Working Group Report on Technology and Statistics Education

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The audience for this report is people who think of themselves as curriculum developers, for example, teachers in classrooms putting together a sequence of activities, writers of instructional materials, or education policy makers. We regard the principles in the list below as a first try–a work in progress—rather than anything approaching a definitive statement.

Principles for Integrating Technology into Statistics Curriculum Development

1. Certain understandings in statistical thinking cannot be realized in a reasonable timeframe without technology. Examples include exploratory data analysis, sampling distributions and regression.
2. Stress automation instead of replication: Don't ask students to repeatedly practice doing things that the computer can do automatically. It may be important to have students make a graph several times by hand in order to understand how the graph works, but they don't need to become facile with making that graph when the computer can automate the task.
3. Teachers will need sustained and considerable support in how to make meaningful use of technology in their statistics teaching.
4. Computers are the medium for how we handle large data sets. Students should be given many opportunities to work with data so that they can develop data-handling skills and internalize a range of concepts.
5. When appropriate, educators must build bridges between reality and simulation. Simulations in statistics have something of a privileged place because they are capable of building bridges both to statistical practice and to probability theory. Simulations, when implemented by computers, can help develop students' understanding of probability and variation. These simulation experiences can be built on later to teach statistical practices such as bootstrapping and Monte Carlo techniques.
6. Teachers need to monitor the use of appropriate statistical techniques. Some, techniques, such as stem and leaf plots, have become outmoded, and should no longer be included in the curriculum. Others, such as bootstrapping, are becoming so useful, so commonplace, and so conceptually appealing that they should be taught at earlier levels than was previously the case.
7. On a cautionary note, technology makes many operations trivial to accomplish and apparently easy to work with when, in fact, there are underlying conceptual problems that can lead to confusion and ongoing difficulties for students. One example of this is the box plot, which is easy for a computer to construct but surprisingly difficult for students, even at the secondary and undergraduate levels, to understand. Statistics education research plays an important role in helping to determine what uses of technology are appropriate for the curriculum.
8. Include technology among the vehicles for disseminating curricula and suggestions for teaching. For example, a new piece of software can carry a pedagogy embedded within it. As another example, consider uses of streaming video as a way of sharing classroom practice.
9. Keep in mind that an important goal of integrating technology into the statistics curriculum is the creation of a learning environment within which students have access to, and use, technology as an extension of themselves; one in which students "own" the technology and are able to choose when and how to use it. Statistics will be one of the areas in which such a learning environment evolves first because computer use is pervasive in the practice of statistics.