# *Mentoring New Faculty Members*

**Rebecca Brent, Ed.D.**
**President, Education Designs Inc.**
**Cary, North Carolina**

**Richard M. Felder, Ph.D.**
**Hoechst Celanese Professor Emeritus of Chemical Engineering**
**North Carolina State University**
***<http://www.ncsu.edu/effective_teaching>***

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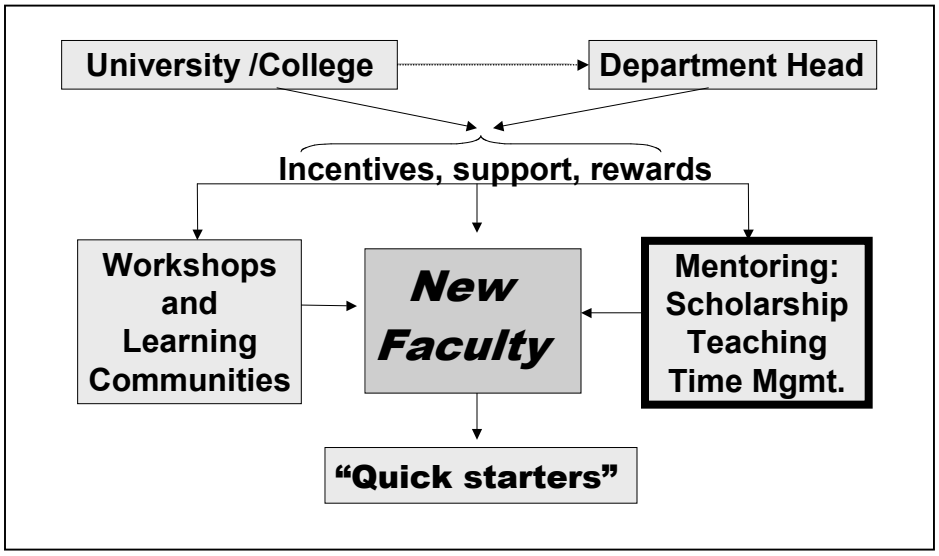
## Workshop Message

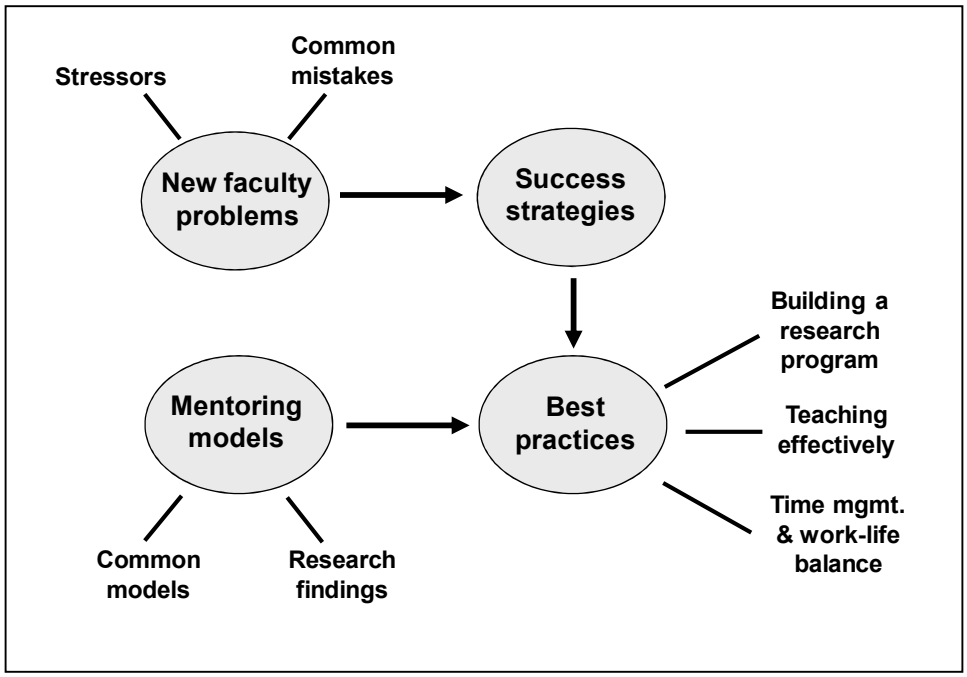
- People are not born knowing how to be professors. Trial-and-error is an inefficient way to learn.
- 95% of new faculty members take 4–5 years to meet their institution's expectations for research productivity and teaching effectiveness. The other 5% (*quick starters*) do it in 1-2 years. We know a lot about what quick starters do that makes the difference.[1]
- Universities may invest a million dollars or more in each new faculty member they hire. Low productivity in research and ineffective teaching are costly. Universities can reap tremendous benefits by helping their new hires become quick starters.
- Research productivity and teaching effectiveness both involve teachable skills. *Mentoring may be the most effective way to help new faculty members acquire those skills quickly.*

## Supporting New Faculty Members




[1] Boice, R. (1992). *The New Faculty Member.* San Francisco, CA: Jossey-Bass, and Boice, R. (2000). *Advice for New Faculty Members.* Needham Heights, MA: Allyn & Bacon.

## Workshop Graphic Organizer




## Workshop Learning Objectives

By the conclusion of this workshop, you will be able to

1. Identify the common mistakes most new faculty members make and outline effective strategies for avoiding them.
2. Describe alternative mentorship models.
3. Summarize characteristics of good mentoring and good mentors and identify pitfalls mentors should avoid.
4. Outline techniques mentors can use to help new faculty develop their research, teaching and time management skills.
5. List useful resources for both mentors and mentees.

## Resources for Mentors, Mentees, and Department Heads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## Workshop Facilitator Biographies

**Rebecca Brent, Ed.D.**
President, Education Designs, Inc.
Cary, North Carolina
Email: rbrent@mindspring.com Twitter: @RebeccaBrent

Dr. Brent is President of Education Designs, Inc., a consulting firm in Cary, North Carolina. She has more than 35 years of experience in education and specializes in staff development in engineering and the sciences, teacher preparation, and evaluation of educational programs at both precollege and college levels, and has authored or coauthored roughly 120 papers on those topics. She holds a Certificate in Evaluation Practice from the Evaluators' Institute at George Washington University. Prior to entering private consulting, she was an Associate Professor of Education at East Carolina University where she won an outstanding teacher award. In 2014, Dr. Brent was named a Fellow of the American Society for Engineering Education.

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**Richard M. Felder, Ph.D.**
Hoechst Celanese Professor Emeritus of Chemical Engineering
North Carolina State University
Email: rmfelder@mindspring.com Website: <*www.ncsu.edu/effective_teaching*>

Dr. Felder joined the N.C. State University faculty in 1969. He is a co-author of the book *Elementary Principles of Chemical Processes,* which has been used as the introductory chemical engineering text by roughly 90% of all chemical engineering departments in the United States and many abroad, and he has authored or co-authored over 300 papers on chemical process engineering and engineering education. He has won numerous awards for his teaching, research, and publications, including the American Institute of Chemical Engineers Warren K. Lewis Award for Contributions to Chemical Engineering Education, the American Society for Engineering Education Lifetime Achievement Award in Engineering Education (first recipient), and the International Federation of Engineering Education Societies Global Award for Excellence in Engineering Education (first recipient).

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Drs. Brent and Felder are coauthors of *Teaching and Learning STEM: A Practical Guide* (Jossey-Bass, 2016), <*www.ncsu.edu/felder-public/TeachSTEM/TeachSTEM.html*>. Separately and together, they have presented over 450 workshops on effective teaching, course design, mentoring and supporting new faculty members, and faculty development, on campuses around the world. They co-directed the American Society for Engineering Education National Effective Teaching Institute from 1991 to 2015. Visit their website, <*educationdesignsinc.com*>, and their Facebook page, <*www.facebook.com/felderandbrent*>.

# A. What happens to new faculty members?

*The idea that all new faculty members should have to sink or swim is inefficient because it takes time and energy away from their actually doing the jobs they were hired to do. Sink or swim also fails the most basic cost-benefit analysis because the time, energy and resources required to replace a faculty member who may have been a great researcher but failed the test of "figuring things out" far exceeds the cost of providing new faculty with the mentoring and support they need to thrive. And it is organizationally unhealthy because it sustains a hazing culture where people respond to their own painful initiation experiences by reproducing them on others.*

(Kerry Ann Rockquemore)

## New Faculty Members: Common Mistakes and Success Strategies

Robert Boice[2] studied career trajectories of hundreds of new faculty members. He found that roughly 95% of them took 4–5 years to meet their institutions' expectations for research productivity and teaching effectiveness, and the other 5%—the *quick starters*—met or exceeded research expectations and scored in the top quartile of teaching evaluations within their first 1–2 years. Boice identified mistakes the 95% routinely made that limited their productivity and effectiveness and strategies the quick starters used to avoid the mistakes, and he also found that new faculty members could be taught to use the same strategies.

**Mistake #1: Giving proposal and paper writing the highest verbal priority while spending relatively little time on them and producing relatively little.** Concentrating on the most pressing tasks (e.g., preparing for tomorrow's class) and waiting for "blocks of uninterrupted time" to do the "real writing."

- *Consequences:* Lack of productivity, and anxiety about it. Long warm-up time when and if the blocks of time appear.
- *Success Strategy #1: Schedule regular time—30–45 min/day, or 2–3 longer blocks weekly—for scholarly writing* (proposals, papers, reports)
  - Make appointments with yourself
  - Work away from your office
  - Free-write first (no critiquing or editing), then revise[3]
  - Keep time log for a week (see how much time is spent on nonessential activities)
- *Results.*
  - Regular sessions → maintain momentum, less warm-up time
  - Steady progress → less anxiety

**Mistake #2: Overpreparing for classes**. Most new faculty members Boice studied spent nine hours or more preparing for each lecture hour. They equated good teaching with having complete & accurate lecture notes and being ready for any question students might conceivably ask.

