I wrote this paper that one of the things I try to
do in my classes is to increase the responsibility students feel for
their learning. It's pleasing to me to see a beginning student mature
when made a proctor and given the freedom and responsibility to "take
charge" of his or her 10 students. And I enjoy watching passive faces
come to life as students assume roles in a game that is suddenly
meaningful because of the recognition of a common problem facing them.

When the learner takes an active role in the learning process--
adopting a role in a game, deciding on a personal problem to change,
building a silly house in a creative exercise--he/she loses the self-
consciousness that is ever-present in the typical class which arises
from the awareness that, "I am being observed. I am being evaluated."

As students, most of us have invoked the Student's Prayer: "Please
God, don't let him call on me today!" This prayer was usually
accompanied by the Student Invisible ploy, which required that you look
straight ahead with a frozen stare while trying to hide behind the
student in front of you. All of this nonsense makes escape from
evaluation rather than learning the chief aim of the student and is
thus counterproductive.

talks about his failures when he attempted to teach in the conventional way and his thoughts about what made a learning environment interesting to him. In one of the most provocative essays I've read, he listed a dozen or so things he discovered about his attempts to teach and concluded by saying that the harder he tried to teach, the more disastrous the outcome. At best, he felt he effected only trivial, unimportant learnings with these traditional methods, so he concluded that he was not interested in teaching and that he didn't try to do it any more. This from one of the more influential psychologists in the last 40 years! What could he mean? He meant that, while teaching was not an important nor interesting activity for him, learning was. In his words, "I have come to feel that the only learning which significantly influences behavior is self-discovered, self-appropriated learning (p. 153)." I agreed with much of his thinking, and his arguments provoked me into examining what my function was as a teacher. What exactly did I contribute to the education of my students? Although I do not have time to go into my experiments with his "open-ended" classroom structure, my experiences with his approach led me to have even greater confidence in the student's ability to do interesting and creative work. And I learned that my major contribution to my students' education was in provoking them--prodding them into applying knowledge and into reexamining their beliefs and assumptions.

Are These Alternatives Always Better?

As I review what I have said about the benefits of these approaches to learning, I can hear someone in the back grumbling, "Doesn't anything go wrong? Does everyone benefit?" The answer is, of course, that things do go wrong and that not every student likes or can
benefit from these approaches. This talk could just as easily have been titled, "Teaching Mistakes I Have Made." For instance, over the seven years in which I used Keller's original plan, about 24% of the students did not complete the course. They procrastinated until the last week and then, in a frenzy of test-taking, tried to do the entire course in one week. These students usually did not show up the following quarter to make up their work and so their incompletes turned to "F's". This was much too high a percentage of failure, and I should have intervened earlier to modify the system. We now use a paced system in which the student is given several chances within a week to pass the unit quiz and this has reduced the number of course failures considerably. We have modified the details of Keller's plan but kept the basic idea of remediation and mastery or, as Keller would dub our approach, SLI (Something Like It). And we continue to change and modify the SLI approach because each quarter the outgoing proctors have something valuable to contribute about making the course better.

Simulations and games can sometimes be a too-powerful experience, and players (and the game director) may learn things that are not discussed in the game manual. In a recent simulation, for instance, a player who was very successful in "winning" incurred the wrath of several of his colleagues and the debriefing was only partially successful in defusing the intense feelings aroused by the exercise. Some students have had their impressions of others altered as a function of their experience in this exercise. Should we expose students to situations which allow their perceptions of others or of themselves to be radically changed? Perhaps we should warn students about the dangers beforehand? Wouldn't it be better to discover our
misperceptions here than in a professional setting? These are not easy questions to answer.

