Notes to Myself

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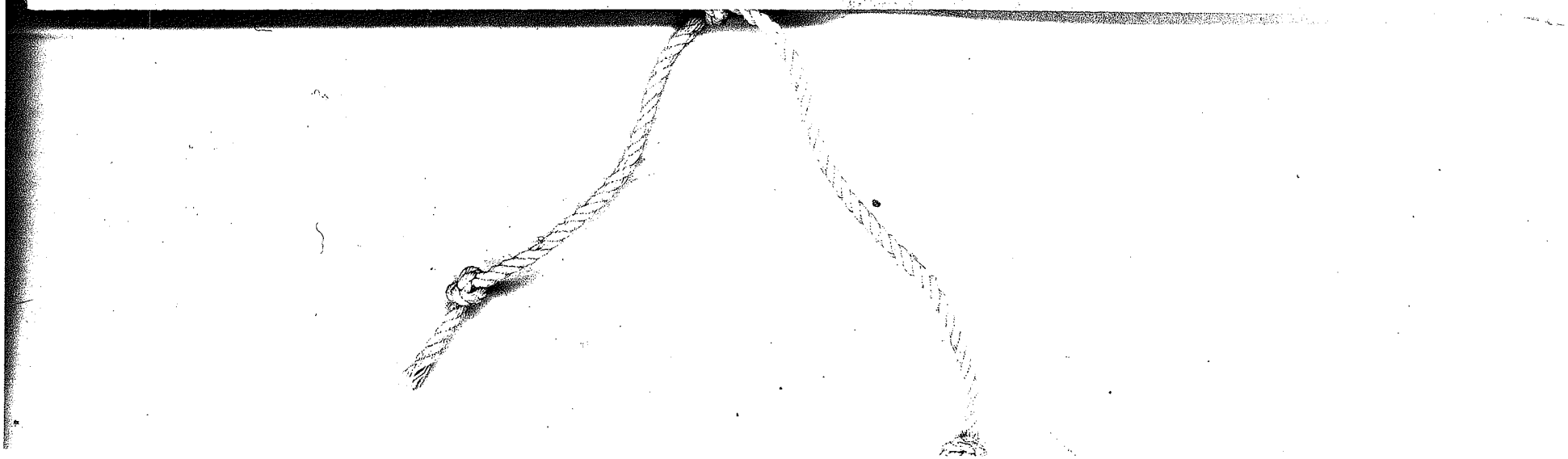
Teach with stars in your eyes. If you're not totally smitten with the subject matter that you teach, you can't expect your students to get excited about it. There is great beauty, elegance, even magic in every branch of technical knowledge. Bring out these qualities, rhapsodize on them, smile as you teach, let enthusiasm show in your voice. Demonstrate to your students by your body language and your actions that you're excited about what you teach, and about giving it to them as a gift.

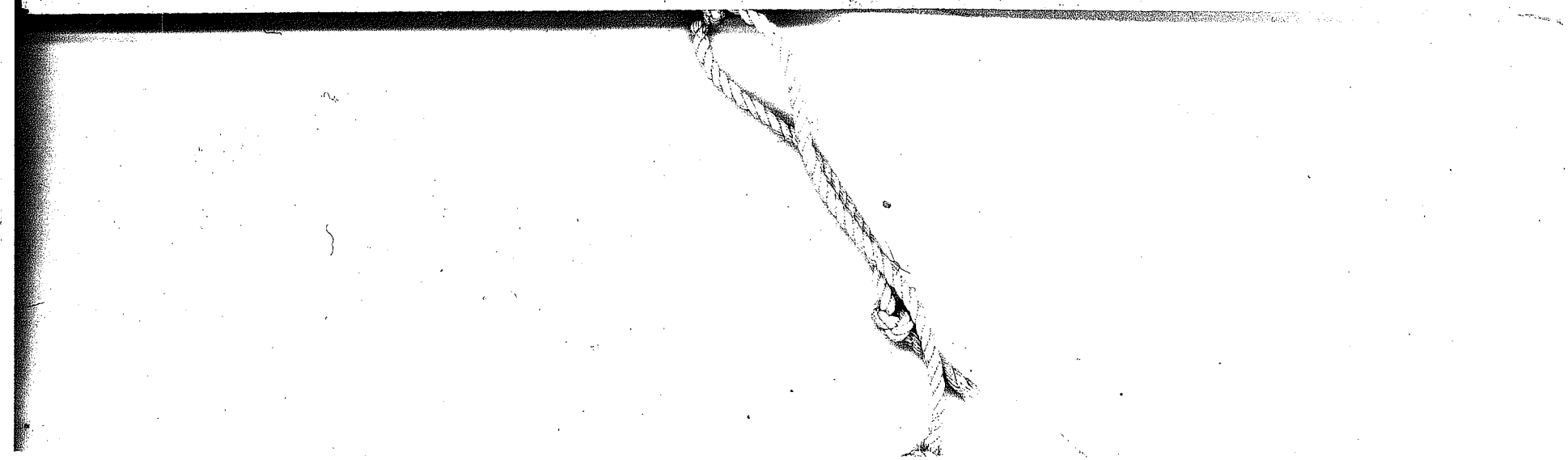
Start fast. Start your course fast. Start each class meeting fast. Research and experience have shown that you have a maximum time window of about ten minutes (and often less) at the start of a class in which you either engage your students' attention or lose it. It's very logical to start a course or a class by discussing the structure, rationale, and history of the material that you are about to teach. But it's not very effective. It's far better to begin with a vivid physical demonstration, an activity that involves the students' participation, or just about anything that will capture the imagination of the kid in the last row of seats. Whatever it is, make it something that draws the student into the subject and teaches an important lesson at the same time. After you've hooked the student with this fast start, then you can go back and explain the structure, rationale, and history.