- *Consequences:* Too much material to cover, have to rush to cover it, little time for questions or activities in class, and poor student evaluations. Also little time for anything else, including research & personal life.
- *Success Strategy #2: Limit preparation time for class*, especially after the first offering of a course. Shoot for 2 hours preparation per lecture hour. Often won't make it, but even in the first offering if it's 8–10, it's a problem.
- *Results.*
  - Less material to cover → more time to cover it well, better learning.
  - Less preparation time → more time for scholarship & personal life.

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[2] Boice, R. (1992). *The New Faculty Member.* San Francisco, CA: Jossey-Bass, and Boice, R. (2000). *Advice for New Faculty Members.* Needham Heights, MA: Allyn & Bacon.

[3] Felder, R.M., and Brent, R. (2008). How to write anything. *Chem. Engr. Education, 42*(3), 139–140. <*www.ncsu.edu/felder-public/Columns/WriteAnything.pdf*> and p. 25 of notebook.

**Mistake #3: Working non-stop and alone**.

- *Consequences:* Failure to get available support and to learn the campus culture. Sense of isolation, depression.
- *Success Strategy #3: Network!* Visit colleagues in their offices, go to lunch or have coffee with them, and talk about research, teaching, and the campus culture**.** If you're facing a specific problem (writing a paper for a journal with a high rejection rate, approaching a tight proposal deadline, dealing with an unproductive graduate student or a rebellious undergraduate class,…), figure out which colleagues are likely to be helpful and seek them out.[4]
- *Results*. Quickly get needed help, learn the culture, discover campus resources, cultivate allies and advocates among those who will eventually be voting on your reappointment, tenure, and promotion.

**Mistake #4. Working without clear goals and plans**.

- *Consequences:* Accept too many commitments that don't help achieve long-term goals, and fail to take steps that *would* help. Become spread too thin and fall behind in the tenure quest. Anxiety, depression.
- *Success Strategy #4: Develop clear goals and specific milestones for reaching them* (proposals, papers, conference presentations, new course preps,...). Get periodic feedback from department head and senior colleagues.
- *Results.* Make commitments wisely & maximize chances of reaching goals.

**How do you get new faculty to adopt the Boice strategies and other practices that will help them succeed?**

1. New faculty orientation and ongoing faculty development
2. Appropriate department head intervention
3. *Mentoring*

[4] Rockquemore, K.A. (2011). Will you be my mentor? *Inside Higher Education,* November 14, 2011. <*www.insidehighered.com/advice/2011/11/14/essay-mentoring-and-minority-faculty-members*>.

# B. Mentorship structures, benefits, and good practices

*The mediocre mentor tells. The good mentor explains. The superior mentor demonstrates. The great mentor inspires, encourages and takes you into the trenches.*

(Navtaj Chandhoke)

**Why mentor?**

In every skilled profession but one, experienced practitioners (mentors) routinely provide guidance to newcomers to the profession (apprentices, mentees). The one exception is college teaching. Most new professors must therefore learn by trial-and-error. The result is the 4–5 year learning curve undergone by 95% of them according to Robert Boice's studies.

**Mentorship structures**

- Each new faculty member who wants a mentor is assigned either (a) one mentor; (b) a research mentor and a teaching mentor; or (c) a lead mentor who helps the new faculty member assemble a mentoring team. *At least one mentor should introduce the mentee to Boice's success strategies for new faculty.*
- *Research mentorship*. The most effective approach is for the mentor and mentee to collaborate on a research project, so the mentee can see first-hand how the experienced researcher plans a study, secures funding, works with graduate students, publishes results, and deals with problems. The mentee takes increasingly large share of the project leadership as time goes on. Less effective than collaboration (but still extremely valuable) is for the mentor to meet regularly with the mentee to offer advice and help with the different stages of the mentee's research. *Over time, the mentor's role shifts to helping the mentee succeed independently.*
- *Teaching mentorship.* The most effective approach is for mentor and mentee to co-teach a course in one section or parallel sections. Initially the mentor does most of the lesson planning, assignment & test writing, and lecturing, and the mentee observes what the mentor does in and out of class. The mentor and mentee have weekly debriefing meetings to discuss how things have gone and what should be done next. Gradually the mentee assumes more of the responsibility and the mentor becomes more of an observer. In the following semester, the mentor occasionally observes and comments on the mentee's class, and offers advice when requested. Teaching mentorships typically last one year.
- *Lead mentor and support team.* Kerry Ann Rockquemore[5], an expert on early and mid-career support, suggests that mentors or department heads encourage mentees to consider, "What do I need and how can I get it?" She lists things new faculty members generally need including professional development (research, teaching), emotional support, intellectual community, role models, safe space, accountability, sponsorship, access to opportunities, and substantive feedback. Any individual mentor may be able to provide some of these, but rarely can anyone provide them all.
- *Group mentoring.* This approach recognizes that not all career advice requires one-on-one interaction. Groups of early career faculty meet with one or two senior colleagues to talk about specific topics of interest to all such as policies on tenure, teaching evaluations, how to develop a new course, or time management.
- *Expert consulting.* If there are individuals with certain areas of expertise (successful grant writing, excellent teaching, contacts with a particular funding agency), those individuals may serve as designated resources for individual new faculty members or groups.

[5] Rockquemore, K. A. (2011). Will you be my mentor? *Inside Higher Ed.* Online column. Accessed 9/20/12 at <*http://www.insidehighered.com/advice/2011/11/14/essay-menoring-and-minority-faculty-members*>.

**Benefits of mentoring**[6]

- Research shows mentoring → *greater research productivity, better student evaluations, greater success in coping with challenges, less social isolation and stress, and higher job and career satisfaction*.

**Lessons learned from research**[7]

- Multiple early mentorships → greater career benefits.[8]
- Mentors & mentees paired by the department head work as well as or better than mentee-selected pairs. (Be careful about self-selection—not everyone is qualified to be a mentor, and new faculty members may be misled by first impressions and make bad choices.)
- The informal mentoring that many senior faculty insist occurs routinely in their department frequently doesn't. *Women & minorities are least likely to be mentored informally*.
- Having all mentor-mentee pairs meet together occasionally increases the effectiveness of mentorship programs.
- Mentors often resist taking action (critiquing mentees' lectures or proposal drafts, initiating meetings) and may need encouragement to do so.
- *A key to successful mentorship is regular meetings, whether or not the mentor and mentee feel a strong need for them*. Many—possibly most—mentorships fail because meetings diminish in frequency and then just stop, ending with "Come see me when you have problems."

**Who should mentor?**[9]

Good mentors

- are effective as teachers and/or scholars (whichever they are mentoring)
- are aware of new faculty challenges and success strategies
- know their campus (department, college, university) culture and resources
- speak positively about their culture and their colleagues
- are willing to spend time with mentees
- are good listeners
- *don't try to clone themselves*

[6] From Menges & Associates [1999], reference on p. 5.
[7] Boice, R. (1992). Lessons learned about mentoring. *New Directions for Teaching and Learning,* #50, pp. 51–62.
[8] Sorcinelli, M.D., & Yun, J. (2007). From mentor to mentoring networks: Mentoring in the new academy. *Change, Nov./Dec.,* pp 58-61.
[9] From Bensimon, Ward, & Sanders. Reference on p. 5.

# THINGS I WISH THEY HAD TOLD ME[10]

**Richard M. Felder**
**North Carolina State University**

Most of us on college faculties learn our craft by trial-and-error. We start teaching and doing research, make lots of mistakes, learn from some of them, teach some more and do more research, make more mistakes and learn from them, and gradually more or less figure out what we're doing.

However, while there's something to be said for purely experiential learning, it's not very efficient. Sometimes small changes in the ways we do things can yield large benefits. We may eventually come up with the changes ourselves, but it could help both us and our students immeasurably if someone were to suggest them early in our careers. For whatever they may be worth to you, here are some suggestions I wish someone had given me.

- *Find one or more research mentors and one or more teaching mentors, and work closely with them for at least two years.* Most faculties have professors who excel at research or teaching or both and are willing to share their expertise with junior colleagues, but the prevailing culture does not usually encourage such exchanges. Find out who these individuals are, and take advantage of what they have to offer, if possible through collaborative research and mutual classroom observation or team-teaching.
- *Find research collaborators who are strong in the areas in which you are weakest.* If your strength is theory, undertake some joint research with a good experimentalist, and conversely. If you're a chemical engineer, find compatible colleagues in chemistry or biochemistry or mathematics or statistics or materials science. You'll turn out better research in the short run, and you'll become a better researcher in the long run by seeing how others work and learning some of what they know.
- *Whenever you write a paper or proposal, beg or bribe colleagues to read it and give you the toughest critique they're willing to give.* Then revise, and if the revisions were major, run the manuscript by them again to make sure you got it right. THEN send it off. Wonderful things may start happening to your acceptance rates.
- *When a paper or proposal of yours is rejected, don't take it as a reflection on your competence or your worth as a human being. Above all, don't give up.* Take a few minutes to sulk or swear at those obtuse idiots who clearly missed the point of what you wrote, then revise the manuscript, doing your best to understand and accommodate their criticisms and suggestions.

