Innovating Our Self Image
(Special Session)

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SUMMARY

The NSF CISE Directorate selected Owen Astrachan and Peter Denning as the first two Distinguished Education Fellows. Their job is to serve as ambassadors for curriculum change in a field whose basic curriculum structure is much the same as it was in the 1970s. They believe that

- The outdated 1970-era curriculum structure is largely responsible for the harmful and misleading external image that CS=programming.

- The external image reflects an internal self-image that started in the 1970s as "we are programmers" and matured in the 1990s to "we are masters of abstraction." These images do not foster collaboration with other fields and do not excite the curiosity of young people.

In this session, Astrachan and Denning will discuss what they see as high leverage points for curriculum innovation. Astrachan will focus on problem-based learning, a way of bringing students directly into contact with real issues in the world where computation can help. Denning will focus on the Great Principles of Computing and on the development of foundational skills of innovation among curriculum innovators. They will answer questions from the audience and provide feedback to the ACM Education Board and ACM Education Council.

Categories And Subject Descriptors

K.3.2 [Computer and Information Science Education]: computer science education, curriculum, curriculum themes, K.7 [Computing Profession]

General Terms

Design

1. OBJECTIVES

The 1960s and 1970s were a heady time for computing technologies. We had many dreams about what wonders computing might accomplish, and we discovered many principles for our computing technologies to embody. It was a time when many young engineers and scientist joined the field, saying, "I want to be part of that."

We encoded our discoveries into a curriculum framework that survives to the present day. That framework conveys the unwanted message that computing is mostly about programming. It does not display the rich diversity of interactions between computing and many fields of science and engineering.

To restore the sense of contact with big ideas and ongoing discovery, we now need to work with alternatives to the traditional CS curriculum model. Possible changes in key assumptions are listed in the table below.

We will illustrate how our two projects will contribute to demonstrating that the new assumptions are fruitful. Astrachan's project on problem-based learning breaks from a standard curriculum model, gets the students involved with the solution of real, interesting problems, and changes assessment from course achievement to problem achievement. Denning's project examines the structure and innovative implications of a Great Principles framework for

the body of knowledge, and directly supports curriculum innovators with ideas and personal skill development.

Traditional CS Model	Possible New CS Model
Standardized curriculum	Diversity of curricula
Consensus process to agree on curriculum	Individual departmental initiatives and innovations
Body of knowledge a taxonomy of core technologies	Body of knowledge a taxonomy of great principles
Students assessed by course achievement, faculty by student opinion surveys	Students assessed by project achievement, faculty by project and life coaching

We believe that computing curricula organized within these new assumptions will once again be vibrant and in contact with the big ideas and major opportunities knocking constantly on computing's door. Departments offering such curricula will once again inspire prospective students to say, "I want to be part of that."

In addition to conveying this message, we will solicit interaction and feedback from the audience, which we will make available to the ACM and IEEECS Education Boards.

OUTLINE

- *Problem overview (10 mins):* evidence that public image is CS=programming, historical analysis of why we embrace this as a self-image, and why it is hurting us. (Denning)

- *Problem-Based Learning (20 mins):* Description and examples about problem-based learning as a way to organize curriculum (Astrachan)

- *Great Principles and Innovation (20 mins):* Nature of the GP framework; new education and research opportunities arising from it. Applying results of separate innovation project to help departmental innovators succeed with their innovations (Denning)

- *Q&A session (25 mins).*

EXPECTATIONS

We expect this topic to be of fundamental interest to almost everyone attending the symposium.

We expect to be provocative enough that those attending will open up their thinking and explore new approaches to organizing their curricula.