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SCHOOLING VERSUS EDUCATION AND OTHER BALANCING ACTS

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- Several years ago I wrote a column on the *Impostor Phenomenon*. That's the tape that plays in some people's heads, telling them that no matter how successful they may seem to be, it's just a scam. Over the years (the tape says) they've managed to fool everyone—their families, friends, teachers, and everyone else who knows them—into thinking that they're this real hotshot...but they know better...and the very next tough question someone asks them or tough exam someone gives them will reveal them for the frauds they are.
- That's what it feels like to be up on this podium giving the ERM Plenary lecture, following in the footsteps of such luminaries as B.F. Skinner, Robert Mager, Wilbert McKeachie, Benjamin Bloom, William Perry, and the rest of the Who's Who roster of former plenary lecturers. It feels like someone has made a terrible mistake.
- But mistake or not, I'm here and deeply honored and flattered to have been asked—especially since the invitation came from my brothers & sisters in ERM, which I truly consider my professional family.
- I'm retiring in a week after 30 years of engineering professoring. In this talk, I want to reflect a little on some of the difficulties that come with the territory, but I first want to make clear that I think it's a fantastic profession—I can't imagine being happy doing anything else for a living.
- You get to study whatever piques your curiosity...get on stage several times a week...sleep late on Tuesday morning or stay home all day if you don't

have a class to teach...get to use the faculty restroom—no trivial perk at Riddick Labs at North Carolina State University.

- And the list goes on. As an engineering professor you get to impress perfect strangers all the time. Many of you have had the experience of sitting next to someone in a plane, and a conversation starts, and your neighbor asks you what you do? You know what happens when you say you're an engineering professor...their eyes widen, their jaw drops, they inch away from you a little, and they start telling you how bad they always were in math. This is heady stuff, friends!
- But we all learn pretty quickly that the job is not entirely a bed of roses. You constantly have to deal with people who complain about assignments, come in late all the time, can't manage to hold on to an idea from Monday to Wednesday, and don't seem to have acquired a shred of practical knowledge despite their years of education—and that's just the faculty meetings!
- The students present quite a few challenges as well, especially if you take the job seriously. This is something our non-academic friends don't think about:

If a doctor, lawyer, or dentist had 40 people in his office at one time, all of whom had different needs, and some of whom didn't want to be there and were causing trouble, and the doctor, lawyer, or dentist, without assistance, had to treat them all with professional excellence for nine months, then he might have some conception of the classroom teacher's job. (Donald D. Quinn)

- And there's more. In the outside world, they think of us as these genteel types, smoking our pipes in the faculty lounge and discussing Great Ideas, or gathered around chalkboards writing hieroglyphics and probing the mysteries of the universe.

[Cartoon: People in lab coats waving arms frantically. Caption: "Scientists trying to describe the size of the big bang."]

- But it's not all like that—it's more often like this.

[Cartoon: Scientist looking up from his experiment with a broad smile: "Eureka—I just thought of another way to get a grant.]

- It's not all genteel, either, as anyone knows who has ever sat in a faculty meeting debating a tough P&T decision or deciding who gets which new graduate students. It would probably surprise the public out there to know just how ugly things can get sometimes in the ivory tower, and it takes an insider to explain it:

University politics are vicious precisely because the stakes are so small. (Henry Kissinger)

- So, college teaching is a lot like real life—good stuff and bad stuff, yin and yang...and college professors are a lot like real people. We have real dilemmas to deal with...we're pulled in different directions by things we're supposed to do, things we want to do but don't have time for, and things we'd like to do but can't because of petty bureaucratic restrictions:

[Cartoon: Professor standing in front of department head's desk. The Head, who is holding a pistol, says "I'm not able to fire you, Douglas, because of your tenure--so I'm going to shoot you."]

- And that's what this talk is about—these conflicting pulls, this tightrope that we all have to walk throughout our careers. We need or want to do A, and at the same time we need or want to do B, and A and B call on us to do different and possibly opposite things.
- One of these dichotomies is the title of this talk: "Schooling vs. Education and other balancing acts." This is what inspired it.