  If the rejection left the door open a crack, send the revision back with a cover letter summarizing how you adopted the reviewers' suggestions and stating, *respectfully*, why you couldn't go along with the ones you didn't adopt. The journal or funding agency will usually send the revision back to the same reviewers, who will often recommend acceptance if they believe you took their comments seriously and if your response doesn't offend them. If the rejection slammed the door, send the revision to another journal (perhaps a less prestigious one) or funding agency.
- *Learn to identify the students in your classes, and greet them by name when you see them in the hall.* Doing just this will cover a multitude of sins you may commit in class. Even if you have a class of over 100 students, you can do it—use seating charts, labeled photographs, whatever it takes. You'll be well compensated for the time and effort you expend by the respect and effort you'll get back from them.
- *When you're teaching a class, try to give the students something active to do at least every 20 minutes.* For example, have them work in small groups to answer a question or solve a problem or

[10] Revised version of *Chem. Engr. Education, 28*(2), 108-109 (1994).

think of their own questions about the material you just covered. In long class periods (75 minutes and up), let them get up and stretch for a minute.

Even if you're a real spellbinder, after approximately 10 minutes of straight lecturing you begin to lose a fraction of your students—they get drowsy or bored or restless, and start reading or talking or daydreaming. The longer you lecture, the more of them you lose. Forcing them to be active, even if it's only for 30 seconds, breaks the pattern and gets them back with you for another 10-20 minutes.

- *After you finish making up an exam, even if you KNOW it's straightforward and error-free, work it through completely from scratch and note how long it takes you to do it, and get your TA's to do the same if you have TA's.* Then go back and (1) get rid of the inevitable bugs and busywork, (2) make sure most of the test covers basic skills and no more than 10-15% serves to separate the A's from the B's, and (3) cut down the test so that the students have at least three times longer to work it out than it took you to do it.
- *Grade tough on homework, easier on time-bound tests.* Frequently it happens in reverse: almost anything goes on the homework, which causes the students to get sloppy, and then they get clobbered on tests for making the same careless errors they got away with on the homework. This is pedagogically unsound, not to mention unfair.
- *When someone asks you to do something you're not sure you want to do—serve on a committee or chair one, attend a meeting you're not obligated to attend, join an organization, run for an office, organize a conference, etc.—don't respond immediately, but tell the requester that you need time to think about it and you'll get back to him or her. Then, if you decide that you really don't want to do it, consider politely but firmly declining.* You need to take on some of these tasks occasionally—service is part of your professorial obligation—but no law says you have do everything anyone asks you to do.[*]
- *Create some private space for yourself and retreat to it on a regular basis.* Pick a three-hour slot once or twice a week when you don't have class or office hours and go elsewhere—stay home, for example, or take your laptop to the library, or sneak into the empty office of your colleague who's on sabbatical.

  It's tough to do serious writing or thinking if you're interrupted every five minutes, which is what happens in your office. Some people with iron wills can put a "Do not disturb!" sign outside their office door and let their voice mail take their calls. If you're not one of them, your only alternative is to get out of the office. Do it and watch your productivity rise.
- *When problems arise that have serious implications—academic misconduct, for example, or a student or colleague with an apparent psychological problem, or anything that could lead to litigation or violence—don't try to solve them on your own. The consequences of making mistakes could be disastrous.*

  There are professionals at every university—academic advisors, trained counselors, and attorneys—with the knowledge and experience needed to deal with almost every conceivable situation. Find out who they are, and bring them in to either help you deal with the problem or handle it themselves.

[*] However, if your department head or dean is the one doing the asking, it's advisable to have a good reason for saying no.

# C. Mentoring for Effective Scholarship

*A first principle not formally recognized by scientific methodologists—when you run onto something interesting, drop everything else and study it.*

(B.F. Skinner)

## Crisis Clinic: Research (Low research productivity and funding)

**Scenario**. You're in the second semester of mentoring and you realize that your mentee is having problems getting his research program started. He talks about a grant proposal he's working on, but you haven't seen evidence of it. What might you do?

## Helping mentees increase research productivity

- Ask questions to find out what the problem is
- Ask to see work in progress and share your own work
- Show mentee successful and unsuccessful proposals and talk about them
- Discuss possible sources of funding and encourage mentee to contact program director
- Get mentee involved in joint research projects with other faculty
- Make sure mentee knows about campus resources and support staff (grants office, reference librarians).

## Helping mentees establish and maintain a research agenda[11]

1. *Know the faculty member's research history.* When a new faculty member is hired, the department head and mentor should become familiar with his or her experience level in research, grant acquisition, and publication. This knowledge will help determine how much help will be needed.
2. *Help create a research agenda.* Depending on the faculty member's research history, help him/her create an agenda that should lead to appropriate levels of productivity to meet the institution's expectations for tenure.
3. *Meet regularly about research.* Meetings to discuss research will give the dept. head/mentor a chance to monitor progress and clarify expectations regarding research.
4. *Provide support for writing.* Often problems are related to writing. The following writing tips may be helpful:
   - *Make writing a regular activity.* Allocate brief intervals (1-2 hours) to scholarly writing at least 3 times a week.
   - *Write when you are fresh.*
   - *Compliment and reward yourself when you meet writing goals*.
   - *Establish or join a writing support group.*
   - *Get into the habit of sharing work with colleagues even if it is in outline or draft form.* This habit will help de-emphasize the private side of writing and will establish a network of colleagues who are familiar with your work.
   - *Develop a portfolio of research that includes completed projects, writing in progress, and plans for the future.* The portfolio can become a focus of discussion for annual reviews and provides a way to monitor progress in establishing a research agenda.
5. *Help with grant proposals.* Show the new faculty member examples of funded proposals and provide feedback on drafts. If more than one department faculty member is experiencing difficulty, schedule a topical workshop using campus or college resources.

[11] Bensimon, Ward, & Sanders. Reference on p. 5, pp. 151–155.

**Three early research options for new faculty members**

1. **Staying the course:** Continuing to work in the area of the Ph.D. dissertation and/or postdoctoral research.

   *a. Best Case Scenario:* You develop real expertise in your research area and find funding easily because of your strong track record and reputation in the professional community. If you're in a really hot or highly productive area, you build a strong program centered around related work making it easier to have your research team help each other and piggyback on each other's work.

   a. *Worst Case Scenario:* If you stay in exactly the same track as your earlier work, you may be accused of simply re-doing your dissertation, and you will probably find yourself competing with your former advisor and other well-established faculty for research funding. The research landscape may change leaving you stuck with only one area of expertise.

2. **I've got what you need:** Taking specific tools used in your earlier work (like Java programming or statistical expertise) and applying them in a variety of collaborative projects.

   a. *Best Case Scenario:* You can explore a variety of fields and projects with collaborators. You develop expertise using your tools and understand them in a deep way because of experience with different applications. You take the lead in larger scale projects by assembling a diverse team.

   b. *Worst Case Scenario:* You could always be a junior collaborator and fail to develop your own program. Since collaboration is challenging, you could have trouble finding good people to work with. It could be more difficult to get your students working together productively since their projects may be very different from each other.

3. **Changing horses:** Moving into a new research area.

   a. *Best Case Scenario:* You get some initial funding in the areas related to your previous work to capitalize on your experience. You find a mentor with experience and a track record in the research area you want to go into giving you the chance to build up your expertise and credentials. Eventually you are independently able to secure funding and pursue research in the new area.

   b. *Worst Case Scenario:* You try to break into the new area on your own or with a weak collaborator. You find yourself unable to secure funding because of your lack of a track record, and you can't establish your program quickly enough for career success.

**Possible approaches**

- Initially stay the course, but gradually move into other areas after 2-3 years.
- Change horses, but begin in collaboration with an established expert. Progressively differentiate your work & take leadership in projects.
- Bring your tools to other projects, but make sure you take the PI role in some of them.

# SO YOU WANT TO WIN A CAREER AWARD[12]

**Richard M. Felder**
**North Carolina State University**

The NSF Early Faculty Development (CAREER) Program Award is the most sought-after recognition a new faculty member can receive. Besides being an impressive addition to the recipient's resume, the award gives major bragging rights to his or her department and institution. As soon as most new assistant professors move into their offices and boot up their computers, they are expected to begin work on their CAREER proposals—and if they don't make it on the first attempt they are expected to keep plugging away until they either win the award or are no longer eligible.

When I recently had the pleasure of serving on an NSF review panel,[13] I noticed that certain common mistakes tended to land proposals in the "Sorry—good try, but not quite good enough to get funded" category. If you're a new faculty member planning to go for a CAREER award, you might consider taking several precautions to avoid these mistakes.

According to the NSF program solicitation,[14] CAREER proposals must include "creative, integrative, and effective research and education plans," and show "excellence in both education and research." The most common mistake I've seen is discounting the importance of the education part. It appeared that many of the authors of proposals I reviewed worked long and hard on their research plans, then thought briefly about their education plans and wrote one or two cursory paragraphs about sponsoring undergraduate research projects or developing a new graduate course related to the proposal topic. With very few exceptions, those proposals were not funded.

This outcome makes sense if you think about it. Most CAREER applicants have spent at least four years thinking about the research topic of their proposals and are also smart enough to get knowledgeable senior colleagues to review their research plans. Those plans are consequently excellent in most proposals that make it past the first cut, which means that the education plans often determine who gets the awards. If the education plans are hastily or unimaginatively written, the proposals are not likely to be competitive.

Here are several more specific suggestions.

- *Read the program solicitation carefully and follow all instructions.* When the solicitation says that the program wants an integrated plan of research and education, provide exactly that. When it tells you that you must obtain the written endorsement of your department head and your bio must contain no more than 10 references and your project description has a 15-page maximum and you may submit letters of support from prospective collaborators but not reference letters, believe it.
- *After you have outlined your plans, run your ideas by the CAREER contact person in the NSF division or program to which you plan to submit.* This is legal; in fact, NSF program officers expect it. You will find them extremely helpful—they don't want you to waste your time, reviewers' time, and ultimately their time by writing a proposal that doesn't fit their program's goals and guidelines. They might recommend modifications that would make your proposal more suitable for them, or they might suggest sending the proposal to another program for which it would be a better fit.

