

# EFFECTIVE TEACHING WORKSHOPS FOR ENGINEERING AND SCIENCE FACULTIES<sup>1</sup>

**Rebecca Brent, Ed.D.**

**Codirector, SUCCEED Engineering Education Coalition Faculty Development Program  
Adjunct Professor of Education, East Carolina University**

**Richard M. Felder, Ph.D.**

**Codirector, SUCCEED Engineering Education Coalition Faculty Development Program  
Hoechst Celanese Professor of Chemical Engineering, North Carolina State University**

Engineering and science professors tend to resist traditional faculty development efforts. Most are reluctant to attend teaching workshops, and many of those who do attend are prone to argue with much of the workshop content and to discount facilitators from fields outside of their own. The experience is not particularly enjoyable to either the facilitators or the participants.

In the past ten years, we have presented teaching effectiveness workshops oriented to engineering and science faculties on campuses throughout the United States and abroad. We (along with James Stice of the University of Texas at Austin) also codirect the National Effective Teaching Institute, an invitational workshop for engineering and engineering technology professors given each year in conjunction with the Annual Meeting of the American Society for Engineering Education. Workshop attendance varies from one campus to another, but we have had as many as 150 faculty members from a single campus in attendance. Although many of the participants in our offerings come with a high level of skepticism about teaching workshops, their final evaluations are consistently positive. We have also learned from post-workshop surveys that many participants adopted methods they learned about in the workshop and are still using them, sometimes years later.

In this paper we offer nine suggestions for presenting well-attended and well-received teaching workshops to engineering and science professors. These suggestions supplement the usual rules for effective presentations (keep it active, make extensive use of visual presentation, provide handouts with copies of overheads and supplementary reprints, end on time, etc.)

Before we begin, a word about terminology. We are speaking in this paper about workshops directed primarily to faculty members in engineering, engineering technology, physical sciences, life sciences, and mathematical sciences. To keep from having to repeat that roster of disciplines again and again, we will use the term “technical faculty” to refer collectively to the intended participants. In using this term, we do not suggest—nor do we believe—that the work done by faculty members in the social sciences and humanities is any less technical, rigorous, or intellectually demanding than that done by their colleagues in the fields listed above.

Here, then, are the nine suggestions.

## **1. Make the workshop content relevant to the participants’ courses, students, and problems.**

- Include discipline-specific examples of the teaching strategies and devices you recommend (e.g. active and/or cooperative learning methods, instructional objectives, and rules for

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constructing challenging but fair homework assignments and tests). Presenters who do not have technical backgrounds themselves and have trouble finding suitable examples might seek help from colleagues in technical fields.

- We have learned to beware of “games” (e.g. name-learning icebreakers, brain teasers intended to stimulate creative thinking) that are not explicitly linked to technical courses. Many instructors in technical fields have a strong aversion to doing that sort of thing in their classes, and having to do it in a workshop confirms their fear that they are wasting their valuable time on fluff. Instead, we imbed activities in exercises that are clearly related to the things the participants came to hear about. Rather than beginning our workshops with general introductions, for example, we have participants introduce themselves in small groups as the first step in a brainstorm of reasons for high attrition rates among first-year engineering students or for abysmal student evaluations

## **2. Emphasize the relevance in promotional materials.**

Faculty developers often complain that they can't get technical faculty to participate in their programs. If the presentation has indeed been tailored to the needs of this population, the fact should be made explicit in promotional materials, and presenters' credentials in technical fields should be brought out as well. Technical faculty members are most likely to come to a workshop with an open mind if they believe that the presenters are aware of their problems and plan to address them.

## **3. Include both technical and pedagogical expertise on the workshop facilitation team.**

Rebecca's professional background is in education and Rich's is in chemical engineering. This combination of backgrounds makes the workshop far more effective than it would be if either one presented alone. Many technical faculty members who come to our workshops do so because they know Rich is one of them, and he goes out of his way to reinforce that notion early in the workshop, injecting terms like “partial differential equations” and “entropy” whenever he can shoehorn them into the discussion. When the participants hear those magic words, many of become more willing to listen to what both Rich and Rebecca (who taught Rich much of what he knows about teaching) have to say. Moreover, when participants ask for examples or applications in their fields or raise questions heavy in technical content (which some of them do just to test the workshop facilitators), Rich is in a better position to respond—although this advantage decreases with each successive workshop we do.