Maintain eye contact. Teaching is a two-way channel of communication. You tell things to the students, they tell you with their eyes and their bodies if you're getting across to them. If you don't look at the students, only one channel of the two is operating. You can't look at every student all the time, but what you can do is look at one student as you talk, and talk to that student as if he or she were your closest friend. After you've talked to that student for a few seconds, look at someone else in the class and talk to him or her. Try to talk to everyone in the class at least once during each class. You'll be amazed at the results.



Put the computer in its place. Computers are great. They allow us to do all sorts of things that we couldn't do before. They have brought wonderful new educational possibilities to the classroom, laboratory, and studio. But they can also seduce us. They can persuade us that if we're using the computer in our teaching, and especially if we're having our students use the computer, we're teaching at the leading edge. Sometimes it's true that the best way to teach some particular subject is through the computer. But often it's not true. One example of this is finite element analysis of structures. What's great about FEA is that when students analyze a structure that they've designed, it tells them all the stresses and deformations. What's not so great is that FEA does this without increasing their understanding or offering any value judgements. A student can design a structure with a really clumsy, inefficient shape, and when FEA gives the numbers for it, the student considers that the design has been validated. The solution to this problem is not necessarily to abandon finite element analysis, but rather to use it in conjunction with other techniques that help students to find good forms for structures, and to evaluate the FEA output critically rather than to consider it as approval of their design. There are lots of other examples of excessive, inappropriate, or ineffective use of computers in teaching. Make every computer application prove its worth before you use it in your teaching.

Make math the servant, not the master. Just because a field has a well-developed set of mathematical tools doesn't mean that you have to teach primarily through mathematics. Math can't create ideas, it can only measure their fitness to a given purpose. Teach your students how to create ideas first, then teach them to use math in support of the evaluation and development of these ideas.



Respect each student's dignity. Listen to every student seriously and with undivided attention. Respond thoughtfully. Praise students publicly, and criticize them privately. **Never** ridicule or embarrass a student. The story is told of a student who asked a question on the first day of class. In response, the professor snapped, "It you had done the assigned reading, you'd know the answer to that. You're wasting my time." For the rest of the term, nobody ever asked a question again.

You do not teach building science. You teach *design*. Your mission is not to teach your students to do research or mathematical computations. It is to teach your students to *design* the more technical aspects of their buildings as integral parts of the architecture–the structure, the cladding details, the lighting, the thermal comfort systems, the acoustics. So constantly ask yourself, "What is the best way to teach design?" And the answer will always be, "The best way to teach design is to engage your students in the process of designing". They can be asked to design in many ways, at many different time scales: A term-long design project. A one-week assignment. A ten-minute sketch design problem on a quiz or examination. A group project to design something during class or lab time. Often this design process, at whatever time scale it is carried out, will involve utilization of knowledge gained from scientific investigation. Often it will involve mathematics. But it is neither science nor math. It is design.

