Foreword

How will information technology (IT) education evolve in the new millennium? Brainstorming answers to this question in an era of knowledge management, life-long self-directed learning, distant education, virtual universities, mobile Internet, e-learning, and virtual reality conjures up interesting images. An amusing one is based on the movie, The Matrix, where the protagonist learned kung fu in seconds by having the core skills downloaded directly into his mind. Will we similarly witness our students downloading Java programming skills or the best practices in information systems analysis and design directly into their minds?

The IT sector is expected to continue to face a severe shortage of workers. According to Information Technology Association of America's *When Can You Start: Building Better Information Technology Skills and Careers* study (April 2001), 425,000 IT positions will likely go unfilled this year. To address this "new deficit" in our digital economy, increasing numbers of IT employers are establishing school-to-career partnerships with the goal of developing a reliable IT job pipeline. That is, a labor pool of skilled workers with technical (IT), academic foundation (mathematics, science, general education), and soft skills (problem solving, communication, teamwork, etc.) needed for entry into IT careers. A workforce trained by educators who receive the career awareness and IT training *they* need, when and where they need it, to integrate information age paradigms for learning and working into high quality IT curriculums.

Eager to help fill the IT labor shortage, a growing number of programs have targeted retraining workers from other fields. Paving the way has been the mainstream acceptance of IT certification as a viable method for measuring an employee's skill set. Since 1989, when Novell awarded the first such certificate, the offerings of certificates (Microsoft, Oracle, Cisco, Novell, A+, etc.) and the demand for certification have grown dramatically around the world, reaching an estimated total of 2.5 million certifications (not people) to date. This "parallel universe" of IT education and training, that is competency-based, confers certificates not degrees, and exists beyond government's control, caught higher education off guard and there is no turning back.

The growth of IT certification will continue to come from the supply side. As new developments in IT rise to meet the challenges of exploring new frontiers in a pervasively networked, knowledge-centric world, there will be a greater

requirement for specialization in IT tools, methodologies, and processes. Vendors, IT industry associations, and large intermediary "training partners" will continue to formally establish standards for what it takes to perform at an optimal level in different areas of information technology. In turn, other vendors will recognize this public set of educational objectives, students reach for those standards, and employers feel free to require a proxy for their attainment leading to a supply-side opportunity for IT certification and re-certification. Universities and other institutes of higher education have no choice but to join the move towards acknowledging IT certifications as becoming as valuable as college credit and even equivalent to it.

Even with universities joining the IT certification marketplace, the increased numbers of certified graduates will not solve the IT *skills* shortage unless the fundamental problem of learning in isolation from the realities of the workplace, inherent in traditional classroom settings or on the Internet, is also addressed. Structured internships, where the work assigned is closely aligned with the educational curriculum and company supervisors work closely with faculty, can go a long way in improving the situation, just as informal learning or learning on the job can. Moving toward an experiential approach by focusing on intact work groups to build teamwork and classroom exercises based on participants' actual challenges and problems on the job can elevate training to where learning occurs through organizational intervention, and education becomes akin to "edutainment" accelerating the learning process.

Edutaining our youth in IT is an effective long-term strategy to address the growing demand for skilled IT professionals. In the near-term, a promising solution is to send existing employees back to school to be retrained for IT skills and certification. Notwithstanding the promise and the potential benefits, employers justifiably fear that training and certification lead to higher salaries and turnover. Although high turnover is not unusual in any type of job characterized by growing demand and increasing wages, turnover among IT professionals is much higher than among professionals in other occupations. Surveys, however, indicate that IT workers are motivated as much by the opportunity to develop new skills as by compensation. Hence, providing increased opportunities for formal and informal learning on the job will continue to remain a key strategy for retaining skilled IT workers.

As more and more organizations accept IT training as a strategic investment and not a cost center, the adoption of e-learning will accelerate. The initial attraction, of course, will be its cost effectiveness in providing just the right amount of IT training to meet a very specific learning need whenever and wherever it is needed. The indelible attraction, however, will be felt when full advantage is taken of the potential of e-learning for creating an experiential learning program that allows the student to absorb the theory in a highly interactive environment and to take newly acquired IT

skills and apply them in a virtually real world. This can only be achieved by allowing the learner to actively experiment with information technology in the real world, or at least a very close simulation of it. Therefore, for example, although the interviewing skills for systems analysis will not be directly downloaded into the mind of the student, the learned skills will be immediately applied in a simulated real world scenario in the virtual classroom.

So, how will IT education evolve in the new millennium? Well, as the research contributions in this volume attest, IT education in an era of knowledge management, life-long self-directed learning, distant education, virtual universities, mobile Internet, e-learning, and virtual reality will look noticeably different. Nevertheless, beneath the new look of IT education a fundamental truth will remain constant:

Tell me, and I forget.
Show me, and I remember.
Involve me, and I learn.

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