

Random Thoughts . . .

SCREENS DOWN, EVERYONE! EFFECTIVE USES OF PORTABLE COMPUTERS IN LECTURE CLASSES

RICHARD M. FELDER AND REBECCA BRENT

North Carolina State University

Portable computers are getting more powerful and cheaper all the time. Most college students now own one, and many engineering and science curricula require all their students to have them. Once colleges do that, though, they are also obliged to give the students enough to do with the computers to justify that requirement. True, homework involving computers is routinely assigned in technical curricula, but the computer labs at most colleges are more than adequate to serve the students who don't have their own computers. Few institutions have enough computer-equipped classrooms to host all their classes, however, and so it makes sense to have the students use their own computers in class. The question is, to do what?

Taking notes in class is not the answer. Lecture notes in engineering, science, and math courses normally involve equations and diagrams, which students cannot enter on a computer nearly as fast as instructors can write them on a board or project them on a screen. Unless the students are given better options, they are more likely to use their computers during lectures to work on homework, play games, surf the Web, and e-chat with their friends. It's hard enough for instructors to hold students' attention in a lecture class under normal circumstances; adding computers with all of the tempting diversions they offer can make it hopeless.

The remedy for attention drift in class—with or without computers—is to use *active learning*,^[1] periodically giving the students things to do (answer questions, solve problems, brainstorm lists, . . .) related to the course content. Extensive research has established that students learn much more through practice and feedback than by watching and listening to someone telling them what they are supposed to know.^[2]

Computers can be effectively incorporated into classroom activities in many ways for a variety of purposes. Several examples follow.

Working through interactive tutorials

Computer-based tutorials can be highly instructive, especially if they are interactive, prompting users for responses to questions and correcting mistakes. Tutorials are increasingly common on CDs bundled with course texts, and they may also be obtained from software companies and multimedia libraries such as MERLOT or SMETE.^[3] A problem is that students worry about how much time they will take and so tend to ignore them. An effective way to deal with their concern is to have them work through the first of a set of tutorials. If it is well designed, they will then be much more likely to work through the others voluntarily. (A recent research study illustrates this phenomenon.^[4])

Richard M. Felder is Hoechst Celanese Professor Emeritus of chemical engineering at North Carolina State University. He received his B.ChE, from City College of CUNY and his Ph.D. from Princeton. He is coauthor of the text *Elementary Principles of Chemical Processes* (Wiley, 2000) and codirector of the ASEE National Effective Teaching Institute.



Rebecca Brent is an education consultant specializing in faculty development for effective university teaching, classroom and computer-based simulations in teacher education, and K-12 staff development in language arts and classroom management. She codirects the ASEE National Effective Teaching Institute and has published articles on a variety of topics including writing in undergraduate courses, cooperative learning, public school reform, and effective university teaching.

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Getting started with new software and building skill in its use

Many students—even those comfortable with e-mail and computer games—feel intimidated when unfamiliar software is introduced in a course. To help them over this psychological barrier, have them run the software in class, working through the same kinds of tasks they will be called on to carry out in assignments. When they get confused or make common beginners' mistakes, they will get immediate assistance instead of having to struggle for hours by themselves and will then be prepared to run the software on their own. Several in-class activities may subsequently be used to help them gain expertise in the software, such as:

- *What will happen?* Give one or more statements or commands and ask students to predict what the program will do in response. Then have them enter and execute the commands and verify their predictions or explain why they were wrong.
- *What's wrong?* Give statements or program fragments with errors and ask the students to identify and correct the mistakes.
- *How might you do this?* State desired outcomes and ask the students to write and test programs to achieve them.

Carry out Web-based research

Answers to many research questions can be obtained in a few keystrokes using powerful search engines such as Google. To help your students develop computer research skills, you might ask them to do several things in class and then in homework assignments:

- Gather information about a specified device, product, or process.
- Locate a visual image to illustrate a concept or include in a report.
- Verify or refute an assertion in the popular press related to science or technology.
- Assemble supporting arguments for different sides of a controversial current issue.

Explore system behavior with simulations

Computer simulations allow students to explore system behavior at conditions that might not be feasible for hands-on study, including hazardous conditions. Having students build their own simulations of complex systems in class may be impractical, but prewritten simulations (which might include random measurement errors and possibly systematic errors) can be used for a number of worthwhile activities:

- *Study simulated experimental systems in lecture classes.*

Ask students to (a) apply what they have learned in class to predict responses of a simulated system to changes in input variables and system parameters, (b) explore those changes, interpret the results, and hypothesize reasons for deviations from their predictions, and possibly, (c) explore or optimize system performance over a broad range of conditions.

- *Prepare for and follow up real laboratory experiments.* Have students in a laboratory course design an experiment and test their design using a simulation before actually running the experiment. Following the run, have them formulate possible explanations for discrepancies between predicted and experimental results.

Implementation tips

Several formats for computer-based activities in class should be used on a rotating basis. If all students have computers, they may work individually, or in pairs or trios, or individually first and then in pairs to compare and reconcile solutions. If there are only enough computers for every other student, the students may work in pairs with one giving instructions and the other doing the typing, reversing roles in successive tasks. After stopping an activity in any of these formats, the instructor should first call on several individuals for responses and then invite volunteers to give additional responses. The knowledge that anyone in the class might be called on will motivate most of the students to actually attempt the assigned tasks.^[1]

Finally, an indispensable device for effectively using portable computers in class is the simple command, "Screens down!" when you want the students' attention for any length of time. As long as they can see their screens and you can't, the temptation for them to watch the screens instead of you can be overwhelming. If you take away that option, at least you'll have a fighting chance.

REFERENCES

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