Run risks. Live on the edge from time to time. It will keep you alert, and like a highwire act, it will engage your students' attentions. One example: I decided to teach a new course on architectural composition. Thirty-five students signed up. I led off the very first class meeting by handing a sheet of 8 ½ by 11 plain copy paper to each student, along with six gummed one-inch blue circles. Then I asked each student to arrange the circles on the paper in a way that he or she found pleasing, and to mount the paper on the wall of the classroom, taking no more than five minutes for the entire exercise. Once all these abstract compositions were on the wall, I gave each student three gummed gold stars. I asked them to look at all the compositions, and to place one star on each of their three favorites. This took another five minutes. Finally, I appointed a committee of three students to tally the stars and bring the most popular compositions together in the center of the tackboard. All this was a risky experiment on my part, one that I had never tried before. I hoped that students would show some commonality in their choices. I feared failure: The results might be completely random, with no clear pattern of preference. What actually happened? To my amazement and gratification, five designs of the thirty-five attracted nearly all the gummed stars, and the five all demonstrated recognized principles of visual composition clearly and unequivocally. The class was off and running. Enthusiasm was high. And the exercise set a suitably experimental, participatory tone for the entire term.

Lead your students to expect the unexpected. Do something special, vivid, and unforeseen during every class meeting. It will give your students a reason to come to class, and to come on time. Don't let the exact nature of these special events become predictable. One day, do an awesome physical demonstration. Another, involve one or more members of the class in an exciting in-class activity such as building something and testing it. Another time, bring in a live guest. Show videos, go on field trips, do sketch problems, create an entertaining but instructive physical demonstration of a physical phenomenon, do a participatory design project on the blackboard, write a poem or a piece of prose fiction that touches on the subject of your course. Just make sure that it's relevant as well as unexpected.

Involve students actively in every class you teach. Even if it's a huge lecture class. They learn a lot more when they're part of the action than when they are passive recipients of a lecture, no matter how superb the lecturer is. Use portions of every lecture class to pose questions for immediate answers from the floor, to give little design exercises that can be solved on the spot in ten minutes or less, to invite students forward to perform a physical demonstration of an important principle under your direction–anything that will change a lecture from a monolog into a dialog. Consider also the potential for group activities within a large lecture class: The class can break into groups to design things, to discuss an issue and report out to the class as a whole, even to grade papers or projects from other groups. In a course in detailing, I often chalked a bad detail on the blackboard before class, then began the class by inviting students to volunteer to come to the board and change the detail for the better. The class was always 100% attentive when this was going on, well above the level of attention I could command on my own.

Break up the hour. Never lecture for a solid hour. Only the first ten or fifteen minutes will hold your students' attention if you do. Introduce other modes of teaching and learning, enough of them that you can change pace several times during every class. I once taught a course in statics that was irrevocably fixed by the registrar to meet once a week, for three hours each time. Everybody knows that you can't teach a concentrated technical subject like statics in three-hour chunks. I tried to get the weekly schedule split into three one-hour classes, but couldn't. Under protest, I started teaching statics in three-hour chunks, as requested. But I made sure that in addition to a ten-minute coffee break in the middle, I also broke up the 180 minutes by adding class discussions, little design problems, slide shows, physical experimentation, and other teaching modes to the lecture format. This way, I was never doing any one thing for more than fifteen to twenty minutes at a time. Week after week, the three hours zipped by too quickly, both for me and for the students. Nobody slept in class, not once. The student's written evaluations of the course were off the top of the charts. A long class isn't long if it is made into a series of short, vivid experiences. And a series of short experiences allows students to see a subject from many different points of view, which tends to reveal more of its full richness and complexity.

Hands on! Few educational strategies are as effective as putting students in direct physical contact with their subject matter. There is little else that I've taught that has been anywhere near as effective as giving a group of students a tub of lime mortar, a pile of bricks, a couple of trowels, and some instruction in bricklaying. I've caught them sneaking back into the construction lab after hours just to try a new idea for a brick structure. Such an exercise teaches them about bricks, mortar, craftsmanship, the inherent beauty of construction materials, and countless other useful topics. It also starts an unstoppable flow of adrenaline. It turns them into construction junkies, hooked for life on the excitement of making materials the media for turning architectural ideas into buildings. I've seen the same thing in other teachers' courses where students are working with thermal measuring equipment, restoring a historic house with their own hands, constructing and testing a small foot bridge, or mocking up full-scale a corner of the building they're designing in studio. Tactile experience not only teaches–it motivates.

Earnestly believe that yours will be the best-taught course in the school. If you do not believe that it can be, it will never be. If you do believe that it can be, then you have established the space within which you can strive for excellence in your teaching. Believe that your course will be the best, then make it so.

