

## Peter Denning's ACM Education-Related Milestones

Updated 8/15/15

**Operating Systems Principles.** I organized and led COSINE Task Force 8 that delivered a recommendation for a CS core course on operating systems principles in 1971. It became the first non-math CS core course. Early OS textbook writers adopted our table of contents and its general structure persists in OS textbooks to this day. My *Computing Surveys* paper “Third Generation Computer Systems” (1971) was an overview of the report. My *AFIPS SJCC Proceedings* paper, “Operating systems principles and undergraduate computer science curricula” (1972), which presented the argument for including systems in the CS core, won the AFIPS SJCC conference best paper award. Copies of these items are available at

<http://denninginstitute.com/pjd/PUBS/cosine-8.pdf>

<http://denninginstitute.com/pjd/PUBS/denning-3G.pdf>

<http://denninginstitute.com/pjd/PUBS/OSprinciples.pdf>

With Ed Coffman, I published textbook *Operating Systems Theory* (Prentice-Hall, 1973), which presented OS principles and their associated mathematical models for graduate students. It became a classic, remaining in print for 25 years.

I published four *Computing Surveys* papers that became classics and were widely used in OS classes before there were textbooks on these topics:

“Virtual Memory”, 1970

“Third Generation Computer Systems”, 1971

“Fault Tolerant Operating Systems,” 1976

“Operational Analysis of Queueing Network Models” (with J. Buzen), 1978

**Computing Fundamentals.** With Jack Dennis and Joe Qualitz, I published the textbook *Machines, Languages, and Computation* (Prentice-Hall, 1978). It was the first “computing fundamentals” book to present the hierarchy of languages and machines for CS students. The machines were presented as programmable entities rather than abstract mathematical “tuples”.

**CSNET.** I was one of the four PIs on the CSNET project (1981-1988), the NSF funded project that built the first large-scale Internet community by adapting the ARPANET technology and making networking available to all CS departments and CS research labs. By 1986 CSNET served about 50,000 students, faculty, and researchers. CSNET alumni helped plan and build NSFNET, which became the backbone of the early Internet. CSNET received the Postel Award from the Internet Society in 2009, honoring its pivotal role in transitioning from the original ARPANET to the NSFNET.

**Experimental Computer Science.** I was principal author and editor of the Snowbird Report from the CS department chairs, “A discipline in crisis” (1980), which built on the 1979 Feldman report and established CS as an experimental science field. I followed up as ACM President with an ACM Executive Committee position “Eating our Seed Corn” (1981) that further strengthened the case. Two results of these efforts were the NSF the Coordinated Experimental Research (CER) program for CS and the CSNET project.

**Computing as a Discipline.** I wrote an article “Educational Ruminations” (IEEE Computer, May 1985) proposing that we could overcome the identity crisis we were still struggling with after the Snowbird Report by adopting a better story about our discipline. Inspired by this, the ACM Ed Board asked me to organize an ACM/IEEE group to advise on how we might better view the discipline and organize the curriculum. I organized and led the ACM/IEEE team that produced the report “Computing as a Discipline” (CACM Jan 1989). The new report reshaped ACM thinking away from the simple-minded and misleading “CS=programming” to a broad view of the emerging discipline. It shaped the 1991 ACM curriculum and influenced later curriculum revisions. We also launched the tradition of ACM and IEEECS cooperating on curriculum recommendations.

**Hyperlearning.** At George Mason University, I co-founded (with Daniel Menascé) the Center for the New Engineer to design and implement technology that supported the competency-based hyperlearning idea that I envisioned in “Educating a New Engineer” (CACM Dec 1992). During 1993-1999, we built a set of online competency based learning modules for computer science plus refresher modules for math and statistics. We built the Hyperlearning Meter system to administer the online tests and track student progress relative to a concept map. Stanford University Library has recognized our site as the first to offer online competency based learning modules. The archived site is at <http://denninginstitute.com/oldcne-archive-home.html>

**Skills of Innovation.** Beginning 1992 at George Mason University I designed and taught a class to teach our engineering students what is involved in being a designer and an innovator. Students reported that our language-action based material did more than teach them to be designers and innovators -- it transformed their lives. We formed an extra-curricula alumni group called Sense 21 (meaning “new common sense for the 21st century”) that most of the students stayed with until 2002 when I left Mason. I continued to develop the themes begun then with partner Bob Dunham and we wrote a book on our findings *The Innovator’s Way* (MIT Press 2010).

