

NECC 2005 SIGTE Workshop: Planning Document

Executive Summary. Somewhat over 20 people have provided input to this workshop project so far. The actual presenters in the workshop have not yet been selected. Some of the key issues and topics are beginning to emerge. Perhaps the single most important one is that of having ICT in preservice programs of study that are of very high quality and are transportable so that each person teaching in this field does not have to “reinvent the wheel.” **High quality** means that the program of study prepares the preservice teachers so that they can immediately (in their first teaching position) do an adequate job of implementing the ISTE National Educational Technology Standards for Students and/or the equivalent standards in the school systems or states in which they will teach. **High quality** also means that the preservice teachers have learned to learn ICT in education and have gained a solid foundation for lifelong learning in this field.

Dave Moursund 1/13/05

Introduction

ISTE's SIG Teacher Education will be presenting a full day workshop Sunday, 6/26/2005 9:00am- 4:00pm in Philadelphia. I have agreed to organize this workshop and be one of the presenters.

Somewhat over 20 people have responded to my initial message requesting input and possible desire to be a presenter. I will be corresponding directly with this group and others who communicate with me about this workshop project. The Website

<http://darkwing.uoregon.edu/~moursund/dave/SIGTE2005.html>

contains access to the Web-based information that I have received. Several people provided me with access to Blackboard, PDF, and other files, and they are not posted on the Website.

The purpose of this Planning Document is to share with visitors to this Website some of the progress that is occurring in developing the Workshop as well as questions and ideas that may be discussed during the Workshop. Currently, what is given below is mainly my “musing.”

A Little Bit of History

I want to share a bit of personal history. I first became involved in the field of computers in precollege education in the mid 1960s. In 1969 I became the first Head of the Department of Computer Science at the University of Oregon. In this position I got to deal with a number of curriculum problems, including:

1. What Computer Science curriculum to offer to students wanting to minor or major in CS, or take a masters degree in this field.
2. What service courses to provide to meet the general needs of students at the University of Oregon.
3. What courses to provide to meet the needs of preservice and inservice teachers, some who wanted to work for masters or doctorates in the field of computers in education.

And, I got to do the above with a budget that was totally inadequate in meeting the needs of the very large number of students wanting to take CS courses. The next three sections discuss a few key ideas relevant to this endeavor in my past and to the SIGTE Workshop that is being developed.

Curriculum Problem 1. Computer Science Curriculum

My knowledge of the field of CS was quite limited. Fortunately, it turns out that the Association for Computing Machinery (established in 1947) had recently produced Curriculum '68. This was a carefully designed undergraduate liberal-arts-oriented degree in CS. (At about the same time, other professional organizations developed a Business-oriented CS degree program and an Engineering-oriented CS degree program.)

In essence, Curriculum '68 defined the **discipline** of CS. CS as a discipline is not a mess of isolated courses such as Fortran and Advanced Fortran, COBLO and Advanced COBOL, BASIC, Pascal, Assembler Language, computer graphics, electronics, and so on. Rather, it is a coherent field, having depth and breadth that focuses on the theory and practice of representing and solving problems both within CS and in all other disciplines.

Gerald Engel did his doctoral dissertation at Pennsylvania State University about 15 years after Curriculum '68 appeared. He studied the effects of Curriculum '68. The effects were widespread and very impressive.

The CS field draws heavily upon mathematics. Even today, CS majors often are required take two years of college math at the level of Calculus and Discrete Mathematics. Computer programming remains an important component of CS, and has growing into a subfield called Software Engineering. A number of other important subfields have histories going back well before Curriculum '68. Artificial Intelligence is an excellent example, and computer electronics provides another example.

In summary, Curriculum '68 as well as curricula provided by the IEEE (Engineering) and DPMA (Business) drew upon the collected knowledge of leaders in way so that each individual community college, college, and university did not need to reinvent the wheel. Moreover, such curricula provided a solid path for textbook writers to follow.

I wonder why a similar thing has not happened in the field of computers in education. Curriculum '68 provided enough detail for a person to teach the various courses that were specified. It seems to me we should have accomplished the same thing for the field of computers in education. The ISTE Standards are helpful, but have a long way to go in providing what we need.

