The Interface (IEEE Education Society), August 2001, pp. 2–3.

TECHNOLOGY-BASED INSTRUCTION AND COOPERATIVE LEARNING

Richard M. Felder
North Carolina State University
felder@eos.ncsu.edu

H.L. Mencken once observed, "There is always an easy solution to every human problem—neat, plausible, and wrong." The field of education seems to be particularly vulnerable to this phenomenon. Going back to biblical times, people have bemoaned the terrible quality of the current generation of students, most of whom they find to be lazy, ignorant, and totally lacking in the critical thinking skills, moral fiber, and intrinsic motivation to learn that previous generations—especially *their* generation—had in abundance. The complainers have always neat, sometimes plausible, and generally wrong explanations for this terrible state of things. The explanations are based on personal observations or prejudices, rarely on systematic research or analysis.

Mencken's observation is splendidly illustrated by a pair of letters in the April issue of *The Interface*. Charles Nestor complains that our current students are unable to think compared to students from third-world countries, and Art Davis takes us to task for routinely passing students who are both incompetent in mathematics and functionally illiterate. Nestor blames technology—the Web, PowerPoint, distance learning, and even hand calculators. Davis trashes active and cooperative learning ("snake oil"), which he claims unequivocally are just feel-good methods that invariably lead to less coverage of material and inferior learning.

While there are certainly problems with many of today's students (as there were with yesterday's, nostalgia notwithstanding), neither the causes of the problems nor their solutions are straightforward, and it is certain that simply taking away the hardware and going back to straight lecturing is not the answer. It happens that a great deal of research on teaching and learning has been done in recent decades, much of it with careful controls and analysis at least as rigorous as that typically used in engineering research. Studies of the physiology of cognition and countless classroom research studies clearly demonstrate that people acquire skills by doing things and reflecting on the outcomes, not by watching and listening to someone else telling them what they are supposed to know. Students may learn in lecture-based courses, but little or none of the learning beyond simple factual recall happens in the lectures.

I urge readers not to take my word for these statements; instead, subject them to the kind of critical analysis that characterizes good research in any field. Browse the recent literature (including the April 2000 issue of the *Journal of Engineering Education*) and examine the meta-analyses of hundreds of studies showing that students who learn through interactive web-based technologies tend to do *better* than students taught the same courses with chalk-and-talk. Spend an hour on the Web (e.g., *http://www2.ncsu.edu/unity/lockers/users/f/felder/public/Cooperative_Learning.html* or *http://www.wcer.wisc.edu/nise/CL1/* or *http://www.wcer.wisc.edu/nise/CL1/CL/resource/R2.htm*) and evaluate the evidence from thousands of studies showing that significant increases in

learning, skill development, and confidence result from properly implemented active and cooperative methods. Consider the work of Uri Treisman, who took a group of entering students at UC-Berkeley who were slated to go into a remedial math program and instead put them through one year of a cooperative learning-based program, after which their four-year graduation rate was higher than the overall average for the Berkeley campus. (The average rate for a control group was on the order of nine percent.) Note also that you don't have to sacrifice syllabus coverage to use active methods—in fact, if you take certain other steps you can do all the active learning you want to in class and actually increase coverage (see *http://www2.ncsu.edu/unity/lockers/users/f/felder/public/Columns/FAQs-2.html*).

Certainly technology and groupwork can be misused, and they often are when instructors plunge into them with no preparation. If instead of taking advantage of the interactive capability of technology you use it to make students even more passive than they are in the normal classroom—delivering lectures entirely by hypertext or streaming video, for example, or converting class sessions into complete PowerPoint slide shows—little learning will result. If your only in-class exercises are unstructured group discussions of the previous night's homework, you are probably wasting your students' time and yours. If you ask students to complete an assignment in groups and do nothing to hold them individually accountable for all the work and to help them learn how to function effectively in teams (two defining conditions of cooperative learning), you may well be doing more harm than good.

On the other hand, if you spend some time in workshops or on the Web finding out how to (and how not to) implement technology-based instruction or cooperative learning and *then* try it, you will start to see the outcomes you are looking for. Doing it right is not necessarily easy—like every other meaningful activity, it involves a learning curve. It is not rocket science, however, and the potential benefits to both students and instructor are definitely worth the effort.