Gender Equity from Multiple Perspectives:

Increasing Girls’ Participation in Computing
Speakers

• Lucy Sanders:
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  – International Society for Technology in Education

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Agenda

• What are the issues and why we should care?
• Why do universities care about equity?
• Why does industry care about equity?
• What is the role of education standards in ensuring equity?
• How do we teach in ways that engage all students?
The Importance of IT to the Nation and World

information technology
1: all forms of technology used to create, store, exchange and use information in its various forms;
2: the design and use of computers and communications to improve the way we live, learn, work and play.

► IT is pervasive
► IT drives the U.S. and global economy
► IT drives science and technology
► IT is changing the economic and social foundations of our society
► IT is a critical tool of national security
IT Jobs Are Growing Fast

Projected Percent Change, STEM Occupations 2004-2014

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percent Change</th>
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<tbody>
<tr>
<td>Industry Average</td>
<td>12</td>
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<tr>
<td>Computer Software Engineers</td>
<td>33</td>
</tr>
<tr>
<td>Electrical and Electronics Engineers</td>
<td>13</td>
</tr>
<tr>
<td>Mechanical Engineers</td>
<td>13</td>
</tr>
<tr>
<td>Biological Scientists</td>
<td>18</td>
</tr>
<tr>
<td>Medical Scientists</td>
<td>22</td>
</tr>
<tr>
<td>Chemists and Materials Scientists</td>
<td>8</td>
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</table>
Interest in Computing is Declining

Students Indicating Computing and Information Sciences as Intended Major on SAT

- **2001**: 58,773 males, 14,693 females
- **2002**: 55,802 males, 12,249 females
- **2003**: 44,897 males, 8,552 females
- **2004**: 39,456 males, 6,423 females
- **2005**: 37,315 males, 5,575 females
- **2006**: 33,338 males, 4,605 females

Male | Female
Diversity of Thought & Technical Innovation

• Men & women bring different life experiences to the technical design table

• Data points:
  - *NCWIT Women and IT Patenting Report*
  - *Product Design (NYT, 6/7/07)* – ease of use, visual appeal, physical differences

• Women are NOT, by and large, helping to design the technology of the future
Alarming Statistics for Girls/Women

56
Percent of Advanced Placement (AP) test-takers in 2006 who were girls

48
Percent of AP Calculus test-takers in 2006 who were girls

15
Percent of AP Computer Science test-takers in 2006 who were girls

54
Percent of 2005 Intel Science and Engineering Fair (ISEF) finalists in Biochemistry who were girls

24
Percent of 2005 ISEF finalists in Mathematics who were girls

12
Percent of 2005 ISEF finalists in Computer Science who were girls
Possible Causes
(Systemic and Implementation Issues)

• **K-12** – low exposure to discipline; computing is an elective; geeky image; beyond programming

• **Post-Secondary** – introductory courses; differing definitions of “failure” in tough disciplines; law of low numbers

• **Careers** – advancement on the technical ladder; few technical women luminaries

• **Implementation** - broader STEM efforts aren’t working for IT; IT needs its own national focus
Why do universities care about gender equity?

- **To be fair:** (of course) We must ensure that the student body reflects the rich diversity of the American population in all disciplines

- **To create future innovators and leaders:** (more importantly) Universities strive to create an excellent educational community to foster innovation and leadership in a rapidly evolving world
  - The educational environment should be a microcosm of the society in which graduates will explore their futures
  - The research environment should reflect diverse perspectives – if women are not represented, half the discoveries won’t be realized
  - The administration and leadership should be as diverse as the populations the University serves
Pipeline Issues

In American PhD-granting universities - Throughout S&E (NSF-2003), women make up:
• ~50% of new students
• 51.5% of bachelors recipients
• 44% of masters recipients
• 37% of PhD recipients
• 38% of assistant professors
• 32% of associate professors
• 18% of full professors
• 32% of deans, department heads/chairs
• 18% of presidents, provosts, chancellors

In Computing (CRA-2006), women make up:
• ~12% of new majors ↓
• 14.2% of bachelors recipients ↓
• 22.9% of masters recipients ↓
• 18.5% of PhD recipients ↓/↑
• 18.5% of assistant professors ↑
• 13.1% of associate professors ↑
• 10.4% of full professors ↑
Action Required

- Universities must reflect gender equity at all levels
  - in the classroom (grad and ugrad)
  - in the laboratory
  - on the faculty
  - on the staff
  - in administration

