



ENGAGING UNDERREPRESENTED YOUTH IN COMPUTER SCIENCE

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Assumptions

- Our Audience
- Defining underrepresented
- Principles for teaching underrepresented youth
 - Cultural competency and relevance
 - Unique barriers to participation
 - 'Whole child' vs. colorblind strategies

Survey of the Room

- CS bachelor's degree (or higher)?
- 25%+ youth from underrepresented populations?
- Less than 2 years of CS teaching experience?

Session Flow

- Panelist presentations
 - Partnerships
 - Parents
 - Pedagogy
 - Pathways (Practice)
- Q & A

Level Playing Field Institute

Mission

Level Playing Field Institute is committed to eliminating the barriers faced by underrepresented people of color in science, technology, engineering and mathematics and fostering their untapped talent for the advancement of our nation.



Areas of focus



To improve access and opportunity in STEM, LPFI:

- Operates **STEM-Focused Education Programs**
 - 5-week, 3-summer H.S. residential program (SMASH)
 - School year out-of-school M.S. program (SMASH:Prep)
- Executes Innovative **Computer Science** Initiatives
- Conducts **Research** on STEM Equity and Opportunity.



Underrepresentation in CS

- Nationwide, African Americans and Latinos combined account for only:
 - **17%** of all computer science Bachelor's degrees
 - **7%** of all computer science Ph.D.'s
 - **6%** of computer science faculty
 - **9%** of the computing workforce nationwide

Source: NSF, 2012, 2013



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- Causes of underrepresentation include:
 - Lack of engaging /culturally relevant CS curriculum, and lack of access to rigorous CS courses
 - Lack of diverse role models & peer networks
 - Negative racial & gender stereotypes about ability
 - Unwelcoming school & workplace environments



LPFI's programs

- To engage underrepresented students, our summer and school-year CS programs include:
 - Diverse CS role models & peers
 - Speakers of color from tech industry
 - CS-focused field trips
 - Community-building activities
 - Family recognition events
 - Addressing misconceptions about CS
 - Youth empowerment (asset-based lens)
 - Rigorous, culturally-relevant CS curriculum



- Curriculum content connects to students' life experiences
- Student-directed projects & topics
- Inquiry-based, social justice focus (solve community problems)
- High school: ECS, BJCx
 - Online freely available curricula
- Middle school: Communication technologies & mobile apps
 - App Inventor
 - Podcasting, web design, video game programming



Outcomes (2014 pre to post)



- 94% of students increased CS assessment scores
- Statistically significant increase in students' familiarity with programming languages
- Significant increase in students' attitudes towards CS
- Percentage of students who:
 - "like" computer increased from 59% to 87%
 - see examples of CS in their everyday lives increased (69% to 86%)
 - believe CS can be a tool to solve community issues increased (63% to 80%)





“My computer science class had the biggest impact on me and I have learned that I have an interest in computer science.”



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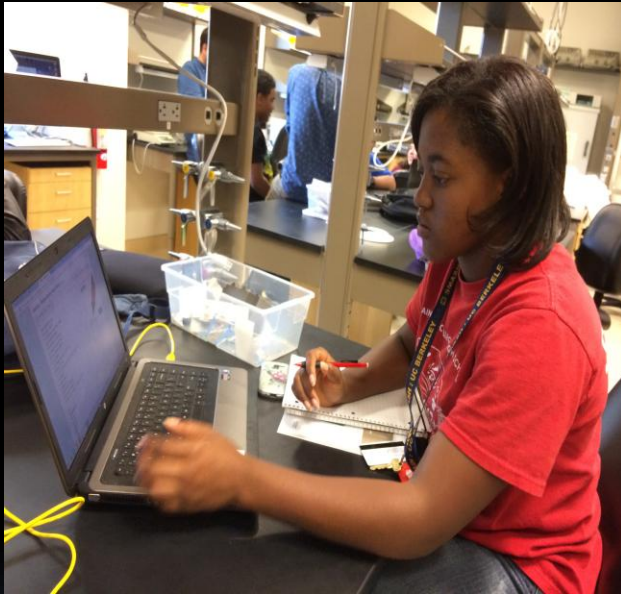
“I learned how to connect social justice to mobile apps.”