Curriculum Problem 2: Service Courses

From the very beginning of the CS Department, it was clear that there were a huge number of students who wanted (needed) various types of service courses. We immediately put into place a computer literacy course that could be taught in very large sections. Initially it was a two quarter-hour freshman-level course and did not contain any computer programming, although it did include hands-on computer activities using a variety of applications programs. Eventually it became a three quarter-hour (equivalent to two semester hours) course with 1/3 of the course time programming in timeshared BASIC. Over the years this course has become a full year sequence that meets University of Oregon requirements for a Science Group Requirement.

A variety of other service courses were developed to meet the needs of various departments and/or groups of students.

Here is a retrospective thought. In the early 1970s and continuing still today, the University of Oregon does not have a freshman-level service course designed to help students learn to learn

in an ICT environment and to build their education in a manner that gives appropriate consideration to what is known about learning theory, roles of computers as an aid to learning, roles of computers in representing and solving problems in various disciplines, and related topics such as transfer of learning and brain science. It seems to me that such a course would be a “natural” for a College of Education and that it has the potential for very large enrollment. My (free) book on problem solving, available at <http://darkwing.uoregon.edu/~moursund/SPSB/>, contains some of the content for such a course.

The reason for bring up this idea here is that I believe that all preservice teachers should be taking such a course, or that the content of such a course should be woven into their required curriculum. This is one of the topic areas that I will be presenting during the SIGTE Workshop.

Curriculum Problem 3: Computer in Education Coursework

By 1969, University of Oregon had already made a good start on courses for preservice and inservice teachers. The first degree program that was approved for the new CS Department was a Master’s Degree in Computer Science Education. It was patterned after the Master’s Degree in Math Education (CS was formed by splitting off from the Math Department). I required 45 quarter hours of credit—30 from CS and 15 from the College of Education. Evidently this was the second such Master’s degree program developed in the US. Illinois Institute of Technology developed the first such program about a year earlier.

A variety of inservice courses were already being offered through support of the National Science Foundation and the local school districts. We began to experiment with what was appropriate for preservice teachers. However, in the early 1970s microcomputers had not yet been developed. There was some access to timeshared computing in the local schools. We had not yet reached a time where our College of Education saw need for preservice teachers to be learning to use computers.

We began to admit students into a Computer in Education doctoral program in 1970 or 71. This was done through the College of Education under the guise that they were already working with doctoral students in Math Education, and the new program merely represented a split off from the math program. Evidently this was the first such program in the country.

The computer in education doctoral students took a variety of courses from CS, including some intended for the computer in education master’s degree students, and a doctoral seminar that I designed and taught. In the initial years of this program, the students tool CS coursework roughly equivalent to a Master’s Degree in CS. They had to meet all of the College of Education requirements for a doctorate. They did a dissertation in the field of computers in education.

Retrospective Comment: One of the things that I have learned through creating a variety of master’s degree programs and working with a variety of master’s and doctoral students is that ICT in Education is a broad, deep, and complex field. The core of this discipline is making effective use of ICT as an aid to representing and solving problems.

Roles of ICT in problem solving cuts across all disciplines. ICT affects the curriculum content, the pedagogy, and the assessment in each discipline. For a number of years I have been teaching an ICT in education course for preservice elementary school teachers who are in their fifth year of a five year program. They had a computer course while they were freshman or sophomores, and this is a graduate course taken in the fall term of their fifth year. They often do student teaching in the winter quarter. A detailed syllabus for this course and a free book that I

wrote for this course are available at

<http://darkwing.uoregon.edu/~moursund/DigitalAge1/index.htm>. This course is one of the topics I will cover during my presentation in the SIGTE Workshop at NECC 2005.

More Recent Past

A 1999 research report gives us some baseline data on the state of the ICT preparation of preservice teachers at that time.

Moursund, D. & Bielefeldt, T. (1999). Will new teachers be prepared to teach in the digital arena? Research study by the International Society for Technology in Education – Commissioned by and in partnership with Milken Exchange on Education Technology. <http://milkenexchange.org>

This report indicated that most teacher education programs had a required computer in education course for preservice teachers, and integrated some use of ICT into other parts of the curriculum. An optimistic interpretation of the situation was that many students were getting a combined equivalent of perhaps 5-5 semester hours of ICT in education if one combined all of the bits and pieces. A modest number of teacher education programs had dropped their required course and depended on integration plus non-required courses.