[12] Revised version of *Chemical Engineering Education, 36*(1), 32-33 (Winter 2002).

[13] I'm sincere about calling the experience a pleasure—sitting in a room full of exceptionally talented people and discussing the pros and cons of clever scholarly ideas for two days is truly enjoyable. If you are ever invited to do it, I'd advise accepting.

[14] <*http://www.nsf.gov/publications/pub_summ.jsp?WT.z_pims_id=503214&ods_key=nsf11690*>.

- *Do a thorough literature review and make sure you cite the most important theoretical and experimental work and most important researchers in the areas covered by the proposal.* Search the literature in the area of the education part as well: if you're proposing a new approach to cooperative learning or distance education or K-12 outreach or the undergraduate laboratory, be sure to find the relevant published work and cite it. Ignoring important research in your proposal reflects poorly on your expertise and looks like you haven't done your homework, and omitting an important researcher will also do very little for your cause, especially if he or she turns out to be a reviewer. Try to avoid negativity in your citations, proposing to build on previous work rather than correcting it: "*Frobish [1998] attempted something similar but got it all wrong—my work will repair his blunders*" is likely to backfire on you. You'd be surprised at how often those important people will get to review your proposals and how surly they can become if they don't see their names in the reference list or their work is trashed.
- *Pay attention to assessment, especially in the education plan.* Be specific about how you will know whether your research and education plans were successful. State your hypotheses, itemize the data you plan to collect, and make explicit connections between the hypotheses and the data. If you're trying something novel in your education plan (or if your research involves teaching and learning) and your "assessment" consists only of surveying students to see how they liked it, you will not get a warm reception from the reviewers. What they want to know is how you plan to demonstrate that your intervention improved learning or skill development or retention in engineering or science.
- *Don't overreach.* If you submit a proposal for a five-year $400,000 study and propose to do research that would clearly require a large team of investigators and a much higher level of funding, it will probably not be funded, especially if you're also going to be teaching three courses a semester throughout the award period. You're much better off proposing something of more limited scope that you have a reasonable chance of accomplishing.
- *Don't forget that you're writing a career development plan and not just a research proposal.* In the project description and/or the biographical sketch, take a little time to spell out your long-range goals and how the proposed work will further them.
- *Push your credentials.* A biography in a proposal is not a good place to be modest. Include anything that suggests your ability to carry out your plans successfully—prior job and research experience, publications (summarize the relevant findings if they're not in your project description), awards, collaborations with leaders in the field, and so on. Since you can't include reference letters in the proposal, the only one in a position to blow your horn is you—and you can be sure that your competitors will be blowing theirs.
- *Get internal feedback before submitting the proposal.* Beg, bribe, do whatever it takes to get knowledgeable colleagues to act like picky NSF reviewers and bleed red ink all over your proposal draft. Ask them to focus on the things that the real reviewers will be rating: (a) the "intellectual merit of the proposed activity," (b) the "broader impacts of the proposed activity," (c) the level of integration of research and education, and (d) the degree to which the work will "broaden opportunities and enable the participation of all citizens—women and men, underrepresented minorities, and persons with disabilities."[19] Revise the proposal to take into account the criticisms and suggestions you get, and *then* send it in.

Doing all these things may not make your proposal a guaranteed winner, but it will unquestionably improve your odds. Good luck.

# HOW TO WRITE ANYTHING*

**Richard M. Felder**
**Hoechst Celanese Professor Emeritus of Chemical Engineering**
**North Carolina State University**

**Rebecca Brent**
**President, Education Designs, Inc.**
**Cary, North Carolina**

*I write when I'm inspired, and I see to it that I'm inspired at nine o'clock every morning.*
(Peter De Vries)

Here's the situation. You're working on a big writing project—a proposal, paper, book, dissertation, whatever—and in the last five weeks all you've managed to get done is one measly paragraph. You're long past the date when the project was supposed to be finished, and you just looked at your to-do list and reminded yourself that this is only one of several writing projects on your plate and you haven't even started most of the others.

If you're frequently in that situation (and we've never met a faculty member who isn't) we've got a remedy for you. First, though, let's do some truth in advertising. Lots of books and articles have been written about how to write clear and persuasive papers, proposals, dissertations, lab reports, technical memos, love letters, and practically everything else you might ever need to write. We're not going to talk about that stuff: you're on your own when it comes to anything having to do with writing quality. All we're going to try to do here is help you get a complete draft in a reasonable period of time, because that usually turns out to be the make-or-break step in big writing projects. Unless you're a pathological perfectionist (which can be a crippling obstacle to ever finishing anything), once you've got a draft, there's an excellent chance that a finished document suitable for public consumption won't be far behind.

We have two suggestions for getting a major document written in this lifetime: (1) commit to working on it regularly, and (2) keep the creating and editing functions separate.**

## Dedicate short and frequent periods of time to your major writing projects

See if this little monologue sounds familiar. "*I don't have time to work on the proposal now—I've got to get Wednesday's lecture ready and there's a ton of email to answer and I've got to pick the kids up after school tomorrow...BUT, as soon as fall break (or Christmas or summer or my sabbatical) comes I'll get to it*."

It's natural to give top priority to the tasks that can be done quickly or are due soon, whether they're important (preparing Wednesday's lecture) or not (answering most emails), and so the longer-range projects keep getting put off as the weeks and months and years go by. If a major project has a firm due date, you panic when it approaches and quickly knock something out well below the best you can do. If it's a proposal or paper, subsequent rejection should not

* Chemical Engineering Education, 42(3), 139-140 (2008).

** We didn't invent either technique—you can find variations of both in many references on writing. A particularly good one is Robert Boice, *Professors as Writers.* Stillwater, OK: New Forums Press, 1990.

come as a surprise. If there is no firm due date, the project simply never gets done: the book you've been working on for the last ten years never gets into print, or your graduate students leave school with their research completed but without their Ph.D.s because they never finished their dissertations.

The strategy of waiting for large blocks of time to work on major writing projects has two significant flaws. When you finally get to a block, it's been so long since the last one that it can take hours or days to build momentum again and you're likely to run out of time before much gets written. Also, as soon as the block arrives other things rush in to fill it, such as your family, whom you've been neglecting for months and who now legitimately think it's their turn.

A much more effective strategy is to *make a commitment to regularly devote short periods of time to major writing projects.* Thirty minutes a day is plenty, or maybe an hour three times a week. One approach is to designate a fixed time period on specified days, preferably at a time of day when you're at your peak, during which you close your door, ignore your phone, and do nothing but work on the project. Alternatively, you might take a few 10–15 minute breaks during the day—times when you would ordinarily check your email or surf the Web or play Sudoku—and use them to work on the project instead. Either way, when you start to write you'll quickly remember where you left off last time and jump in with little wasted motion. When you've put in your budgeted time for the day, you can (and generally should) stop and go back to the rest of your life.

These short writing interludes won't make much difference in how many fires you put out each day, but you'll be astounded when you look back after a week or two and see how much you've gotten done on the project—and when a larger block of time opens up, you'll be able to use it effectively with very little warm-up. You can then be confident of finishing the project in a reasonable time...provided that you also take our next suggestion.

**Do your creating and editing sequentially, not simultaneously**

Here's another common scenario that might ring a bell. *You sit down to write something and come up with the first sentence. You look at it, change some words, add a phrase, rewrite it three or four times, put in a comma here, take one out there…and beat on the sentence for five minutes and finally get it where you want it. Then you draft the second sentence, and the first one is instantly obsolete and you have to rewrite it again...and you work on those two sentences until you're satisfied with them and go on to Sentence 3 and repeat the process...and an hour or two later you* may *have a paragraph to show for your efforts.*

If that sounds like your process, it's little wonder that you can't seem to get those large writing projects finished. When you spend hours on every paragraph, the 25-page proposal or 350-page dissertation can take forever, and you're likely to become frustrated and quit before you're even close to a first draft.

At this point you're ready for our second tip, which is to *keep the creating and editing processes separate.* The routine we just described does the opposite: even before you complete a sentence you start criticizing and trying to fix it. Instead of doing that, write whatever comes into your head, without looking back. If you have trouble getting a session started, write *anything*—random words, if necessary—and after a minute or two things will start flowing. If you like

working from outlines, start with an outline; if the project is not huge like a book or dissertation and you don't like outlines, just plunge in. If you're not sure how to begin a project, start with a middle section you can write easily and go back and fill in the introduction later.

Throughout this process, you will of course hear the usual voice in your head telling you that what you're writing is pure garbage—sloppy, confusing, trivial, etc. Ignore it! Write the first paragraph, then the next, and keep going until you get as much written as your budgeted time allows. Then, when you come back to the project the next day (remember, you committed to it), you can either continue writing or go back and edit what you've already got—and then (and *only* then) is the time to worry about grammar and syntax and style and all that.

Here's what will almost certainly happen if you follow that procedure. The first few sentences you write in a session may indeed be garbage, but the rest will invariably be much better than you thought while you were writing it. You'll crank out a lot of material in a short time, and you'll find that it's much easier and faster to edit it all at once rather than in tiny increments. The bottom line is that you'll find yourself with a completed manuscript in a small fraction of the time it would take with one-sentence-at-a-time editing.

We're not suggesting that working a little on big projects every day is easy. It isn't for most people, and days will inevitably come when the pressure to work only on urgent tasks is overwhelming. When it happens, just do what you have to do without beating yourself up about it and resume your commitment the next day. It may be tough but it's doable, and it works.

## 12 Steps to Establish a Daily Writing Practice[15]

**Step 1: Clarify your writing goals.**

Do his at the beginning of the week so that you will be ready to start writing.

