From Human-Centered Design to Learner-Centered Design

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When computer use was expensive, relatively speaking, end-users put up with //;; type interfaces. But, as the zorch (MIPS, screen resolution, etc.) of the computer has increased over the past 30 or so years, we can now afford to devote computer resources to making it easier for the user to interact more easily and effectively with the computer. The graphical user interface (GUI) was a revolution: it has allowed developers to create computing environments for everyone. Well, just about everyone.

Learners and learning still has not seen the benefits of computerization. Learners are not just short users; learners have unique needs, needs that differ from users, e.g.,

- **Growth:** Learners develop understanding over time; one day 1 of a semester, say, a 6th grader uses a word processor and on day 180 of the semester the child uses the same word processor – but he/she has changed, has grown, has learned. But the software has remained static.
- **Diversity:** By definition, a professional in a practice defines a homogenous population, e.g., secretaries, physicians, each have a great deal in common and software is built that leverages that homogeneity. Go into a 3rd grade classroom and the diversity of learners and learning is enormous. Unfortunately, our current learning technologies – e.g., textbooks -- encourages teaching all the children in lock step. The promise of computing is the promise of finally addressing the enormous diversity that is the hallmark of learning and learners.
- **Motivation**: On the job, the boss can say to his/her employee: learn this software if you want to keep your position. While one can indeed command children, that has precious little impact on their learning. Computing can provide interfaces and styles of interaction that are motivating – if only we knew how to build them!

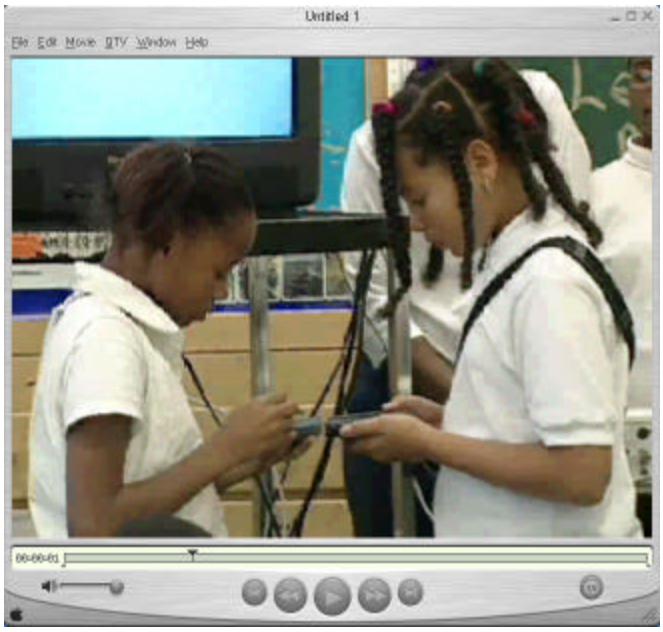
Education is THE major industry in America. Education is THE mechanism by which our people develop, achieve, and improve their lot in life. It's time to apply computing technology to improve learning and teaching. Science knows a great deal now about how individuals – young ones and not so young ones – and groups learn. Leveraging that understanding and applying it to the development learner-centered interfaces – not human-centered interfaces – must be one of the Grand Challenges of our times.

Indeed, the emergence of palm-sized computing devices at the cost of a pair of tennis shoes makes possible the vision that each and every one of America's 50,000,000 K-12 school children could have their own personal computer. Tomorrow.

But, what would teachers and students do with such computers? Drill the children on their number facts? Technology is not about gadgets but about changing the process: what palm-sized computers enable are new ways to address age-old problems in teaching and learning. Two-dimension text on paper, while motivating to our generation, is simply

not interesting to many, many of our children – and thus they are not learning to read. There is overwhelming evidence, indeed, that computational technologies are more effective at engaging learners than are their paperback cousins. Our challenge is a basic one: literacy, learning to read and write, learning to communicate and participate. The vehicle to that end is not going to be the same for the "kids these days" as it was for us. Rather than decrying the use of technologies because that's not how we learned, we need to leverage that which the generations coming up today value – and that is technology.

Interface design, simply put, that addresses the unique needs of learners and learning needs to be a Computer Science Grand Challenge. If we are successful in developing design guidelines and implementation strategies that effectively use computationally-based interfaces to engage and support children's intellectual efforts, the impact would be truly transformative, truly revolutionary.



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Learning and teaching have been driving forces in Elliot Soloway's research, teaching and service activities for over 30 years. In 1966, as an undergraduate philosophy major at Ohio State University, he was thunderstruck by the conundrum in Plato's *Meno – how can the slave boy learn the proof of the Pythagorean Theorem*?! Ten years later, using the tools of Artificial Intelligence to further explore learning for his Ph.D. dissertation in Computer Science at the University of Massachusetts, he built a computer program that learned the rules of baseball from watching example games. Teaching at Yale and having a family he came to realize that making children smarter would be a better use of his time than making computers smarter. So, he gave up AI and focused on using technology in K-12. Coming to see, the hard way, that simply building "boxes" – no matter how pretty, elegant, or amazing – is not going to make one whit of difference in a classroom he has joined up with School of Education faculty Phyllis Blumenfeld, Joseph Krajcik, and Ron Marx in the Center for Highly-Interactive Computing in Education. Together this group has produced inquiry-driven, project-based, technology-pervasive science curriculum that is making a difference in the lives of children and teachers in Detroit and around the country. Lately, Elliot is focused on figuring out how each of the 50,000,000 school children in the U.S. can productively have and use a $100 palm-sized computer. In the teaching courses in Computer Science, Elliot also uses inquiry-driven pedagogical strategies – though they are augmented by strategies borrowed from Zero Mostel.

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Dr. Norris' efforts in research, teaching and service all have a common focus: integrate learning technologies more effectively into classrooms, in K-12 as well as post-secondary education. Currently, Norris is President of the National Educational Computer Association (NECA), the organizing body for the country's leading education and technology conference for 20 years, National Educational Computing Conference. In addition to the Snapshotsurvey.org Project, Norris is exploring design guidelines that address the unique needs of children in the WebKids Project, and in the Convergent Analysis Project, Norris is developing strategies to help educators extract value from the research literature on technology in education.