

Guest editorial

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Computer aided learning in the twenty-first century

The use of computers in natural science education has been revolutionized during the last decade. We see an evolution from computers as a means of acquiring data from sensors and detectors, to computers for making simulations and finally to computers as the backbone of networked multimedia teaching. The hope for a new pedagogy arising from an integration of computers in education demands the efforts of teachers, psychologists, and pedagogues in a number of areas. Modern computer aided learning encompasses integrated environments where conceptual demonstrations, model and simulation tools, real-time acquisition of data and assessment are being realized at several universities worldwide. Advanced measurements can be brought into the home via remote laboratories, simulations can be created to show a variety of principles in physics and chemistry, and animations can be tailored to fit the problems at hand.

In the wake of the new technology the inevitable questions arise, how do we measure the effectiveness of the new tools, how do we implement them in old curricula, and how do teachers who learned perfectly well through traditional lecturing and long nights programming accept this new branch of education? Is there a new pedagogy here which we have missed?? These questions motivate a continuing discussion among teachers where ideas and solutions are exchanged, and new experiences are related. The projects reported in *CAL-laborate* reflect the efforts of teachers using new technologies and their reports contain more and more links to web-based educational material.

Clearly distance learning, where access to laboratory experiments and equipment are minimal or nonexistent, and where opportunities for direct communication or contact with the teacher is impossible and dialog with fellow students limited, will benefit greatly from these efforts. New techniques which bring the student into the laboratory through virtual or even remote-controlled laboratory measurements are now feasible and even flexible. The intercompatibility of many program packages makes transfer and sharing of computer based material nearly trivial. Student group work is encouraged even in distance learning environments, and student chat groups, blackboards and discussion pages are now a routine part of many distance courses conducted over the Web.

Even though the information technology 'bubble' has burst on the financial front, Information Communication Technology seems healthier than ever in education.

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