I try not to let my schooling interfere with my education. (Mark Twain)

[Balance graphic—balance pans, one labeled schooling, the other education]

- We want to turn out graduates who are appropriately *schooled* in the professions for which we are preparing them, partly because it's our job and partly out of fear for our lives. I like to drive over the bridges they design and walk into their buildings and fly in their airplanes and drink the output from their water treatment plants without feeling an overwhelming need to recite Hail Marys beforehand...among other reasons, because I'm Jewish.
- At the same time, we want our graduates to qualify as *educated* citizens, able to talk intelligently about things besides the diffusion equation and bending moments on composite I-beams. We want our graduates to read the newspaper and listen to political speeches and know what the columnists and politicians are talking about and how much of it to believe.
- So, schooling requires doing some things, education requires other things, and it's hard to find time in our curriculum to do both. And that's just one of several dilemmas we face—balancing acts we have to perform. I've got several in mind.

SCYLLA	CHARYBDIS
Schooling	Education
Research	Teaching
Lecturing (teacher-centered instruction)	Active/cooperative learning (student-centered instruction)
Gatekeeper	Coach
Professional advancement	Personal fulfillment

- The great philosophers have pondered the need to choose between competing life alternatives:

*More than any other time in history, mankind faces the crossroads.
One path leads to despair and utter hopelessness, the other to total*

extinction. I pray we have the wisdom to choose wisely. (Woody Allen)

- But another great philosopher has the answer.

Why, a four-year-old child could understand this. Someone get me a four-year-old child. (Groucho Marx)

- My five-year old granddaughter Mary has no hesitation when given a difficult choice. [*Photograph of her.*] "Which do you want, Mary—ice cream or pie?" She doesn't even pause for breath before answering..."Both!" Even three-year-old Benjamin has figured this out by now. [*Photo*] One-year-old Jack can't say it yet, but he has no trouble expressing his understanding. [*Photo*]
- As the kids have learned, the answer to a dilemma is, both. Not *or*, but *and*. Ice cream *and* pie. Research *and* teaching. Gatekeeper *and* coach. Personal *and* professional growth. The faculty rest room *and*....
- OK, so now that I've disposed of my theme question, what's left to say here? Well, everything. It's easy to say, "Do both," but then a few more questions rear their ugly heads. *How* do you do both with only 24 hours in a day? And since all activities are not equally rewarded in our business—perhaps you've noticed?—how much of each do you do?
- Time is of course a problem. If there's one thing everyone in this room has in common, it's our strong sense that there's not enough time to do all the things we have to do and all the things we want to do. On the other hand,

Don't say you don't have enough time. You have exactly the same number of hours per day that were given to Helen Keller, Louis Pasteur, Michelangelo, Mother Teresa, Leonardo da Vinci, Thomas Jefferson and Albert Einstein. (H. Jackson Brown, Jr.)

- But setting that point aside, let's look at the balance issue. How do you do both, and how much of each?

- Let me first dispose of the ever-popular *Research vs. Teaching* dichotomy. Most of you have heard the conventional wisdom on this topic: for example,

"Everyone knows that if you're not doing research you're not up on new developments in the field and so you'll be teaching obsolete material."

However, for those of you who have been in the profession for less than ten minutes, I want to get your more seasoned colleagues to summarize the CW for you.

- Let's demonstrate the capacity for creative thinking that ERMers are famous for throughout the known galaxy. With a bow to Karl Smith I'll ask you to form groups of 3 or 4 & introduce yourselves. (*Allow time for groups to form.*)
- Here's the scene. Someone in the faculty lounge has dared to suggest that perhaps teaching quality should count for more in the faculty promotion and tenure system than it does, and the defenders of the conventional wisdom rise indignantly to refute this heresy. Now—with drama and *panache*—explain why research alone is a perfectly suitable basis for promotion and tenure decisions. Work with me here—if I can't get activity from this crowd, there's no hope for the future of education. OK, one minute—go!
- I hope that was therapeutic. Let's hear what some of you came up with. [*Collect a few responses*]
- These and similar axioms have been repeated ad infinitum for the past four decades, to the point that these articles of faith are taken as incontrovertible truth: (*Read them together.*)