**Lessons for Students Who Are Thinking about Becoming Teachers**

Many of you students listening to this may be tempted to think of teaching as a rewarding experience. Good! I hope to tempt you! But you may also not see how these techniques can be used in your discipline. Could you use Keller's PSI approach or the open-ended system of Carl Rogers in math? I don't know. I suspect that both you and your students would learn something about better ways to teach from these approaches. Whenever the student is invited into the teaching process, he/she ends up telling us some important things, things that we have forgotten as teachers which we knew to be true as students. I recently had a student tell me how she "hated to be wrong," that she frequently didn't volunteer because she felt she might be wrong. Sound familiar? She also hated math, had recently received an "F" after much hard work, and dreaded with intensity the thought of having to take the course for a third time because her teaching major required she pass this course. When and if she does get into teaching our children, what impression will she convey of math and math-related subjects? What will we have taught her? It's dismaying to think about, isn't it? Perhaps if she had been enlisted into designing her own program, the end result would have been a better-educated teacher and, more importantly, a teacher with a more positive attitude toward math.

I do not want to convey the impression that the teaching techniques discussed here are the techniques for you. They might work for you. But that is not the point of this essay. What I would like the prospective teacher/learner to take away with him or her are
several ideas that might make them more effective in the classroom. First, good teaching is difficult and time-consuming. If you decide to become a teacher, get some help with teaching early in your career. I don't necessarily mean that you have to take courses from departments of instructional development, although that would not be a bad idea. There are excellent teachers in every discipline. Sniff them out and ask for help. They are waiting for you. You would be surprised at how much information they have and how little use is put of it by anyone. Perhaps the most destructive myth implicitly taught by graduate schools is that the Ph.D. automatically bestows wisdom about teaching. To know a subject matter well implies little about teaching that subject matter well.

Each discipline generally has a journal devoted to teaching. Read it and try some of their techniques early in your career. Take a look at some of the books that have been published on teaching. Merrill and Tennyson's small book (1977), Teaching Concepts, should be in every professor's library. They stress the importance of numerous examples and counterexamples when presenting a new concept and of not hiding the main points of a presentation--something most writers of texts still manage to do.

Kenneth Eble (1972) in his book, Professors as Teachers, has made many cogent observations about university teaching and, unfortunately, he observes that many of the critical comments made about teaching practices decades ago still hold true. After making a limited defense of the lecture as a means of conveying information, Eble says:

...I cannot be faithful to my experiences in various classrooms without expressing some strong reservations about the effectiveness of the lecture method. Wherever the student goes during his collegiate years,
he is likely to have information and ideas thrust upon him. Some lectures repeat what he is getting in more lucid form in textbooks. Others thrust ideas at the student in ways he must accept even when the lecturer permits discussion or makes a point of entertaining questions. A great many lectures, probably the majority, have little meaning for the student beyond the classrooms and class contexts in which they take place. (pp. 5-6)

Read these books and see if you can improve on the ways in which you were taught. You will make mistakes, but you will also grow. In a recent presentation at APA, Phillip Zimbardo (1985) said that good teaching will take all your time. If you do "good teaching," you won't have time to do research, write grants, see clients, or give talks to the Kiwanas Club. This produces a minor problem: If you decide to be a good teacher, you will get fired! He maintains that the only way to be a good teacher in today's university system is to cheat. By cheating he means that you must combine activities. One way I cheat, for instance, is by doing research on simulations with the introductory class and by incorporating the simulation into the curriculum of the course. But you must invent your own cheat system.

Another lesson I hope you to take away with you is that "the student is not a pigeon." Translated, this means that you should not assume that the student knows nothing and you know all--that you must feed the students information and that their job is to sit quietly, look respectful, gulp it down, and lots of other nonsense. The most important lesson I've learned is that the student can learn much more than I expected--that the students can contribute to their education far more than they have in the traditional lecture class. That is, if we encourage them. I've discussed a few ways of encouraging them and I leave it to you to discover your own ways, hopefully better ways than
mine, of encouraging your students.

And speaking of encouragement, you'll need someone to encourage you. There are days when logistics overwhelm, or administrators demand time for "important affairs," or students cling stubbornly to ineffective ways of thinking. I was helped through those days by my wife, Elki, who somehow knew that my crazy ideas would eventually work! I thank her for the warm-hearted support she has provided me through these years of experimentation in teaching.


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