

ICER "White Paper"

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1. Preparing undergraduates for computing careers: What are the biggest challenges that you face in your role (i.e., as an educator, employer, administrator, leader, other)?

The first challenge is a **low interest in the CS major** by high school students. Enrollment in computer science programs and participation in AP CS classes have fallen by half from the (admittedly frothy) late 1990s and continue to fall.

The fear of outsourcing has been a powerful demotivator. For example, look at the reader feedback to the recent BusinessWeek article http://businessweek.com/technology/content/dec2005/tc20051205_259817.htm. In the article, the Intel CEO Craig Barrett bemoans the fact that American students don't study science or engineering. Reader feedback has been almost exclusively negative. Parents write that they would actively discourage their kids from entering fields that high-tech companies such as Intel are currently outsourcing.

The next challenge is **the low rate of retention**. Incoming students show a lack of mathematical preparedness and low tolerance for tasks that require a sustained intellectual effort.

Finally, those students who do stay in the program face **insufficient job preparation**, particularly for interdisciplinary or customer-facing positions. For example, at my institution, computer science students interested in applications such as bioinformatics are held back by rigid curricula.

2. Transforming the educational experience: What might the community do to address the challenges you identified above?

We need to get in front of secondary students and their parents and make it plausible to them that (a) computing offers interesting career paths, not just the "lonely hacker in a cubicle" and (b) there will be a market for those careers.

3. Models for transforming computing education: What might an ideal undergraduate model for computing education look like in five years?

I don't believe that the typical undergraduate CS major program is fundamentally broken. I see the need for two incremental changes:

- Make the introductory classes more accessible
- Add an application-oriented facet to the major

In addition, CS general education courses and minor programs should be strengthened.

4. Inhibitors and strategies: Can you identify inhibitors that might prevent the nation from achieving goals it sets for computing education? Can you identify strategies that may enable the transformation of undergraduate computing education in the USA?

We live in a society that has, over the last thirty years or so, developed a pervasive lack of respect for math, science, and engineering. Up to now, we have dealt with the lack of local talent through immigration. However, the supply of foreign students has dwindled substantially in recent years, perhaps because of visa issues or simply because there are more attractive study opportunities elsewhere. In the future, we will need to grow more CS talent locally or fall behind the countries that do.

Support for change should come from the highest levels of society. In particular, the Federal government should energize students and parents, perhaps with another "put a man on the moon" like mission. The current pandering to the anti-science sentiment of religious extremists sends exactly the wrong message.

In absence of a grand top-down plan, our best hope lies in the fact that our discipline is **plain good fun** for a good number of people. We must get their **hearts and minds** in the secondary schools. CS education should start in junior high school and go well beyond "Introduction to Microsoft". When students learn about DNA in biology, they can't do anything with it beyond a lame lab where they run something through an expensive "black box" machine. CS students have it much better--they can tinker, make changes, see the effects of their own work, and create new things that were never there before.

We don't want to turn CS into the "new math". But we do want CS to have a presence in every junior high and high school, from "programming for everyone" courses to computer clubs and AP classes.

5. Who might participate: What stakeholders should be involved in designing strategies to catalyze the transformation of university computing education throughout the nation? What is the role of government in this process? Professional societies? Universities and faculty? Others?

(a) High-tech industry, to present an honest picture of outsourcing and the jobs that will be available (b) High school educators