1. *If you are doing world-class frontier research in your discipline, you're automatically qualified to teach anything to anybody, including freshmen*

2. *If you're not doing world-class frontier research in your discipline, you're not qualified to use the faculty rest room*
 3. *Elmer Dinwiddie in Electrical Engineering is in the National Academy and won an outstanding teaching award last year, which proves that research ability and teaching ability go hand-in-hand.*
 4. *Everyone on the faculty can be Elmer Dinwiddie if they work hard enough.*
- The belief that everyone on the faculty can be Elmer Dinwiddie if they work hard enough is what I called the "Myth of the Superhuman Professor" in a *JEE* paper a couple of years ago. I won't go through the whole song and dance now, but let me just suggest some responses you might throw in next time the articles of faith are recited in the faculty lounge:
 - *"You can't be a good teacher unless you're doing good research."*

Absurd on the face of it. Most of you can think back to one or two outstanding teachers you had—teachers who made difficult concepts clear to you, and more importantly, who motivated and inspired you to want to learn what they had to teach. Some of you may even be in your current careers because of one of those master teachers. If I collected their names from you and we made a list, many of those teachers would not be world-class researchers, or researchers at all.

- *"If you're a good researcher you're automatically qualified to teach."*

That one's also easy to dispose of. Think back to your college professors again—you won't have any trouble finding examples of great researchers who should have been barred by law from ever standing in front of undergraduates.

- *"Elmer Dinwiddie proves it!"*

People who offer this argument should know better. It's like saying that you can't be a good statistician unless you're a good skier and

pointing to someone they know who is both and thinking that the case has been made.

- In fact, a lot of research on this subject has been done, and the CW is wrong—the occasional Elmer Dinwiddie notwithstanding. Correlations have been mildly positive if entire faculties were studied and *negative* if only the most highly rated researchers were considered. For most professors, there just isn't time to do world-class research and outstanding teaching.
- So, here we are. Some people are excellent teachers, some are excellent researchers, and a few but not enough are great at both, and we need to do both. What do we do?

[Balance graphic—one pan teaching, the other research]

- We follow Ernest Boyer's lead, and get away from the one-size-fits-all model of faculty composition.

[Boyer balance graphic—frontier & applied research, educational scholarship, professional practice]

- It's starting to happen--Oregon State, N.C. State, elsewhere.
- Next dilemma.

Picture yourself in France in a cave with prehistoric drawings on the wall. These drawings tell a story and were perhaps the first use of technology for educational purposes. Now, thousands of years later, professors are still drawing on walls! (Bruce Finlayson)

- Someone in your department has come up with the bizarre idea of putting students to work in class on solving problems and in teams on homework. You're traditional senior faculty again, dispensing conventional wisdom by the shovelful. In your groups, why won't those things work? One minute—hit it.

- See how many of these you got. [*Responsive reading*]
 1. *You're not doing what you're being paid to do.*
 2. *The students don't know enough to do what you're asking—you've got to tell them how to do it.*
 3. *All that noise—you've clearly lost control of the class.*
 4. *They won't do their own work, they'll cheat, they'll give me bad evaluations and complain to my department head.*
 5. *That's just touchy-feely education theory—there's no evidence that it works.*
 6. *There's no way I can do all that and still cover the syllabus I HAVE to cover.*
 7. *That's how I was taught, and look how well I turned out!*

I'm sure you thought of others.

- What's the answer on this one? Same answer—balance.

[Balance graphic -- lecture and cooperative learning]

- 100% lecturing in a class is boring and soporific; there's no evidence from empirical research or cognitive science that it promotes learning; and there's some evidence that it stifles learning. On the other hand, 100% student-centered learning is slow & can lead to a dangerous proliferation of misconceptions.
- So you do both. Want to know how? Dan Budny and Alisha Waller and Phil Wankat and Charlie Yokomoto will be delighted to explain it to you.
- Next.

