Panel on Revitalized Undergraduate Computing Education

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SUMMARY
There is an imbalance in the supply and demand for computing professionals that has generated shortages in meeting personnel needs within industry. A major program was developed by the U.S. National Science Foundation to encourage innovations in undergraduate computing education. There are a variety of new projects that are revitalizing undergraduate computing education. One approach to such revitalization is the introduction of interdisciplinary courses to expand the scope of computing education. The basic idea is to have students from various disciplines work together on computing projects to expand their educational horizons and make computing courses more appealing. This panel brings together research managers with educators who have developed and taught interdisciplinary courses with these goals in mind. The panelists will share their experiences and solicit new ideas from the audience.

Categories and Subject Descriptors
J.5 Arts and Humanities, Fine Arts, Music, and Performing Arts.

General Terms
Design

Keywords
Computer Education, Interdisciplinary Computing Programs

1. JOSEPH E. URBAN
The Directorate for Computer and Information Science and Engineering (CISE) at the United States National Science Foundation (NSF) developed the CISE Pathways to Revitalized Undergraduate Computing Education (CPATH) program as the means for generating a transformation on a national scale. There have been two rounds of competition completed for the NSF CPATH program [2, 3]. The projects proposed efforts in community building, institutional transformation, and the evaluation, adoption, and extension of innovative models. In addition, during the first NSF CPATH competition, there was an explicit effort to undertake leadership development through CISE Distinguished Education Fellow (CDEF) type projects. An example of a focus area has been in computational thinking, as described by Wing [4], which has been a catalyst for stimulating advances in computing education.

An NSF CPATH Principal Investigators workshop will be held in November 2008. The workshop will be the major forum for NSF CPATH project leaders to share their results for revitalizing the current approaches to undergraduate computing education. This panel will provide a forum for describing the NSF CPATH program and obtaining input for the future. The four panelists will bring breadth and depth through discussion of the program and specific projects.

Overviews of the NSF CPATH program will include the informational and community building workshops, taxonomy of funded projects, and summary of the lessons learned through the Principal Investigators workshop. There will be two NSF CPATH projects that will be described as representative examples and to illustrate the breadth in one aspect of the NSF CPATH program.

2. HARRIET G. TAYLOR
The NSF CPATH program is the major U.S. federal funding effort for advancing undergraduate computing education. This program provides leadership in transforming undergraduate computing education on a national scale to meet challenges and opportunities of the global economy and future workforce needs. The program is now in a third year of funding projects.

The impact of the NSF CPATH program has raised the national consciousness about the transformation of computing education. There have been a large number of geographic areas and

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institution types funded through this program. The collaborations that have been established are across many disciplines to foster new pathways that will broaden the scope of undergraduate computing.

The 2009 NSF CPATH competition will be underway during this panel session. An overview of the program solicitation will describe the changes in focus that have occurred as a result of the previous two competitions. The interactions with attendees will help to enhance and improve future offerings of the program.

3. JESSE M. HEINES

The Univ. of Massachusetts Lowell received an NSF CPATH grant to connect computer science to the performing, fine, and design arts by developing a specialty track within the computer science curriculum called *Performamatics*. The focus of this work is to develop courses that combine Computer Science (CS) with Art, Music, and Theater and a process for introducing such courses into traditional CS programs. The latter point is not a trivial one, as the demands of an already packed curriculum and cultural inertia conspire to inhibit the introduction of new courses, particularly ones that do not explore newly developing CS areas.

However, we see the current trend to teach computing concepts in virtually all academic areas as a newly developing CS area itself. This trend is particularly common in today's art, music, and theater courses. In addition, computer applications in these areas are a major focus of students' interests, so we think it makes sense to try to tap into this interest to attract and retain CS majors. Courses we are currently working on include:

- *eAMP (Extended Art Media Performamatics)*
  Bringing together CS and Art students to create visual art that will be distributed rather than exhibited. [1]
- *Music Performamatics*
  Bringing together CS and Music students to gain firsthand experience with the pros and cons of creating technology applications for classrooms with students who are growing up under the strong influence of media.
- *Tangible Interaction Design*
  Bringing together CS and Art students around the theme of creating useful and educational artifacts that include embedded computing technology.

The first two courses listed above have already been taught and evaluated once, and we are in the planning stages of offering them a second time. The third course is being offered for the first time in the Fall 2008 semester.

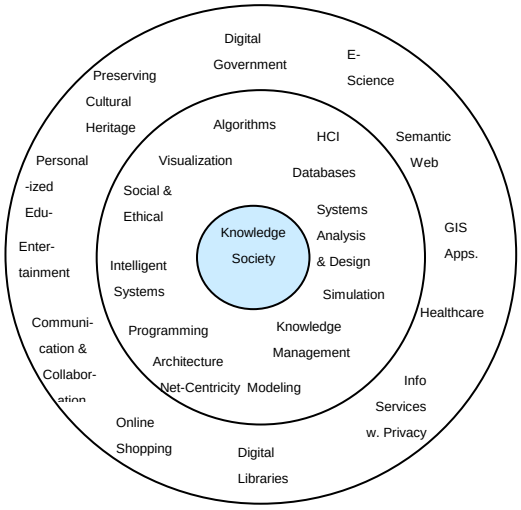
Our findings so far include guidelines for the structuring CS courses that remain self-contained but that are "synchronized" with courses in the arts, observations on the transformation of the professors who teach such courses, and the pros and cons of various types of interdisciplinary projects.

4. EDWARD A. FOX

NSF has awarded CPATH Collaborative Research Community Building grants for *Living In the KnowlEdge Society* (LIKES) to Virginia Tech (lead institution, with PI Fox and co-PIs Evia, Fan, Sheetz, and Zobel, from Computer Science, English, Accounting & Information Systems, and Business Information Technology), North Carolina A&T (PI Carr, CS), Santa Clara Univ. (PI Chung, Information & Decision Sciences), and Villanova Univ. (PI Beck, CS). Our aim is to connect computing-related disciplines with many other fields (especially required "core" or liberal arts courses) to ensure that the nation's undergraduate students are prepared to live in the emerging Knowledge Society.

Through a series of four workshops (starting with late 2007 at Santa Clara and spring 2008 at North Carolina A&T), related online community discussions, and our own research, the LIKES community is discovering key computing-related issues in core disciplines and engaging leaders nationwide in brainstorming about their computing education needs. Deliverables include (1) new pedagogies in computing education, (2) integration of computing concepts into non-computing disciplines, (3) principles, guidelines, and techniques for integrating computing and non-computing curricula, and (4) formation of new communities for enhancing that integration.

This transforming of education in computing-related disciplines will yield a next generation of builders of the Knowledge Society. Thus, the figure illustrates how CS concepts (2nd circle) relate to (KS) applications needed by individuals and society (3rd circle).



Further, at Virginia Tech, there is a new pathway through the core curriculum: with an Introduction to LIKES, a LIKES capstone, and a list of LIKES-designated courses taught in a variety of departments, so students interested in the Knowledge Society, majoring in any discipline, can form an ongoing learning community. This should broaden the impact of LIKES greatly.

5. REFERENCES

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