Statement of teaching with technology

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March 31, 2005

Technology has always had a relationship to teaching—from figures drawn in the sand with a stick to complicated flight simulators. Books, blackboards, tape recorders, projectors, and computers are all technologies that are used in teaching—finding the appropriate technology for a given teaching aim is not a new problem.

Computers in teaching have received the most attention over the last 25 years, perhaps because books and blackboards are so familiar that we no longer consider them to be technology, or specific solutions to problems of communication. Several questions I use to help decide whether to use a technology in a given instance are as follows.

- Does the technology enable and empower the student? That is, does it extend a student's abilities or enable the student to solve problems he or she otherwise could not or would not?
- Does the technology encourage students to think?
- Will the technology be useful to the student after the course has ended?
- What are the advantages of the technology as compared to the costs of adoption (e.g. learning curve)?

For example, consider the use of software packages like Mathematica or Maple to help students solve equations in an engineering dynamics class. Such packages can allow for solution of equations that are not tractable analytically. Computers can automate certain tasks very well and can quantitatively handle more elaborate calculations than students can themselves. This could bring a qualitative change in the kinds of problems students are able to address in a class. The questions the instructor asks will determine whether use of the software will encourage critical thinking or simply be an exercise in filling in the blanks. Working with computers can in general teach logical thinking, as the machines do exactly as you instruct them. Teaching with a general software package instead of custom software designed specifically for a given class gives students a tool they will be able to use in the future, at a cost of a greater learning curve.

It is important to always cover the principles of what the computer is doing—for example, explain how the Euler method of approximating the solution to a differential equation works; and explain that the computer solves differential equations in essentially the same way (in many cases, at least), but with more complex algorithms. One does not need to know all the tricks of doing arithmetic quickly in order to grasp the basic concepts and profit from using an abacus.