I arise in the morning torn between a desire to improve the world and a desire to enjoy the world. This makes it hard to plan the day. (E.B. White)

- In *Embracing Contraries*, Peter Elbow observed that college teaching is a schizophrenic profession. As professors we have to be *gatekeepers* [*graphic*], setting and enforcing standards high enough to certify that our graduates are qualified to practice the profession for which we are certifying them. On the other hand, we must be *coaches* [*graphic*], doing everything in our power to help our students get over the high barriers we have set in their path. Like E.B. White's conflicting desires, these competing job demands make it hard to plan the day.
- Elbow's prescription for dealing with this paradox shouldn't come as much of a surprise. It's *balance*. We keep both a gatekeeper's hat and a coach's hat handy at all times, and play both roles.

Gatekeeper: If you want to do well in this course, you're going to have to get over some high hurdles.

Coach: I'm going to do everything in my power to help you get over them.

[*Balancing graphic—gatekeeper & coach*]

- How do you manage *this* tap dance? You alternate. You might come in on the first day of class wearing the gatekeeper's hat. [*Gatekeeper graphic*] Policies and rules, high expectations—memorizing and plug-and-chug won't get you where you want to go, no curving grades.
- Take off that hat and put on the coach's hat. [*Coach graphic.*] Announce when you'll be available, motivate learning by establishing the relevance of what you'll be teaching to what they already know and care about.
- Don't keep both hats on at the same time—you'll forget what you're doing and most of the students will be even more confused than they usually are.
- Alternate throughout the course. *Gatekeeper*—write instructional objectives including some at high Bloom levels—some schooling, some education. Make the tests consistent with the high objectives. *Coach*—give practice in

the required knowledge and skills...active learning exercises in class, relevant homework assignments done cooperatively, everything else Stice & Smith & Woods & Miller and Olds and a couple of dozen other people in this room have been encouraging us to do for years.

- As coach, tell the students what the gatekeeper's objectives are so they won't have to guess what you want them to know. To quote my dear friend and my favorite educational philosopher, Jim Stice, "Teaching should not be a mystery religion."
- Be coach most of the time, gatekeeper on tests and the final exam. Balance them—embrace the contraries.
- Last dilemma.

*The intellect of man is forced to choose
Perfection of the life, or of the work (W.B. Yeats)*

- Let me give you some personal history. I'm an off-the-scale introvert and don't normally force a captive audience to listen to my life story, but since I'm retiring very soon, humor me for a little while.
- As I mentioned, I've been in the engineering professor business for the last 30 years. For first 15, I followed a dead-straight line down the prescribed path—photochemical reaction engineering, polymeric interfaces for stack gas monitoring, diffusion of gases and vapors in polymers, fluidized bed gasification, & all sorts of mathematical modeling. The only off-path thing I did was writing a textbook for the intro chemical engineering course, mostly out of ignorance of what I was letting myself in for until it was too late to get out.
- I thought my research activities were somewhat interesting and, by the usual metrics of the profession, successful...but except for some of the math modeling that felt more like recreational puzzle-solving than research, I didn't find them particularly enjoyable or personally fulfilling. I never really felt that the world would be a better place because, for example, I proved that for an n^{th} -order reaction in a tubular laminar flow

photochemical reactor, radial diffusion increases conversion. (I'll wait for the excitement to die down.)

- I was always troubled by my lack of real enthusiasm for research in my chosen field. I loved teaching and derived tremendous satisfaction from it, but I understood that by the rules of the game it was just something I had to do during intervals between writing proposals and papers. It certainly didn't count in my quest for the brass rings of promotion and tenure.
- It took quite a few years, but eventually I started to wonder whether in the broad view the priorities I and my colleagues were imposing on ourselves truly made sense.

[Cartoon: Two professors at funeral, looking sadly at the grave, and one says to the other "Poor Finchley—published and published, but perished anyway."]

