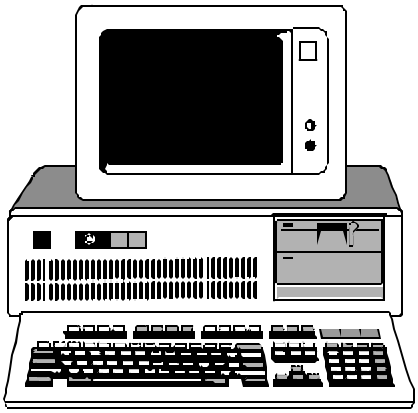
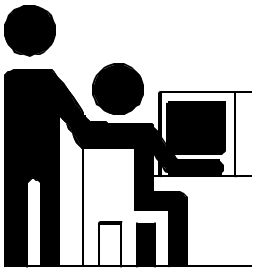
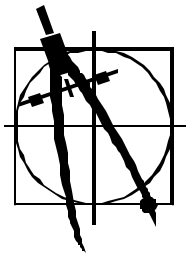


Technology

Authors

Charlie Patton
Lisette dePillis
Frank Wattenberg
Robert Soutas-Little
Heidi Mauk
John Scharf
Patrick Driscoll
Lee Zia
Penelope Dunham
Joseph Myers
Wade Ellis, Jr.





Technology Group

Technology has been both a driving force in curriculum reform and the source of controversy since the late nineteen eighties when graphing calculators were introduced and computer algebra systems (CASs) were ported to desktop computers. The ability of CASs for visualization, numerical solutions and approximations, closed form symbolic solutions, and iterations has shifted curriculums from focusing on mechanics to focusing on setting up problems and interpreting solutions. In short, technology has refocused curriculums on the modeling process and away from the solution process. The resulting reduction of hand calculation skills is the major source of the controversy surrounding the use of technology. The Technology Group looked at the roles of technology in our curriculums, the difficulties involved, and the potential for leading further curricula reform.

L.G. de Pillis identified two related, but distinct issues encompassed by the phrase "technology in the classroom." They are "Technology as an End" and "Technology as a Means." The former is usually minimized or absent from the curriculum even though knowledge of it lessens the "black box" syndrome and helps the student to develop uses of technology as a tool. A fundamental reason for incorporating technology in our teaching is to prepare our students for the technological world into which they will graduate. Robert Soutas-Little notes that the College of Engineering (Michigan State University) is under strong pressure from professional societies to train all students in the use of computational software. Joe Myers points out the emergence of a new learning style among students who have grown up with technology – "Many students will ignore the texts on the shelf in front of them and instead surf to research and find information." What impact will this new learning style have on curriculums? Pat Driscoll and John Scharf also address this issue noting that students arrive in college more comfortable with change than most faculty members, more willing to experiment with technology than most faculty members, and expecting an unrealistically high level of efficiency in the learning process.

Several authors listed benefits and drawbacks to the use of technology. The principle benefits are

- Visualization – graphics provides the first step in problem solving.
- Modeling and Demonstration – simulations of physical experiments can be carried out computationally and systems can be seen to evolve in real time.
- Discovery (experimentation) – elimination of time-consuming hand calculations, the ease of What-ifing, and visualization capabilities invite student inquisitiveness leading to conceptual understanding and discovery.

The principle drawbacks are

- Time investment – "start up time" to become competent and comfortable with a particular software or calculator, time to update to a new version, planning time to effectively incorporate technology into the curriculum, time to update to a new version, planning time to effectively incorporate technology into the curriculum.

- Ease of use – The practical issues of getting the equipment properly set up sometimes interferes or discourages the use of technology in the classroom.
- Decrease of hand calculation skills – this is the major source of the controversy swirling about the use of technology in teaching.

Frank Wattenberg underscores the importance of the interplay between modeling and application. He argues that neither alone is sufficient and illustrates his reasoning with three examples showing the value of the synergism between application and theory. John Scharf agrees and advocates that all students gain experience modeling realistic problems so that they "see the importance of mathematics as they learn it."

The explosion in technology will continue to produce "tools" for learning and doing mathematics. The evolution of flexible, general-purpose tools will enable students to explore ideas beyond the confines of a text and prepare them for the open-ended experimentation and analysis required in the workplace. Penelope Dunham directs our attention to three challenges

1. Keeping up with technology advances;
2. Dealing with the classroom effects of technology;
3. Preparing students to used technology effectively.

Charlie Patton, the main presenter for this group, suggests that as the computer fills the role of the textbook in the future, there are numerous challenges and opportunities on the horizon. They primarily fall into the areas of discovery, communications, and assessment.