**Step 2: Create accountability.**

Try a writing buddy, online writing communities, a coach, or a spouse to whom you will report your progress.

**Step 3: Start each day with a pause.**

Rockquemore suggests "taking a deep breath and a momentary pause to clarify what really matters" as you start your writing time.

**Step 4: Get your butt in your chair.**

"Half of life is just showing up" is a quote attributed to thousands, but good conventional wisdom!

**Step 5: Set a timer.**

By doing this, you'll keep yourself accountable for the time you said you would work and start to get a realistic idea of how much time it takes to complete certain types of writing tasks.

**Step 6: Manage your resistance.**

As soon as you sit down (or contemplate sitting down) to write, you will suddenly have a huge list of things to do—email, talking with a colleague, preparing for your next class, etc. That's natural resistance. Promise yourself you'll write for 5 minutes and then do it. By then you should be settled enough to work the full 30-60 minutes you've allotted.

**Step 7: Stop when the timer goes off.**

Lots of us have a "binge" approach to writing. That's a bad idea because you'll neglect all the other things on your plate and quickly find your work life is completely out of control.

**Step 8: Track your writing.**

Find a simple way to track your writing by words or pages written. You can do this on your calendar or on a spreadsheet. The key is to be able to see your progress.

**Step 9: Give yourself a treat.**

Do a little something to celebrate when you've done your writing. It may be as simple as a coffee break or a short game on your computer.

**Step 10: Review your progress on Friday.**

Take a look at what you've done and assess where you are in meeting your goals. Think about how long it took you to do what you did and use that knowledge to make good decisions about what you commit to in the future.

**Step 11: Assess and adjust as necessary.**

Be gentle with yourself especially as you are starting out when you don't reach your (unrealistic) goals. We all have to learn how much time it takes us to get tasks done.

**Step 12: Take time off.**

Consider taking the weekend off from writing to give your mind a rest.

[15] Rockquemore, K. A. (2012). Jump-Start your Productivity. *Inside Higher Ed.* Online column. Accessed 9/20/12 at http://www.insidehighered.com/advice/2012/07/09/essay-mid-career-productivity-issues

**Crisis Clinic: Research (Can't attract new graduate students)**

**Scenario.** Your mentee included his grant proposal abstract on the department's list of possible research topics for new graduate students. Only three students out of 22 came by for more information, and only one selected his topic (as third choice). *What might the problem be*?

## Promoting Research and Recruiting Students

**Project Title:** Permeabilities and diffusivities of gaseous permeants in polymeric membranes
**Principal Investigator:** Arvin Schmaltzig

The permeation of a gas through a tubular polymeric interface is described by the following equation:

$$\frac{\partial C}{\partial t} = \frac{D}{r}\frac{\partial}{\partial r}\left(r\frac{\partial C}{\partial r}\right)$$
$$t = 0, C = 0$$
$$r = r_1, C = Sp_1$$
$$r = r_2, C = 0$$

We have assumed that the inner surface of the membrane is abruptly exposed to a gas in which the permeant partial pressure is $p_1$, and the outer surface is exposed to a gas in which the permeant concentration is maintained low enough to be considered effectively zero. The permeant dissolves at the inner surface of the membrane (Henry's law solubility = S) and the dissolved permeant whose concentration is $C(t,r)$ diffuses through the membrane (Fickian diffusion coefficient = $D$), desorbs, and enters the gas at the outside surface. We neglect mass transfer resistance at both membrane surfaces. The permeation rate through the membrane is

$$Q(t) = -D(2\pi r^2 L)\left(\frac{\partial C}{\partial r}\right)_{r=r_2}$$

where $L$ is the tube length. It is well known that the permeability of the permeant, $P = DS$, can be determined from the steady state value of the permeation rate, $Q(t \to \infty)$. In a recent paper, we demonstrated that the diffusivity can be determined as a simple function of the zeroth moment of the normalized inverse permeation rate,

$$D = f\left[\int_0^\infty \left(1 - \frac{Q(t)}{Q(t \to \infty)}\right) dt\right]$$

In the research to be performed, a continuous permeation tube will be exposed to several different permeants at several temperatures, and the transient permeant flux will be monitored and analyzed to validate the ideal solution-diffusion model and to determine permeant diffusivities and solubilities at the temperatures studied. Flow rate variations will be used to test the assumption of the neglect of mass transfer at high flow rates, and if the permeation rate varies with flow rate at low flow rates, further analysis will be performed to estimate the effective boundary layer mass transfer coefficients. The implications of the results for determining concentrations of trace pollutants in stack gases will be explored.

**Project Title:** Design of a polymeric gas sampling interface for monitoring waste gas emissions in highly polluted environments
**Principal Investigator:** Arvin Schmaltzig

Measuring emissions of toxic pollutants (say, $H_2S$) in stack discharges from industrial processes is an important and difficult task. The filthy and corrosive atmospheres in many stacks can easily destroy conventional sampling instruments in a short period of time. The development of an accurate stack gas analysis method that functions reliably for long periods of time under such conditions would be a major advance for environmental protection.

We recently proposed using a corrosion-resistant polymeric material like teflon as an interface for stack gas sampling. A U-tube containing a section of the polymer is inserted in the stack and a clean carrier gas flows through the inside. The hydrogen sulfide in the stack dissolves at the outside tube surface, diffuses through the tube wall, and emerges into the carrier gas, which flows to an analyzer capable of measuring hydrogen sulfide concentrations down to parts-per-billion levels. If the device works as intended, particulate matter in the stack would simply bounce off the tube (which functions as a non-stick surface in a skillet) and acid gases in the stack would similarly have little corrosive effect on the polymer.

Designing an instrument for a specific application of this technique means that the relationship between the permeant (pollutant) concentration in the stack and the flux of the permeant through the tube wall must be known as a function of stack gas temperature and pressure. Recent theoretical work conducted by our research group has established this relationship, and has shown that the solubility and diffusivity of gases in a polymer can be determined from measurements of transient permeation rates through a membrane exposed to a step concentration change at one of its surfaces. The research to be carried out will involve the following steps:

- Design and construct a continuous-flow permeation cell and use it to demonstrate the feasibility of the proposed stack sampling technique.
- Carry out permeation rate measurements for a permeant of environmental importance (probably sulfur dioxide) to validate the ideal solution-diffusion model on which the previous analysis was based and to determine the permeant diffusivities and solubilities as a function of temperature and carrier gas flow rate. (These data do not now exist in the literature and would be valuable additions to it.) Extend the prior analysis to determine effects of mass transfer resistance in the carrier gas on the permeation rate.
- Build a stack sampling interface and test it in a real stack environment. (Arrangements for this portion of the research have already been made with a nearby sulfuric acid manufacturing facility.)

The student working on this project will gain experience in measuring and modeling membrane transport phenomena (which have environmental applications but are also important for such things as gas separations, food packaging, and controlled drug delivery) and in monitoring emissions of trace pollutants in industrial gas discharges. Funding from the Environmental Protection Agency will begin in January.

## Organizing an Effective Research Project Description

Whether you're trying to persuade a search committee to offer you a faculty position, a funding agency program director to award you a research grant, or new graduate students to sign on with you as a research advisor instead of one of your more famous and experienced colleagues, you need to sell your research. The first of the two project descriptions just given does a terrible selling job; the second one is much better. Here is a suggested framework for a project description:

- What is the general topic? Why is it important to science or industry or society?
- What problem is this research going to help solve? Why is *it* important?
- What approach will be taken? Experiments conducted? Models developed?
- How will the results contribute to the solution of the research problem?
- What knowledge and skills will the graduate student develop?
- If the research is part of a continuing project, where does the project stand?
- Is funding available now? If not, how likely is it to become available?

Avoid complex mathematical derivations, elaborate descriptions of experimental and analytical procedures, and long detailed summaries of background literature, but be prepared to discuss those things if someone asks you about them.

## Meeting with Prospective Graduate Students

- Be friendly & courteous. Find out about their backgrounds and interests.
- Re-emphasize the importance of your research to science, technology, or society and the skills that the student will develop in the course of doing the research
- Minimize technical and mathematical details (be ready to discuss them if asked)
- Show enthusiasm! If you're not enthusiastic about the research, why should they be?
- Communicate your expectations and desires for every graduate student in your research team.

## Involving Undergraduates in Research

The best undergraduates at most universities are as smart or smarter than most graduate students. Consider putting their talent to work for you by involving them in your research.

- Identify *good* undergraduates and actively recruit them (especially if you're just starting your research program and are struggling to attract graduate students). Beware of weak ones—they can be a major time drain.
- If your department has an REU (Research Experience for Undergraduates) grant, sign up to participate in it. Involve your research team in selecting the project.
- Define a task they can learn to do quickly. Help them build their learning through their work.
- If you have graduate students or postdocs, assign them to mentor the undergraduate researchers.