- In 1982, I was on sabbatical at the University of Colorado when I got a call from my dean telling me that I had won the R.J. Reynolds Award for excellence in teaching, research, and extension. The winner of that annual award was required to prepare a talk for the engineering faculty and to write a monograph.
- I set off to write the talk and monograph on my research, which is what everyone else had done, when one morning I picked up the Rocky Mountain News and read this headline: "Teacher gets honor, and then is a goner." It was about a professor at the University of Colorado-Denver who won his university's highest teaching award one day and was fired on the next day for allegedly inadequate research.
- This irritated me, and I decided to make it the basis of my monograph. I started looking at the still prevalent grotesquely unbalanced university incentive and reward system, and I branched from that into ways we were shortchanging our students by de-emphasizing the importance of teaching. What resulted was a monograph called "Does Engineering Education Have Anything to Do with Either?" which I later turned into a paper in the *Journal of Engineering Education* and which got me started on the lines

I've been following ever since.

- At about the same time, I had occasion to hear Don Woods & Jim Stice give talks at AIChE meetings. I was surprised and delighted to find out that engineering education was in fact a discipline and not just something people did between writing grant proposals and papers, and that at least a couple of engineering educators seemed to be specializing in it and were still managing to make a living.
- To make short work of the next 17 years, I joined the ASEE, started reading the education literature, and began to appreciate how much more there is to this profession than I had dreamed of.

It can be said unequivocally that good teaching is far more complex, difficult, and demanding than mediocre research, which may explain why professors try so hard to avoid it. (Page Smith)

- I learned about the different ways in which people learn, different things instructors can do to facilitate learning, and—mainly from Karl Smith—how well cooperative learning works when done right. I talked my Dean into letting me put on a workshop to pass some of the ideas along, started writing about what I was doing, started getting invitations to put on workshops elsewhere, and eventually wound up right here.
- Well, so what? Why am I violating the introvert's creed and telling you all this? It has to do with this

[Balancing graphic]

*The intellect of man is forced to choose
Perfection of the life, or of the work*

- That's a terrible dilemma to have to resolve, but in my own case, I think I stumbled into a resolution, which was to put the work and the life together. As long as my work was just that—work, not something I found particularly meaningful or satisfying—then trying to perfect it was a difficult and troublesome matter.

- Once I figured out that it was the teaching—no, the learning, the motivating, and on a very good day, the inspiring—that I cared about, and I moved more and more into making *that* my life work, I had shifted from schooling to education—of both my students and myself. Yeats' dilemma was resolved. In perfecting my work, I *was* perfecting my life.
- So what does this mean to you, especially to those of you still trying to figure out what you want to do when you grow up? (Which, I might add, I'm also still doing.) Does it mean that everyone in the room should drop their disciplinary research and follow the path I've taken?
- Certainly not. For many of you, disciplinary research is an activity of the heart—challenging, stimulating, and deeply rewarding when you succeed in disentangling whichever knot you're struggling with. You shouldn't dream of dropping it. For others, teaching and learning may be where your heart lies. *You* may need to consider taking the road less traveled by, at least after you get tenure.
- It's not an easy road. You may have to struggle to get the respect you deserve from colleagues who don't understand what you're doing and why. You may not get the ultimate brass rings of our profession—the full professorship, the named chair (although you may, and some in this room have). But there's a pretty good chance that even after you've been doing it for years, you'll still look forward to getting up in the morning and going to the office, and you may have the unparalleled privilege of getting letters from former students telling you what a difference you made in their lives. You want personal fulfillment? That's as good as it gets.
- So the road may be difficult, but it leads right down the middle of the tightrope. Your research and your teaching are inseparable. You set standards as high as you think it's possible for the students to reach—trying both to school them and educate them—AND you do everything you can to help them meet those standards, and you keep trying to discover ways to do it better. It's a difficult road but a great one, the road less traveled by...and for me, taking it has made all the difference.

For us, there is only the trying. The rest is not our business. (T.S.)

Eliot)

- Thanks for listening. Good luck on whichever road you take.