Then, the Preparing Tomorrow's Teachers to Teach using Computers (PTTT) grant program was started. A substantial amount of funding from the US Department of Education, with matching funds (typically "in kind") from many sources allowed hundreds of teacher education programs to make significant progress in ICT in education.

ISTE published National Educational Technology Standards (NETS) for students in 1998 and NETS for Teachers in 2000. These were achievements of major importance and have certainly helped to shape the field of ICT in education. They have helped in facilitating significant progress in ICT in PreK-12 education.

But, this progress is far less than many people would have liked to see. In some sense, a summary of our limited progress to date is provided by the following quote from the *Executive Summary of the National Education Technology Plan 2004*, U.S. Department of Education, released January 7, 2005.

This report was undertaken by the staff of the U.S. Department of Education in response to a request from Congress for an update on the status of educational technology. As the field work progressed, it became obvious that while the development of educational technology was thriving, its application in our schools often was not. Over the past 10 years, 99 percent of our schools have been connected to the Internet with a 5:1 student to computer ratio.

Yet, we have not realized the promise of technology in education. Essentially, providing the hardware without adequate training in its use – and in its endless possibilities for enriching the learning experience – meant that the great promise of Internet technology was frequently unrealized. Computers, instead of transforming education, were often shunted to a "computer room," where they were little used and poorly maintained. Students mastered the wonders of the Internet at home, not in school.

Now and the Future

The reports I have seen suggest that in 1983 the K-12 schools had about one microcomputer or computer terminal for instructional purposes for each 125 students. More recent data suggest the ratio is now about 1 per 4.5 students. In addition, perhaps 75% of K-12 students have access to a home microcomputer. I don't have solid data on the percentage of preservice teachers who own a computer, but my guess is that in many Colleges of Education it may be in the range of 80

to 90 percent, or higher. Finally, it is important to note that the current microcomputers are thousands of times more powerful than those of 1983, the Web exists, and software to support ICT in education is far better than it was in 1983.

If we combine the improvements in hardware, software, and availability with the improvements in Standards and in preservice and inservice teacher education, it seems to me we should expect to see that ICT is doing very well in making a significant contribution to the education of our students.

The following brief quote helps to capture what has been going on in hardware, and gives a hint of the future.

Mashey, John R. (December/January 2004-2005). Languages, Levels, Libraries, and Longevity. ACM Queue vol. 2, no. 9 . Quoting from the article accessed 1/12/05 <http://www.acmqueue.com/modules.php?name=Content&pa=showpage&pid=245>

Any old Unix person would be amused to think that Unix's January 1, 1970, date would be enshrined so long. We have begun a process in which many people's lives are already dependent on the correct working of software, and likely to become even more so. Software once runnable only on large systems migrates downward onto larger numbers of smaller computers. Some current cellphones use 300-MHz CPUs, running at a rate higher than any CPU commercially produced by 1990. Some have 64 MB of memory, competitive with many expensive systems of the late 1980s. Vinge's book extrapolates from current small "smart dust" computers to assume that 5,000 years from now, most computing will be done by their hyper-powerful, barely visible descendants, containing layers of software (and more than a few trapdoors). In the United States, we already have approximately 100 CPUs per person, and this number has traditionally increased tenfold each decade. As wireless sensor networks proliferate, we face a future in which most objects have CPUs and are linked together via radio.

Here are some of the thinks that I hope we can accomplish through the NECC 2005 SIGTE workshop:

1. Identify progress that has been made in recent years on the development and implementation of high quality, widely adopted ICT in preservice teacher education courses of study. Research makes it clear that the ACM Curriculum '68 strongly shaped the college undergraduate academic discipline of CS. Do we have research that shows we are making significant progress in our ICT in education curriculum for preservice teachers?
2. What is going on outside the US versus what is going on inside the US. Are their countries that are doing a lot better than the US in terms of the ICT preparation of preservice teachers?
3. How does the ICT in education of preservice teachers stack up against a rigorous interpretation of the ISTE NETS-Teachers? That is, are teachers being adequately prepared to implement ISTE NETS-Students and are they doing so when they begin their teaching careers?
4. The ICT in education preparation of preservice teachers draws on a number of contributors. What are successful, replicable models of:
 - A. The (informal) home education of the preservice teachers as they are growing up.
 - B. The formal contributions of PreK-12 education.