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Broadening CS participation: Partnership examples

1) Teacher at underresourced OUSD HS created AP CS course from ground up



- 100% low-income students of color
- Industry volunteers co-teach through TEALs (nationwide resource of volunteer CS teachers)
- Outside orgs for pre-AP exposure (Girls Who Code, Girl Code, Yes We Code, CodeNow)
- Guest speakers
- Coding club
- Start-up weekend/Hackathons

2) OUSD CS Working Group

- Co-founded by OUSD and LPFI
- CS, Math, & Science teachers, administrators, OUSD board member, non-profit partners
- Survey on assets & challenges to broadening CS sent to teachers & admins
- Committees formed based on results, to address challenges and design policy vision



Extracurricular Activities

- Hackathons and competitions
- Developer Conferences
- Mentorship
- Internships
- Family Engagement
- Entrepreneurship



Hackathons/Competitions UY:

- LPFI Level the Coding Field
- Black Code Girls
- Qeyno Labs
- Yes We Code Hackathons
- HackerFund (school specific)
- Technovation Challenge
- NCWIT Aspirations in Computing

Developer Conferences:

- Grace Hopper Celebration of Women in Computing
- Google I/O
- F8
- WWDC

Mentorship and Internships:

- iMentor (AFSE)
- Mentorship Local professional organizations
 - NSBE
 - SHPE
 - SWE
- INROADS
- Various Company HS Internships
 - Microsoft
- Various National Laboratories

Family Engagement:

- Multi-lingual Information on what is CS
- Parent-Student Workshops
- Computer Science Fair/Open House



Entrepreneurship:

- Selling what you build
- Design Thinking Skills
- Real-world Product Development
- Rapid Prototyping
- Economic Opportunity

Culturally Relevant curriculum

- Culturally Relevant Pedagogy vs. Culturally Responsive
 - Find ways to build upon culture of the student
 - Bring in relevant industry conversation



Sense of Belonging CRITICAL

- Student led projects
 - ✦ This fosters a deeper sense of belonging



Adding Value to Community

- Have student share their work with external community
 - ✦ Let them get used to getting feedback
 - ✦ Let them get used to adding value to larger CS community
 - ✦ Kano World
 - ✦ Scratch Community
 - ✦ Github and meet ups (Where appropriate)