Don't try to cover your subject. How many times have you said in despair, "I'll never be able to get through all this material by the end of the term"? There's more to every subject than you can possibly cram into a course. This bothered me a lot until I realized that because of technical developments and changes in standards and methods, most of what I now know and use in any technical subject area I learned **after** I graduated from architecture school. The same thing will happen to your students during their careers–most of the "facts" and techniques that you've taught them will obsolesce sooner than you think. The lasting value of the courses that I took was that they introduced me to their subject areas, taught me to operate at a basic level within them, laid a philosophical base, and taught me how to learn about them over time. The MIT Faculty Manual puts this very neatly: "Don't try to **cover** your subject. Try to **uncover** a meaningful portion of it for your students." And teach them to keep abreast of it over the coming years. Then relax a bit and savor your teaching and their learning rather than racing the clock.

Treasure your quirky, offhand ideas. There's a part of the mind that works by itself and spits out crazy ideas without warning. Often it's the odd bit of stuff that you designed or wrote on a whim that turns out to be the most important. And sometimes the long, sustained process of creation doesn't yield nearly as wonderful a product. Long ago I produced in a couple of hours for my studio students in Boston a six-page handout containing rules of thumb for structural design. They liked it well enough, it improved their design work a bit, and I continued to use it. It was only a sideshow to the studio project. A couple of years later I was a guest at UC Berkeley, where I was amazed to see fuzzy copies of copies of copies of my MIT rules-of-thumb handout on a number of students' desks. It had walked three thousand miles across the continent under its own power. That was when I began to take this offhand idea seriously, and soon afterward, through collaboration with the gifted Joseph Iano, who knows the value of quirks and whims, *The Architect's Studio Companion* was born. And that's just one example.

Teach it straight and simple. Don't try to complicate your subject. Don't overload it with history or philosophy or high-flown rhetoric. Just teach the basics in simple words and short sentences. Relate them to the process of creating the form and space of buildings. That's all.

Start in the middle. It may seem logical to start at the beginning, but often it's more effective to start in the middle. By plunging your students in the meatiest, most exciting part of the subject matter, you demonstrate immediately why they're studying your subject, and they gain motivation to study it. They won't always understand fully at this early stage what they are doing, but they will learn an enormous amount about the subject, and they will become excited. Then you can go back to the "logical" beginning and start developing the basic knowledge that students will need to get back to the middle of things.

Scrap the syllabus. Students learn best not when they're following a preconceived plan for knowledge acquisition, but when they're working on a project that forces them to learn things in order to proceed. Your design of the project and your ability to lecture and demonstrate on an impromptu basis create a virtual syllabus and a uniquely effective learning experience. For instance, students who were asked to design a wood-framed shelter house for Yosemite National Park soon thirsted for knowledge of how to lay out framing plans, how to detail the cladding and structural connections, and how to verify sizes of structural members. As each thirst developed I offered a lecture to satisfy it. This meant that I was scheduling lecture topics on the fly, sometimes even impromptu, on the spot. It meant, too, that students were learning at nearly 100% efficiency, for three reasons: 1. The students knew from the start why they were studying each subject. 2. They also had a coordinated vision of how and where to file the information that they gained from the class. 3. They could put the new knowledge to work immediately, while it was fresh in their minds. So scrap the syllabus. Design a design project that will encourage students to learn the stuff you want them to learn. Turn them loose on it. Then lecture directly to their needs. It's the natural way to teach, the natural way to learn, and a whole lot more effective and enjoyable than being slaves to a predetermined schedule.

Quit quizzing. It's the least effective way to find out what your students know, and it tends to test only rote learning. Instead, find out what they know and whether they can utilize it by having them design things or discuss things. In this way, you'll find out not only what they have remembered, but what use they can make of it, which is the ultimate test.

The most important thing about teaching is love. Love your subject matter. Love the act of teaching. Love your students (no, not just that adorable creature in the front row, love your students as a group). If you truly love everything there is to love about the teaching situation, students will perceive your love, and they will seek to develop such a love for themselves. It's contagious. Even more than in most other areas of life, love is what makes things happen, what makes them enjoyable, what makes them of lasting value. If your teaching becomes a pure act of love, then you will have become the consummate teacher.

Favorite readings to return to again and again for inspiration and advice:

Gelernter, Mark. "Reconciling Lectures and Studios." *Journal of Architectural Education*, Winter 1988, p.46.

Davis, Barbara Gross. *Tools for Teaching.* San Francisco, Jossey-Bass, 1993.