- C. The college education outside of the College of Education. Roughly speaking, 3/4 of the college level coursework of preservice teachers is taken outside of the College of Education.
 - D. Specific ICT coursework taken through the College of Education or required for admission to a teacher education program.
 - E. ICT in education coursework integrated into required Methods courses.
 - F. ICT in education coursework integrated into required, non-methods courses. There is a wide range of possibilities here, such as ICT in an assessment course, in a special education course, in a curriculum design course, or in a capstone project course.
 - G. ICT in education integrated into the various field placements and student teaching activities of preservice teachers.
5. This relates to (4) above. What prerequisite structures have been developed and implemented, and how is this being done? For example, one might expect that ICT in education courses given at the college level would be able to assume a prerequisite of ISTE NETS-Students at some grade level (perhaps 8th grade nowadays, and eventually 10th grade or higher). Similarly, when in a preservice teacher's program of study is the first course such as (4D) required, and how do subsequent courses (such as additional 4D courses, and 4E to 4G) assume and build upon the initial course.
 6. To what extent is ICT in preservice education a well organized discipline of study, with appropriate depth and breadth, as compared with a rather haphazard collection of bits and pieces drawn from many different learning opportunities? (This question ties in with the way that most CS was taught before Curriculum '68 provided appropriate guidance.)
 7. What are really important ICT in education topics that are missing in the preservice education of the great majority of preservice teachers. Progress in identifying these might contribute to changes to or additions to the overall program of ICT in education that our students are receiving. Here are a few examples from the various preservice elementary education programs at the University of Oregon:
 - A. The preservice elementary teachers are learning next to nothing about roles of ICT in Art and Music.
 - B. The preservice elementary teachers are not learning much about roles of ICT in representing the problems in the various liberal arts contents courses they are taking. (This is part of 4C above.)
 - C. The preservice teachers are not being taught in a manner that captures some of the unity of the various pieces they study and possible transfer of learning among them. As an example ICT is very important in process writing. But, it is also important in any problem-solving task that is process-oriented, such as any instruction involving project-based learning. As another example, consider templates. A template represents

accumulated knowledge and serves as a starting point and model for working to accomplish certain tasks or solving certain problems. Templates are important in word processing, desktop publication, many different aspects of multimedia and slide shows, and so on.

- D. The preservice teachers are learning very little about the science and technology that are the foundations of ICT in education. For most, the computer and its related hardware and software are black boxes.
- E. The preservice teachers are not learning about Artificial Intelligence—capabilities, limitations, how it can change education, and the capabilities of people versus the capabilities of machines.
- F. The preservice teachers are gaining almost no hands-on experience with e-learning (distance learning, computer-assisted learning).

To close this section of the document, I want to comment on a problem that greatly troubles me. The problem is the strong movement towards increase use of part time employees (“adjuncts”) to teach College of Education courses. Such adjunct faculty are typically highly qualified and experienced within the areas that they teach. However, they are often weak in ICT within the areas that they teach. Moreover, they are not much involved in the overall day to day operations of the program of study they teach in, so they tend to have limited knowledge of the other courses their students have taken, are taking, or will take. I hope that our SIGTE Workshop can address the ICT in education aspects of this situation.

Additional Needs

1. I need access to more Web-based syllabi for initial and follow-up ICT in education courses for preservice teachers.
2. I am looking for people who have knowledge of ICT in preservice education courses in countries outside of the US.
3. I am looking for any research reports that provide solid evidence of the success of particular ICT in preservice education courses. People can give me research evidence that they have produced and/or point to research literature that I should be reading.
4. I am looking for books or other solid materials that people use to define the content of their courses, and that they feel are really good. (Such books and materials help to make it possible for courses to not continually reinvent the wheel.)
5. I am looking for examples in which a number of people are teaching essentially the same course, or a number of students from diverse locations are receiving essentially the same learning experience. This category includes distance learning.
6. I am looking for examples where people are pushing the envelope.