## Building an Effective Research Environment

Research environments vary considerably from one discipline to another, but certain common elements are needed to make them as effective as they can be. They can (a) be organized and orderly, or chaotic and unsafe; (b) be collegial and cooperative, or competitive and combative; (c) produce M.S. and Ph.D. graduates in reasonable times, or students who switch to other advisors or leave school without their degrees

### Creating an effective, professional, and welcoming research environment

- *Discuss your desired reporting and writing strategies.* Written updates? Lab notebooks? (Give them one on the graduate students' first day.) Oral reports? How often? One-on-one or to the research team? Structure of the dissertation? Expected frequency of presentations and papers?
- *Meet regularly with each of your RAs.*
  - get progress reports
  - discuss future research & writing plans
  - advise, consult, encourage, applaud, share,…
  - fit frequency of meetings to student's needs
- *Hold regular research team meetings.* Designate a facilitator to set the agenda and guide each meeting, and rotate this role.
  - research updates
  - literature reviews
  - conference reports
  - sharing successes & problems
  - planning for the future (involve everyone!)
- *Be sensitive to students' course pressures, especially in their first 1–2 years.*
  - Plan research responsibilities around exams.
  - Help relate research to coursework.
  - Keep track of students' performance in classes.
  - **Don't discourage them from taking courses.** Graduate school provides a unique opportunity for students to learn from experts in all fields. Don't deprive them of this opportunity because you want them to spend every waking hour working on their dissertation research. That might be in your best interests, but it's not in theirs.
- *Maintain good lab maintenance and safety practices.*
- *Encourage a professional environment, & avoid cliques*. Build an appreciation for differences (minorities, international students).
- *Make sure everyone treats staff (secretaries, technicians) respectfully.* Discourtesy to anyone is always wrong, and discourtesy to department staff can lead to serious breakdowns in the efficiency and effectiveness of a research program (particularly the research of those being discourteous).

**The three roles of an advisor.** Blend them, switch between them when appropriate.

1. **Boss.** Set expectations and rules, allocate resources, monitor and maintain order and safety, approve papers, theses, and dissertations. This role is important early in the graduate program and should diminish with time.
2. **Mentor**. Provide training and guidance in
   - grant writing
   - paper writing
   - reviewing papers and grants
   - effective presentation techniques
   - teaching strategies
   - tips for job interviews
   - research ethics

   This role is critical throughout the graduate program and may go on for years after graduation.

3. **Colleague.**
   - Give students responsibility & trust.
   - Share recognition with them.
   - Introduce them as colleagues.

   This role should be the dominant one toward the end of the doctoral program and thereafter.

## Avoiding problems in research programs, and dealing with them when they arise

- Make sure research questions & plan of work are clear to RA's.
- Involve RA's in the whole research process, including budget management.
- Consult as much as possible, don't supervise unless absolutely necessary.
- Take the graduate students' ideas seriously.
- Meet monthly with them in groups for brief progress reports.
- *Stay on top of the budget*.
- Be open to changes in the research plan when they become necessary.
- Get RA's to do first drafts of all papers, presentation abstracts.
- When appropriate, make them first authors.
- Have them present, and don't be too quick to rescue.
- *Facilities/equipment problems* (always!). Explore using equipment in other laboratories.
- *A student leaves the program*. Most contracting agencies will understand if you inform them as soon as possible.
- *Plagiarism and forged (desired) results.* Constantly challenge students to justify their results (set the example—challenge your own results). There are no correct results, only validated results.
- *Students have personal problems*. Be understanding and supportive, but don't play therapist. Be prepared to refer them to appropriate campus resources, such as the Counseling Center.
- *Their work does not meet your expectations*. Criticize what they do but never who they are (they can change what they do).
- *The research isn't working or the environment has changed.* Know when to switch topics.
- **Do all those things that were suggested to build a welcoming research environment!**

## Ethical problems to watch out for

- Asking RAs to do things unrelated to research/education
- Failure to fulfill teaching and mentoring responsibilities to them
- Failure to give them appropriate credit in paper authorship (match recognition to contributions)
- Harassing them
- Violating their confidentiality
- Plagiarizing (intentionally or unintentionally) yourself or failing to catch plagiarism in your students' work
- Misusing position as a paper or proposal reviewer
- Misusing research funds
- Misusing university facilities

## Avoiding ethical problems

- Be clear about expectations of RA's
- Be consistent in dealing with them
- Keep priorities straight
- *Use common sense.*
- Document important communications by memo/e-mail
- Discuss problems with mentor or department head soon after they occur
- Stay informed about what is going on

# D. Mentoring for Effective Teaching

*Instruction begins when you, the teacher, learn from the learner. Put yourself in his place so that you may understand what he learns and the way he understands it.*
(Kierkegaard)

## Crisis Clinic: Teaching (Poor evaluations)

**Scenario**. Your mentee has been expressing frustration about her teaching and complaining that the students just don't seem prepared or interested in class, and their test grades have been very low. You visit the class and find her giving a reasonably good lecture. What might you suggest?

**Tips for teaching mentors**

- Visit mentee's class. Don't rescue.
- Invite mentee to observe your class.
- Arrange for mentee to observe good teachers in and out of your department.
- Debrief observations in regular meetings.
- Provide feedback on tests and assignments. (Watch out for tests that are too long.)
- Share your class materials and talk about what you do.
- Encourage mentee to use variety in class activities. (See "Active Learning: An Introduction," *<http://www.ncsu.edu/felder-public/Columns/ALpaper(ASQ).pdf>*).
- Suggest a visit to the campus teaching center.
- Direct mentee to useful books on teaching (such as some of the references on p. 5).
- Suggest a mid-semester evaluation of the class. (Mentees are likely to wait until the end of the semester, at which point it's too late to get corrective feedback.)
- Suggest videotaping a lecture and reviewing the tape with a consultant.

**Debriefing a classroom visit**

- Ask the mentee how he/she thinks the class went. Listen carefully to the response.
- Often mentees will be supercritical of themselves. Point out the things that *did* work if they don't mention them.
- Ask the mentee "What could you do differently to improve the class?" Help him/her focus on one or two things to work on. When appropriate, tell about similar problems you've had in your teaching.
- End on a positive note with an encouraging comment.

**Teaching resources**

R.M. Felder & R. Brent, *Teaching and Learning STEM: A Practical Guide* (Jossey-Bass, 2016).

*Resources in Engineering and Science Education <www.ncsu.edu/effective_teaching>* is Rich Felder's homepage**.** Click on "Education-Related Articles" to find papers on a whole range of teaching topics, including articles specifically addressed to new faculty members.

# TEACHING TEACHERS TO TEACH: THE CASE FOR MENTORING[*]

**Richard M. Felder**
**Department of Chemical Engineering**
**North Carolina State University**
**Raleigh, NC 27695-7905**

Teaching—like medicine, auto mechanics, professional basketball, and chemical engineering—is a craft. There are distinct skills associated with its practice, which people are not born knowing. Some people are naturals (in education, the so-called "born teachers") and seem to develop the skills by intuition; most are not, however, and need years of training before they can function at a professional level. Doctors, mechanics, basketball players, engineers, and teachers at the K-12 level routinely get such training—but not college professors, most of whom get their Ph.D.'s, join a faculty, and set off to teach their first course without so much as five seconds on how one does that.

Not realizing that there are alternatives, new professors tend to default to the relatively ineffective teaching methods they experienced as students. Although they work hard to make the course material as comprehensible and interesting as they can, many of them consistently see only glazed or closed eyes during their lectures, terrible test grades, and evaluations suggesting that the students liked neither the course nor them. Some of them eventually figure out better ways to do their job; others never do, and spend their careers teaching ineffectively.

The absence of college teacher training is not an unrecognized problem, and at least some institutions are trying to address it. Various schools offer graduate courses on teaching, hold faculty teaching workshops lasting anywhere from one morning to several days, and provide teaching consultants to critique end-of-course evaluations and videotaped lectures. However, while such programs are worthwhile and should be standard on every campus, there are limits to what they can accomplish. You can't turn someone into a skilled professional in a one-semester course, much less a three-day workshop or a two-hour consultation. True skill development only occurs through repeated practice and feedback.

Fortunately, the resources needed for effective training of college teachers are readily available on every campus. Most academic departments have one or more professors acknowledged to be outstanding teachers by both their peers and their students. They have learned how to put together lectures that are both rigorous and stimulating and homework assignments and tests that are comprehensive, challenging, instructive, and fair. They have found ways to motivate students to want to learn, to co-opt them into becoming active participants in the learning process, to help them develop critical and creative thinking and problem-solving abilities.

Unfortunately, under our present system, faculty members may collaborate on research but generally don't even talk to each other about teaching. Most professors must therefore plod through the same lengthy trial-and-error process when learning how to teach, seldom benefiting from the knowledge and experience of their colleagues.

Here is a proposal for what I believe might be a better way.

- *All new professors should team-teach their first two courses with colleagues who have earned recognition as excellent teachers and who agree to function as mentors.*
- *The first course would begin with the mentor taking most of the responsibility for laying out the syllabus and instructional objectives, planning and conducting the class sessions, and constructing*

[*] *Chem. Engr. Education, 27*(3), 176–177 (1993), <*http://www.ncsu.edu/felder-public/Columns/Mentoring.html*>.

*the homework assignments and tests. Both professors would attend most classes and have regular debriefing sessions to go over what went well, what didn't go so well and why, and what to do next. The protégé would gradually take over more of the course direction, ending up with primary responsibility by the end of the course*

- *In the second course, the protégé would take sole responsibility for planning and delivering the course. The mentor (who may be the mentor from the previous semester or a different professor) would function entirely as a consultant, observing class sessions and participating in debriefing meetings.*
- *When planning teaching assignments, the department head should recognize that team-teaching a course and serving as a mentor to a new instructor is a heavier time burden than simply teaching a course alone, and should provide a suitable reduction in the mentor's other responsibilities. Ideally, the mentor would get additional compensation like a summer stipend, release time, or a travel grant.*

The potential benefits of this plan are evident. New professors would get a jump-start on learning their craft rather than having to rely entirely on painfully slow self-teaching. The experience would likely energize the mentors as well, stimulating them to reexamine and improve their own teaching as they provide active guidance to their junior colleagues. The overall quality of the department's instructional program would inevitably improve. Caution, however—mentoring is also a craft, with its own assortment of skills and pitfalls. As it happens, teacher educators have explored this subject for decades and have developed a variety of methods to make mentoring successful.[16] If you find yourself serving as a mentor, formally or informally, consider the following guidelines:

- *When you teach, you often do subtle things that you learned by experience and you also occasionally make errors in judgment when handling classroom situations. The inexperienced observing protégé is likely to miss it all. Go over items in both categories during debriefings*
- *When protégés get into trouble in class, fight off the temptation to rescue them immediately. Instead, prompt them in debriefings to figure out for themselves what went wrong and how to fix it.*
- *Offer suggestions, not prescriptions. What you lay out for protégés explicitly is unlikely to stick. What they discover for themselves with your help, they will own.*
- *Don't try to turn your protégés into clones of you. Instead, help them find the teaching style best suited to their own strengths and personalities and encourage them to develop and perfect that style.*

Only one step remains to complete the process. When a department colleague—perhaps one of your protégés—starts to win teaching awards, talk her into serving as a mentor for the next faculty hire. When she protests that she doesn't know how, pass along this column and add that while she's figuring it out you'll be happy to be her mentor.

