

TechStart/ OCSTA/ OPAS Classroom Equity Workshop Year 2

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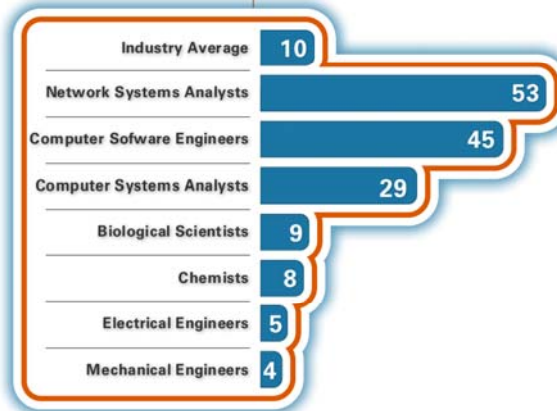
November 7, 2009

We need more Engineering, CAD & CS Students

- Survey given to incoming engineering & CS students at OUS institutions says:
 - Classroom experiences matter; 36% have taken CS, 40% have taken engineering/CAD/electronics
 - What aspects of learning are important to them?
 - 76% - solving problems, hands-on work, learning by doing
 - 68% - learning about science, technology, engineering & math
 - 55% - feeling challenged & growing into that challenge

Fastest Growing Occupations

Projected Percent Change,
STEM Occupations 2006-2016



Source: Bureau of Labor Statistics, Monthly Labor Review, November 2007

From Chris Stephenson, CSTA

The Importance of Transferable Skills

Students who study computer science learn a number of vital skills that can be transferred to any subject area and contribute significantly to their performance as professionals:

- Problem solving skills
 - Problem definition, solution design, implementation, testing, revision
 - Creativity, perseverance, teamwork
- Design skills
 - Designing and working to specifications
- Logic and reasoning
 - The ability to analyze a problem and break it down into a logical sequence of steps
- Computational thinking
 - Drawing on fundamental concepts in computer science to analyze and solve problems.
 - Thinking at multiple levels of abstraction

From Chris Stephenson, CSTA

What Works to get more students?

- Targeted recruitment
 - Students, parents, counselors, other teachers
- Out of School Time/ Expanded Learning Opps
- Meaningful Engagement
 - Projects, service learning, internships/jobs, exhibitions/competitions
- Connect to families and community resources
- Hands-on learning & problem-solving

Once you have them

from IES "Encouraging Girls in Math and Science"

- Tell them academic skills, including math, are expandable and improvable ... "use your brain and grow smarter"
- Provide prescriptive, informational feedback (the compiler/robot/prototype will help)
- Show girls and minorities role models who "look like me" – don't forget recent graduates!
- Create a classroom environment fostering long-term interest in math and science
- Provide spatial skills training

Working With Students

- **Ask your students how to make your courses better (these are your consumers... learn how to sell to them)**
- Actively recruit (letters inviting students to take your classes, open house for students and parents)
- Encourage students to explore a variety of course options
- Use a project-based learning approach and encourage students to design projects that interest them
- Use goal-oriented teaching strategies
- Take kids on cool field trips and use the teachable moment (laser tag, simulators, local manufacturing industries that use robotics)
- Bring back former students to talk about their experience at university or in the work world (near-peer mentors)
- Bring in industry speakers

From Chris Stephenson, CSTA

Gender, Race, and Ethnicity

- Be creative in your choice of assignments
- Work with students to find ways to help them achieve
- Be very aware of classroom dynamics
- Access good resources for addressing career options
- Talk about stereotypes with your students
- Bring in speakers who represent a broad ethnic spectrum
- Go that extra mile to be encouraging (this is the MOST important thing!)

From Chris Stephenson, CSTA

Chris' Five Favorite Teaching Methodologies

- Project-based learning (a constructivist approach)
- Real-world/authentic learning (from a learner-centered epistemology)
- Group work with an emphasis on so called “soft skills”
- Service learning
- Integrated/interdisciplinary learning

From Chris Stephenson, CSTA

Wonder and Awe vs. Shock and Awe

Shock:

- Beating them to death with syntax
- Programming, programming, programming
- No relevance to what you are or who you care about
- No big dreams, big goals, or unexplored frontiers

Wonder:

- Our discipline is more than rules and tools
- Incorporating and exploring the rich breadth of the discipline
- CS is solving problems that matter to people and communities
- We don't even know all the questions yet, let alone all the answers

From Chris Stephenson, CSTA

Strategies in the trenches

Support a team-based process and skills development

- Wait for answers
 - reward thorough thinking as well as fast thinking
- Ask leading questions
 - To lead students to successful solutions and deeper understanding
 - To lead mentors to understanding student thought processes
 - To encourage students to ask each other questions
- Reward effort and explanation as well as results
 - Encourage good process: research, experimentation, documentation, discussion, conclusion

Oshiro & Collay; inserted after the November 7 workshop.

More points from Diana Halpern

lead author, IES "Encouraging Girls in Math and Science"

- Some kinds of positive feedback have negative effects on future performance – praise doing rather than being; reward effort
- Stereotype threat has been shown to interfere with short-term memory; belief is not necessary
- Girls may need more positive reinforcement to develop confidence

*Education is **not** a zero-sum game.*

*All these recommendations are
good practices that will improve
interest and motivation for boys as
well as girls.*