**ACM Communications.** I led a Publications Board team to redesign the CACM from a research journal to a flagship magazine (1982) and then became editor-in-chief to implement the plan 1983-1992. Around 1980 there were numerous

complaints that the Publications Board plan to start Transactions in several areas had drained most of the good research content from CACM, leaving behind a handful of orphan and peripheral research areas. The new CACM was a magazine for all members with a strong emphasis on communicating research and technology development for practitioners. It received several industry awards.

**Digital Library.** As chair of the ACM Publication Board 1992-1998, I organized and led the team that designed and built the ACM Digital Library -- including the library system, business model, and copyright policies. I received the ACM Outstanding Contribution Award for this in 1999.

**IT Profession Initiative.** I founded ACM "IT Profession Initiative" in 1998 to promote the ideal of computing as a profession and ACM as the professional organization. Results included: inspiring CRA to found the IT deans group, consisting of deans of schools of IT or computing; inspiring ACM to found the Professional Board; inspiring the formation of ACM *Queue*; and establishing the IT Profession column in CACM starting in 2001. I wrote 60 essays promoting a broad, holistic, science view of computing in that column from 2001-2015.

**Great Principles of Computing.** I formally initiated the Great Principles of Computing Project in 2003. I had been working on articulating fundamental principles of computer for about five years because of a new identity crisis arising as STEM education started gathering momentum without computer science being included. The objective was to find a way to present computing in terms of fundamental, "cosmic" scientific principles that transcend the fast-changing technologies and go well beyond the resurging popular idea "CS = programming". This perspective was new for many computer scientists, who were used to the technology-oriented bodies of knowledge behind ACM curriculum recommendations. I chaired an ACM Education Board task force to study and promote this perspective from 2004-2008. The perspective took root in the new genre of "CS principles" courses designed as part of the NSF initiative and are now influencing the design of a new AP curriculum. My book with Craig Martell, *Great Principles of Computing*, was released by MIT Press (2015).

**Rebooting Computing.** I was selected as one of two NSF CISE Distinguished Education Fellows in 2007. I used the associated grant to organize the summit "Rebooting Computing: The Magic and Beauty of Computer Science" (2009). The objective was to simulate action to overcome the STEM identity crisis noted earlier. The summit brought together about 200 people from university, K12 education, industry, and international to discuss how computing people might adopt a more effective presentation of the field for education and for the general public. Of the 19 action groups formed at the summit, 12 achieved all or most of their objectives. Results included various people supporting the new NSF

programs in computational thinking and high school teacher training, for example, Dan Garcia's course on computing principles course at UC Berkeley.

**Future of Education.** I am current working with a group led by Fernando Flores examining the nature of education in the emerging, massively digitally connected world. Not even our fastest computers and most advanced data analytics help us predict, model, manage, and control this world. We are beginning to discern a new skill set that will enable future graduates to read and navigate this world effectively. A big challenge is how to adapt engineering and computing education for a new model of what we must know. Papers and books will start emerging from these discussions in the next year.

### **Offices**

Founding chair of SIGOPS and of the SOSP bi-annual conference series (1969).

First chair of the ACM SIG Board (1970-1974). Helped form SIGCSE.

ACM Vice President 1978-1980

ACM President 1980-1982

Editor-in-Chief ACM *Computing Surveys* 1976-78

Editor-in-Chief ACM *Communications* 1983-1992

Chair ACM Publication Board, 1992-1998

Chair ACM Education Board 1998-2002

Editor-in-Chief ACM *Ubiquity* since 2008.

### **Awards**

(26 awards in all. These are the ones related to education.)

ACM Distinguished Service Award (1989), recognizing contributions to education and other aspects of ACM.

CRA Computing Research Distinguished Service award (1989) for promoting computing research in university and government and writing about computing for the general science audience of *American Scientist* magazine.

ACM Karlstrom Education Award (1996).

SIGCSE Outstanding Educator Award (1999).

SIGOPS Hall of Fame award "The working set model for program behavior" (2005)

SIGCSE Lifetime Achievement Award (2009).

Teaching excellence awards from George Mason University (2002) and of Virginia (2003).

Author or co-author of 10 books and about 400 reviewed published papers.