[16]I am indebted to Dr. Rebecca Brent, my mentor on all matters related to teacher education, for many of the ideas that follow. See also T.M. Bey and C.T. Holmes, *Mentoring: Contemporary Principles and Issues*, Reston, VA, Association of Teacher Educators, 1992.

# HOW TO PREPARE NEW COURSES WHILE KEEPING YOUR SANITY*

**Richard M. Felder**
**North Carolina State University**

**Rebecca Brent**
**Education Designs, Inc.**

Think of a two-word phrase for a huge time sink that can effectively keep faculty members from doing the things they want to do.

You can probably come up with several phrases that fit. "Proposal deadline" is an obvious one, as are "curriculum revision," "safety inspection," "accreditation visit," and "No Parking." (The last one is on the sign posted by the one open space you find on campus minutes before you're supposed to teach a class, with the small print that says "Reserved for the Deputy Associate Vice Provost for Dry Erase Marker Procurement.")

But the phrase we have in mind is "new prep"—preparing for and teaching a course you've never taught before. This column describes the usual approach, which makes this challenging task almost completely unmanageable, and then proposes a better alternative.

## Three steps to disaster, or, how not to approach a new course preparation

1. *Go it alone.* Colleagues may have taught the course in the past and done it very well, but it would be embarrassing to ask them if you can use their materials (syllabi, learning objectives, lecture notes, demonstrations, assignments, tests, etc.), so instead create everything yourself from scratch.

2. *Try to cover everything known about the subject in your lectures and always be prepared to answer any question any student might ever ask.* Assemble all the books and research articles you can find and make your lecture notes a self-contained encyclopedia on the subject.

3. *Don't bother making up learning objectives or a detailed syllabus—just work things out as you go.* It's all you can do to stay ahead of the class in your lectures, so just throw together a syllabus that contains only the course name and textbook, your name and office hours, and the catalog description of the course; invent course policies and procedures on a day-by-day basis; and decide what your learning objectives are when you make up the exams.

Here's what's likely to happen if you adopt this plan. You'll spend an outlandish amount of time on the course—ten hours or more of preparation for every lecture hour. You'll start neglecting your research and your personal life just to keep up with the course preparation, and if you're unfortunate enough to have two new preps at once, you may no longer have a personal life to neglect. Your lecture notes will be so long and dense that to cover them you'll have to lecture at a pace no normal human being could possibly follow; you'll have no time for interactivity in class; and you'll end up skimming some important material or skipping it altogether. Your policies regarding late homework, absences, missed tests, grading, and cheating will be fuzzy and inconsistent. Without learning objectives to guide the preparation, the course will be incoherent,

* *Chem. Engr. Education, 41*(2), 121–122 (Spring 2007).

with lectures covering one body of material, assignments another, and tests yet another. The students' frustration and complaints will mount, and the final course evaluations will look like nothing you'd want to post on your blog.

There's a better way.

**A rational approach to new course preparation.**

1. *Start preparing as soon as you know you'll be teaching a particular course*.

Dedicate a paper file folder and a folder on your computer to the course and begin to assemble ideas and instructional materials. While you're teaching the course, continue to file ideas and resources as you come up with them.

2. *Don't reinvent the wheel.*

Identify a colleague who is a good teacher and has taught the course you're preparing to teach, and ask if he/she would be willing to share course materials with you. (Most faculty members would be fine with that request.) In addition, try finding the course on the MIT OpenCourseWare Web site (*<http://ocw.mit.edu>)* and download materials from there. Open courseware may contain visuals, simulations, class activities, and assignments that can add considerably to the quality of a course and would take you months or years to construct from scratch. The first time you teach the course, borrow liberally from the shared materials and note after each class what you want to change in future offerings. Also consider asking TA's to come up with good instructional materials and/or inviting students to do it for extra credit.

3. *Write detailed learning objectives, give them to the students as study guides, and let the objectives guide the construction of lesson plans, assignments, and tests.*

*Learning objectives* are statements of observable tasks that students should be able to accomplish if they have learned what the instructor wanted them to learn. Felder and Brent recommend giving objectives to students as study guides for tests[17,18] and show an illustrative study guide for a midterm exam.[19]

Before you start to prepare a section of a course that will be covered on a test, draft a study guide and use it to design lessons (lectures and in-class activities[20]) and assignments that provide instruction and practice in the tasks specified in the objectives. As you get new ideas for things you want to teach, add them to the study guide. One to two weeks before the test, finalize the guide and give it to the students, and then draw on it to design the test. The course will then be coherent, with mutually compatible lessons, assignments, and assessments. Instead of having to guess what you

[17]R.M. Felder and R. Brent, "Objectively speaking," *Chem. Engr. Education, 31*(3), 178–179 (1997), *<http://www.ncsu.edu/felder-public/Columns/Objectives.html>*.
[18]R.M. Felder and R. Brent, "How to teach (almost) anyone (almost) anything," *Chem. Engr. Education, 40*(3), 173–174 (2006), *<http://www.ncsu.edu/felder-public/Columns/TeachAnything.pdf>*.
[19]R.M. Felder, Study guide for a midterm exam in the stoichiometry course, *<http://www.ncsu.edu/felder-public/cbe205site/studyguides/studyguide2.htm>*.
[20]R.M. Felder and R. Brent, "Learning by doing," *Chem. Engr. Education, 37*(4), 282–283 (2003), *<http://www.ncsu.edu/felder-public/Columns/Active.pdf>*.

think is important, the students will clearly understand your expectations, and those with the ability to complete the tasks specified in the objectives will be much more likely to do so on the test. In other words, more of your students will have learned what you wanted them to learn. The objectives will also help you avoid trying to cram everything known about the subject into your lecture notes. If you can't think of anything students might do with content besides memorize and repeat it, consider either dropping that content or cutting down on it in lectures, giving yourself more time to spend on higher-level material.

4. *Get feedback during the course.*

It's always a good idea to monitor how things are going in a class so you can make mid-course corrections, particularly when the course is new. Every so often collect "minute papers," in which the students anonymously hand in brief statements of what they consider to be the main points and muddiest points of the class they just sat through. In addition, have them complete a survey four or five weeks into the semester in which they list the things you're doing that are helping their learning and the things that are hindering it. Look for patterns in the responses to these assessments and make adjustments you consider appropriate, or make a note to do so next time you teach the course.

5. *Do everything you can to minimize new preps early in your career, and especially try to avoid having to deal with several of them at a time.*

Some department heads inconsiderately burden their newest faculty members with one new prep after another. If you find yourself in this position, politely ask your head to consider letting you teach the same course several times before you move on to a new one so that you have adequate time to work on your research. Most department heads want their new faculty to start turning out proposals and papers in their first few years and will be sympathetic to such requests. It might not work, but as Rich's grandmother said when told that chicken soup doesn't cure cancer, it couldn't hurt.

# E. Mentoring for Effective Time Management and Work/Life Integration

*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.)

*Probably the most wasteful time you can spend is when you try to do something well which you shouldn't be doing at all.*

(Source unknown)

## Faculty Guide to Time Management[21]

**or**

**How to simultaneously write proposals, do research, write papers, teach classes, advise students, grade papers, serve on committees, eat, sleep, and occasionally visit your family.**

- Set 2–3 year goals along with reasonable steps necessary to reach them. For example
  1. Stay in good health
     — Exercise at least 3 times a week
     — Get sufficient sleep
     — ...
  2. Get promoted to associate professor
     — Write __ papers in refereed journals
     — Write __ proposals.
     — ...
  3. Learn to wind-surf
  4. Remain married
- Prioritize goals. Find an order that satisfies you now—you can always change it. *Suggestion*: Make staying in good health top priority—it will make the others possible.
- Have a regular weekly meeting with yourself to look over your accomplishments in the preceding week and to schedule the coming week. Assign blocks of time for the most important work that needs to be done (including working on important writing projects).
- Consider developing routine commitments to your life outside work. Examples:
  - Have a regular "date night" with your significant other.
  - Be home for dinner with your family each evening.
  - Take one afternoon each weekend for an enjoyable activity or hobby.
- Develop a Gantt chart to track your progress in meeting your professional productivity goals.
- Create and frequently update a to-do list. Use a 4-quadrant system[22]:
- Create and frequently update a to-do list. Use a 4-quadrant system[23]:
  1. Urgent and important. (Deadline-driven activities that further your goals.)
  2. Important but not urgent. (Long-term professional, family, and personal activities that further your goals.)
  3. Urgent but not important. (Much e-mail, many phone calls and memos, things that are important to someone else but don't further your goals.)
  4. Neither urgent nor important. (TV, computer games, junk mail.)

  Commit to several hours a week on Quadrant 2 items, and cut down on time spent in 3 and 4.
- Work on Quadrant 1 and 2 items when you're at peak efficiency.
- If you're trying to complete a big project (book, article, research proposal), put it on the Quadrant 2 list, otherwise it will never get done.