## **4. Emphasize practical content & ideas that can be easily implemented.**

Most technical faculty members who go to teaching workshops are not in search of philosophical discussions about the nature of learning and the role of the teacher; they want to know what they can do next Monday to make their classes work better. Some discussion of material from educational and cognitive psychology is acceptable and even desirable, but it should be brought in to support the concrete ideas that constitute the bulk of the workshop rather than being an end in itself.

## 5. Be authoritative...

Most professors in technical fields are “thinkers” on the MBTI thinking/feeling scale. They tend to make decisions based on facts, logic, hard evidence, and research, and many are skeptical of anything that might be considered “soft science” or “touchy-feely stuff.”

Instructional methods that are known to be effective—establishing a need to know new material, linking new material to previously known material, using active and cooperative learning, addressing a broad spectrum of student learning styles—have solid theoretical foundations and are supported by extensive empirical research. Most faculty members in technical fields will not consider changing how they teach unless they know that there is strong evidence in support of the changes. Workshop handouts should include summaries of relevant research results and references for those who wish to check the research for themselves. There is no need for a long lecture summarizing all the research, however; it suffices to put a brief summary in the handout, mention it in the presentation, and hold some ammunition in reserve to meet challenges rather than firing all of it at once.

In addition to presenting external support for ideas, presenters must come across as authorities themselves to convince technical participants to give recommendations serious consideration. Many faculty developers come from academic cultures that encourage being open, accepting, and non-judgmental, offering possibilities rather than prescriptions. Unfortunately, when faculty developers come across in this manner to technical faculty, they risk losing credibility.

In the first workshops we gave together, several participants expressed annoyance at Rebecca’s warm and invitational presentation style (which is exactly the approach one wants for teacher education), with one complaining that she “smiles too much.” With her agreement, Rich arranged a signal to her to “toughen up” in her presentations—not to change her personality, but to project a greater sense of being the authority that in fact she is. It worked. It has been several years since anyone complained about the “softness” of her presentation style and her evaluations are consistently good.

## 6. ...but don’t be dogmatic.

Being authoritative and being dogmatic are two different things. While we show confidence in the methods we are presenting and are prepared to back up those ideas with research data, we are careful not to suggest that our recommended methods represent the only acceptable way to teach. Most professors resent being told that most of what they have been doing in their classes is wrong and that they must either do it differently or accept being bad teachers.

Several times in our workshops, we encourage the participants to take a gradual approach to our recommendations.

- (i) Try one or two new techniques at a time rather than trying to do everything at once.
- (ii) Stay with the techniques long enough for both instructor and students to get used to them.
- (iii) If the techniques seem to be working, keep using them, otherwise rethink them.
- (iv) Next semester, pick up one or two more new techniques and give them a try.

We emphasize that there is no teaching method or style that is optimal for all teachers and all students and that the participants must seek the methods that work best for them and their students.

In most of our post-workshop evaluations, several participants express appreciation for the freedom we seem to be granting them to choose their own path and set their own pace.

### **7. Call on the participants' expertise.**

Faculty developers all learn quickly that in most of their presentations to technical faculty they are preaching largely to the choir—to instructors who are already committed to effective teaching, who are more often than not good teachers already, and who always look for ways to become even better. Among those individuals are people who already know about many of the techniques being presented in the workshop and who have figured out how to adapt them to their own disciplines. An important task of the facilitator is to elicit these ideas for sharing with the rest of the participants.

### **8. Be ready for tough questions and difficult participants.**

This advice applies to workshops for any audience but is particularly apt for teaching workshops presented to technical faculty, especially if the facilitators come from non-technical disciplines. Standard references on workshop presentation and public speaking describe helpful strategies for dealing with difficult participants, such as restating their concerns and moving on or making personal contact with them during breaks. We would also repeat our suggestion to be ready with research backup for recommendations. Finally, recalling Suggestion 7, presenters should not hesitate to call on the technical expertise of co-facilitators or other participants if questions carry them into unfamiliar technical fields.

### **9. Practice what you preach!**

Participants are acutely conscious of whether or not we walk our talk. When we recommend that the participants write instructional objectives for their courses, we present a set of objectives for the workshop. When we describe the importance of presenting information visually rather than relying entirely on words, we make sure our workshop visuals look professional. Before we discuss cooperative learning, we include group exercises of different types in the workshop.

We offer no guarantees of success if these suggestions are adopted. Workshops are like college courses: you can do the same thing in two successive offerings and it will work like a charm one time and fall flat the next. Workshop participants are also like college students: no matter what you do, someone won't like it. We only say that based on our experience, the nine suggestions we have offered should significantly increase the chances of presenting a teaching workshop to technical faculty that is useful to the participants, satisfying to the presenters, and enjoyable to everyone.