Promising actions
- Advocacy in public statements
- Intentional role modeling and mentoring
- Outreach to convey opportunity and introduce computing (hands-on/real-world)
- Strategic & targeted recruiting
- Creative “on-ramps” to return/enroll
- Encourage persistence, make it meaningful, employ inclusive pedagogy and collaborative learning, improve classroom climate, establish affinity (peer support) groups
- Proactive advertising for hiring
- Salary/promotional equity and equitable work/life arrangements
- Professional and leadership development
IT is an Educational Issue

• IT skills are required to survive in the 21st century

• IT is a part of every other professional discipline – e.g., medicine, engineering, business, law – and every field of innovation and industry – e.g., automotive, aerospace, transportation, power, healthcare, biotech, environmental, nanotechnology, financial, management, planning and policy

• As IT educators, we help the next generation of girls succeed in whatever career they choose

• Let’s inform girls, parents and counselors about the need for IT fluency!
Why Does Industry Care About Gender Equity

• Pipeline Issues Are Critical

• Corporate Citizenship Matters

• It’s Good Business
Key Pipeline Issues

• Industry cares about filling the “pipeline” – will we have enough workers with computer science skills in the future?
  
  – 1,000,000 new professional IT jobs by 2014 (US Dept. of Labor)
  
  – 80,000,000 Baby Boomers will retire over the next 25 years

  – Industry depends upon an ecosystem of customers and partners who have technically literate employees

• Who will fill these jobs?
IT is a Jobs Issue

• Jobs in computing are well-paying jobs

• Women have achieved parity: law, medicine and business

• As adults, we can help the next generation of girls succeed in computing careers

• Let’s inform girls and parents about IT jobs!
A Woman’s Place is in IT

• It benefits industry & consumers when women create & design technology in addition to using it

• Women currently constitute 42% of the US workforce

• Women comprise only 26% of the professional IT workforce. We’re leaving a lot of untapped talent on the table

• Women want meaningful careers. What could be more meaningful than creating the future?
What’s the Connection Between Standards and Equity?

• Standards define what students should know and be able to do

• Standards are about excellence and equity
  – <content area> standards for all students

• Standards resulted from the commitment to educate all our children for life and work in the 21st century.
Standards and Equity

Appropriate use of standards implies:

• Establishing shared expectations
• Opportunity
• Appropriate and valid uses of assessment
## Essential Conditions

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<tr>
<th>• Shared Vision</th>
<th>• Curriculum Framework</th>
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<tr>
<td>• Implementation Planning</td>
<td>• Student-Centered Learning</td>
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<td>• Consistent and Adequate Funding</td>
<td>• Assessment &amp; Evaluation</td>
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<td>• Equitable Access</td>
<td>• Engaged Communities</td>
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<td>• Skilled Personnel</td>
<td>• Support Policies</td>
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<tr>
<td>• Ongoing Professional Learning</td>
<td>• Curriculum Framework</td>
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<td>• Technical Support</td>
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If we don’t meet the essential conditions, if we don’t provide the environments, teaching, and support necessary for all students to achieve the standards, then what we end up with is...
If we don’t meet the essential conditions, if we don’t provide the environments, teaching, and support necessary for all students to achieve the standards, then what we end up with is *less than what we set out to achieve.*
What Needs to Change?

- We have to shift the focus from machines to human beings
- We have to engage students by connecting with their reality and their daily lifestyles
- We have to stop using the same old assignments
- We have to let go of some of the control
- We have to be prepared to teach all of the students
- We have to improve our pedagogy
Why Must We Change?

• Our discipline is constantly evolving
• Our national demographics are changing
• Our students are changing
• The world around us is changing
• Technology is changing how people learn
• All of the issues we are facing now with regard to the computing pipeline and the lack of equitable engagement are going to get worse
What Does Not Need to Change?

- Our creativity
- Our love of teaching and of our disciplines
- The academic rigor of our courses
- The commitment to ensuring that students acquire core concepts
- The commitment to ensuring that students can apply their knowledge appropriately and effectively
How Do We Change?

• New Ways of Teaching
  – Student-driven learning
  – Project-based learning
  – Culturally-focused learning (community based)
  – Service Learning

• New ways of designing the curriculum
  – Computational thinking
  – Media-based curriculum
  – Pair-programming
  – Robotics
  – Game-based learning
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