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[21] Adapted from P.C. Wankat & F. S. Oreovicz, *Teaching Engineering,* New York: McGraw-Hill, 1993. Chapter 2 contains excellent ideas on efficiency, some of which are included in this list.
[22] S.P. Covey, A.R. Merrill, and R.R. Merrill, *First Things Firs*t, New York: Simon & Schuster, 1994.
[23] S.P. Covey, A.R. Merrill, and R.R. Merrill, *First Things Firs*t, New York: Simon & Schuster, 1994.

### Office hours and mail

- Set office hours and let students know you will be faithful in keeping them. When students come to see you outside of office hours and you're busy, ask them if they can come back during office hours or make an appointment.
- Be mindful of time spent reading and responding to email. Limit response to email to one or two time periods each day. If you encourage email from students, have a special address set up for each class. Read and respond to student email no more than once or twice a day and let students know when you are likely to respond.
- Learn how to get people out of your office when you don't have the time to spend. ("Good talking to you, but I've got something I need to attend to now.")
- Meet in the other person's office, not yours. (Easier to get away.)
- Handle each mail item once, if possible. Open, respond, file, or discard.

### Working smarter

- Schedule blocks of uninterrupted time to complete larger tasks. If necessary, work at home, in the library, or at an out-of-the-way desk in the department.
- Avoid perfectionism—don't keep revising until the deadline, and don't revise unimportant letters and memos at all. Be aware of the point of diminishing returns.
- Be careful of computer graphics—they're a time sink.
- Piggyback work—use the same notes or manuscripts for multiple applications.
- Keep research projects in the pipeline. Well before a project ends, start writing the next proposal.
- Reward yourself—take breaks.

### Learn how and when to say no!

- Always give yourself a chance to think about a commitment overnight before agreeing to it. The time will give you a chance to see if it fits in with your goals and priorities.
- Keep an updated list of all your responsibilities (including research, teaching, service and life outside of work). Refer to it when the next request comes in.
- Check out service requests with your mentor or department head. Consider showing the latter your list if he or she is the one making the request.
- Practice declining requests:
  1. *"That sounds interesting, but can I call you back tomorrow? I need a little time to think about it before I can decide."*
  2. *"I'm sorry, but I've just got too many other commitments right now."*
  3. *"I'd love to help, but I really don't have time for a formal commitment. Maybe we could just talk once or twice."*
  4. *"I'm afraid I'm not the best person to help you with this. Have you thought about asking _____?"* (Penny Gold)

# Appendix

# What can the department head/chair do to help new faculty?

## Department Head Support of New Faculty[24]

***Year 1***

1. Give new faculty members copies of Boice's *Advice for New Faculty Members* and McKeachie's *Teaching Tips.*
2. Provide a list of university and community resources and services available (nearby daycare, exercise facilities, travel agent, health clinics). The University or local Chamber of Commerce may be able to provide these.
3. Provide research start-up funds, secretarial support, graduate research or teaching assistants, a computer, and technical support for putting course material online.
4. Pay professional society dues and provide travel funds for professional society meetings.
5. Preview required career documentation and provide samples (i.e., faculty activity report, reappointment papers, teaching portfolios)
6. Impose light teaching and service loads. Suggest appropriate service activities that will not take up a lot of time.
7. Tell them about Boice's findings regarding quick starters.
8. Introduce them to campus leaders and faculty with related research interests in other departments.
9. Make them aware of campus resources that identify relevant funding sources and provide other forms of support for research program development.
10. Initiate collaborations with experienced colleagues who can function as research mentors.
11. Set them up to succeed on their first proposal by making initial contacts and assuring a good match.
12. Arrange formal (*preferable*) or casual teaching mentorships. Encourage new faculty members who may not be inclined to undertake a mentorship to give it a try, reminding them of Boice's findings regarding quick starters.
13. Several times in each semester, schedule informal sessions over lunch or coffee to discuss how things are going. Provide informal feedback on their performance in teaching, research, and service.
14. Facilitate the preparation of an annual professional development plan to encourage attention to long-term and short-term goals. (A sample professional development plan is on p. 55.)
15. Urge new faculty to make realistic time allotments and to eliminate unnecessary commitments. Often they need help in learning to say no (and whom not to say it to).
16. Encourage them to come to you at any time about any problem that arises related to their research, teaching, service, or interactions with colleagues and students.

[24] Adapted from Daniel W. Wheeler, "The Role of the Chairperson in Support of Junior Faculty" in *Developing New and Junior Faculty* by M. D. Sorcenelli and A. E. Austin (Eds.), *New Directions for Teaching and Learning*, No. 50, Summer 1992. San Francisco: Jossey-Bass.

***Years 2-5***

17. Once a semester schedule a session to discuss concerns, provide performance feedback, and encourage growth and development. Think about asking, "What do you want to do?" and "How can I help you do it?"
18. Give a lighter load one semester in the second or third year to encourage research program development after they have gotten some projects under way.
19. Nominate them (in moderation) for professional society positions and funding agency review panels. If necessary, continue to fund travel to meetings.
20. Encourage them to participate in faculty development activities, on and off campus, to strengthen their skills and expertise in selected areas.
21. Meet at the beginning of each year to formulate an annual plan and again at the end of the year to evaluate progress on the plan. (More detail is given on pp. 55 and 56.)

***To support all faculty within the department:***

22. Meet early in the academic year with each faculty member to discuss professional goals.
23. Meet with faculty on their turf, particularly when discussing difficult issues or problems.
24. Have regular departmental seminars where faculty share their research *and* teaching innovations and problems.
25. Recognize faculty teaching and research achievements on the departmental bulletin board, in a newsletter, and publicly at faculty and advisory board meetings.
26. Have someone in the department take responsibility for identifying campus, regional, and national awards for research, teaching, and advising and making sure eligible faculty members are nominated for them.
27. Have faculty who have attended conferences/workshops share what they learned with their faculty colleagues in seminars or by distributing information. Do this for education conferences as well as research conferences.
28. Maintain a departmental reading room of publications related to teaching as well as research.
29. Institute a voluntary program of visitation in one another's classes and provide extra travel or supply funds to the faculty involved.
30. Hire a copy editor to help faculty members get their proposal and article manuscripts in the best possible shape before submitting them. (If this idea leads to just one or two new grants, which it almost invariably will, it more than pays for itself.)
31. *Have departmental faculty complete the* Academic Culture Climate Assessment.[25] *Take steps to change factors that work against collegiality.*

***For more ideas on developing new faculty into teachers and scholars, see the Bensimon, Ward, and Sanders book and the Bland* et al. *books in the reference list on p. 5.***

[25] Felder, R.M. (2009). Does your department culture suit you? *Chem. Engr. Education, 43*(2), 113–114. <*www.ncsu.edu/felder-public/Columns/DepartmentCulture.pdf*>.

## Sample Annual Plan for Faculty in Year 1[26]

### Research Goals

- Establish a research agenda with a focused line of inquiry.
  1. Attend faculty development workshops on writing and research.
  2. Meet with department chair to discuss short- and long-term research publication goals and solicit suggestions on how to best meet these goals.
- Make connections to fellow faculty with similar interests to develop the potential for collaboration.
- Submit one conference proposal.
  1. Brainstorm proposal.
  2. Submit proposal.
- Submit one article for publication.
  1. Draw on dissertation to prepare article.
  2. Send drafts of article to three colleagues for feedback.
  3. Incorporate comments from colleagues and submit article for publication.
- Submit at least two grant proposals (one internal and one external).
  1. Collect information about grant opportunities.
  2. Write internal grant proposal, get feedback from three colleagues, revise, and submit.
  3. Write external grant proposal, get feedback from three colleagues, revise, and submit.

### Teaching Goals

- Get feedback on teaching.
  1. Have at least one person come to class to do an informal evaluation of spring and fall courses.
  2. Conduct midterm student evaluation of fall courses and incorporate information into courses for fall and spring.
- Prepare for spring courses.
  1. Prepare syllabi for spring.
  2. Submit spring book requests.
- Say no to summer teaching for the first year.

### Service Goals

- Collect information about departmental, college, and university priorities.
- Say no to non-departmental committee work for the first year.
- Meet with department chair to strategize service commitments.

[26] Adapted from Bensimon, Ward, & Sanders. Reference on p. 5, pp. 117-118.

## Providing Yearly Feedback to New Faculty

It is essential to tell new faculty members at least once a year how they are doing in their progression toward contract renewal, tenure, and promotion. It is also unethical not to do so. *Renewal, tenure, and promotion decisions should never come as a surprise.*

Who should provide the feedback?

- **Department head/chair.** Face-to-face annual review of new faculty activity report and future plans. Mandatory if head recommends T&P decision to Dean.
- **Feedback committee.** Several senior faculty who will be involved in the T&P decisions. Committee review is useful when the senior faculty and the head make separate recommendations. The committee also may offer a greater variety of good suggestions.
- **Mentor.** Faculty member who has been working with the new faculty member on teaching and/or research and/or integration into the campus culture.

### Sample Schedule of Department Chair, Senior Faculty Committee, or Mentor Meetings with Untenured Faculty

- Within the first two weeks, meet with new faculty member to go over orientation information and answer questions. Have the faculty member leave with the assignment of developing a list of goals for the year for research, teaching, and service.
- Several weeks later, meet to go over the goals and finalize the first year's annual plan. Find out if the new faculty member has questions about the tenure and promotion process or any other topic. Talk about how well the faculty member is maintaining a balance among research, teaching, and other responsibilities.
- During the second semester, touch base to see how things are progressing with research and teaching.
- At the end of the first year, conduct the first annual review and develop teaching and research goals for the summer and Year 2.
- At the outset of Year 2, meet to assess the summer's progress and to go over plans for the coming year.