Gender Matters

- Gender matters even in curriculum



Slides and Additional Resources

- Slides - TBD
- Resource List - <http://bit.ly/1RvtPps>

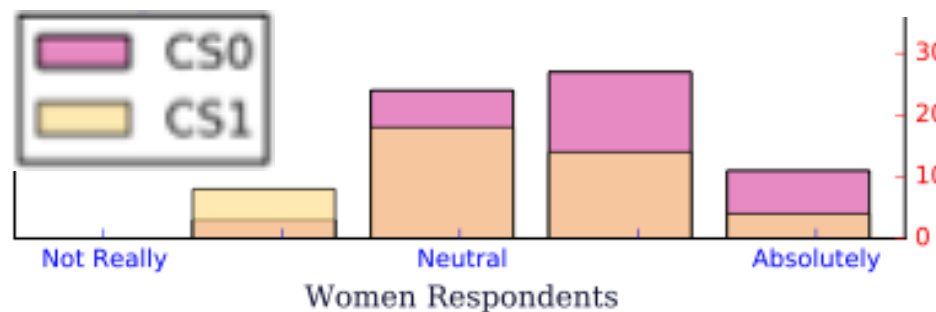
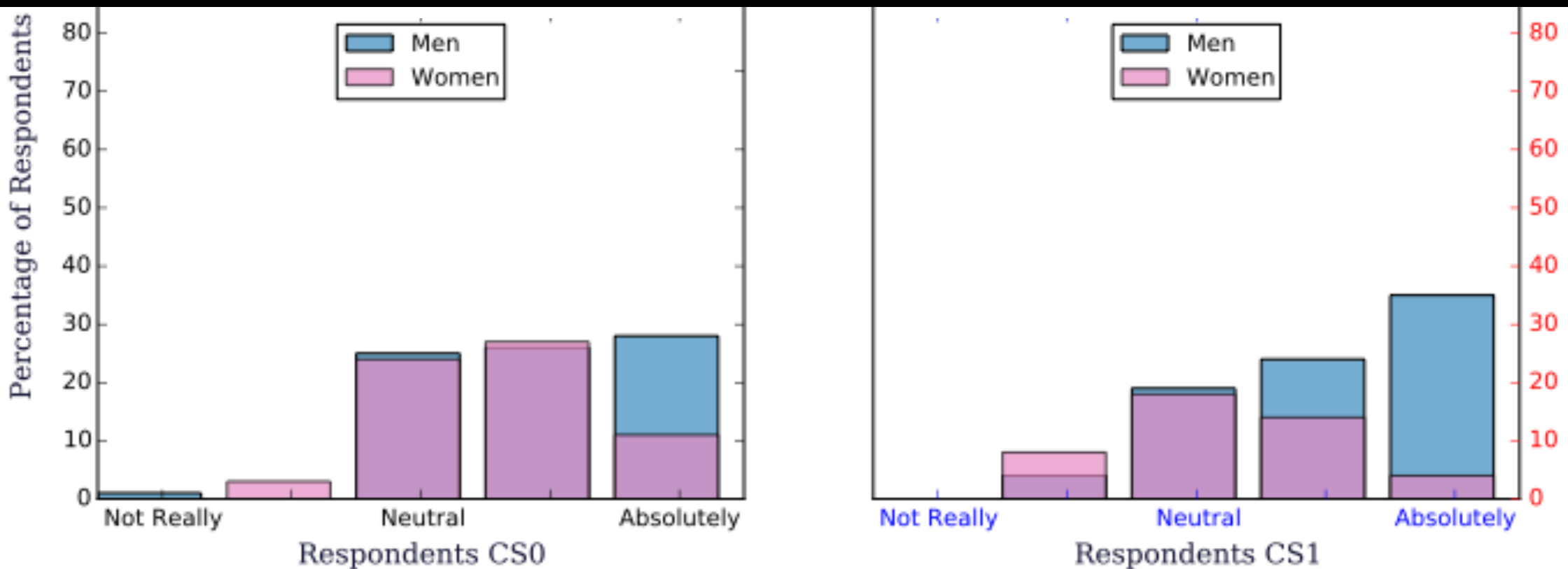
Culturally Relevant curriculum

- **Culturally Relevant Pedagogy**
 - Find ways to build upon culture of the student
 - Bring in relevant industry conversation
 - Make sure that our teaching is aligned with what best serves our students.
 - Gladson Billings (guru of culturally relevant teaching),
“we should be injecting EDUCATION into CULTURE and not the other way around”

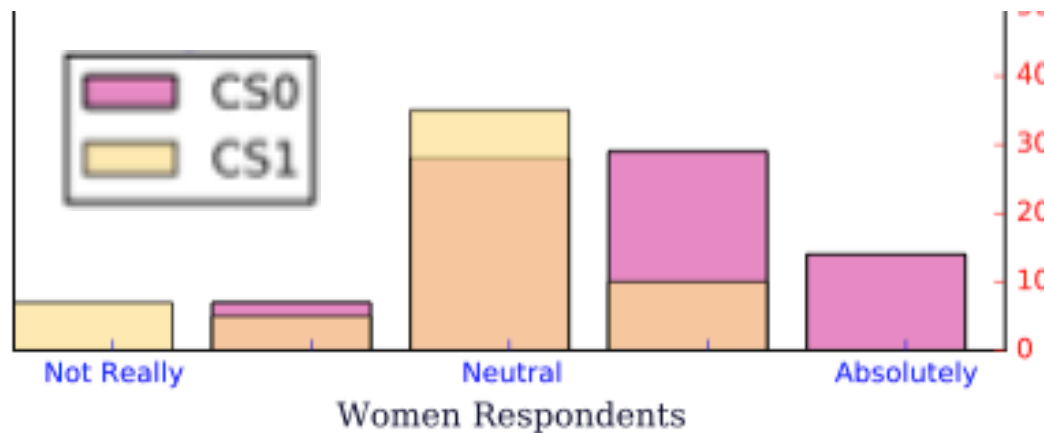
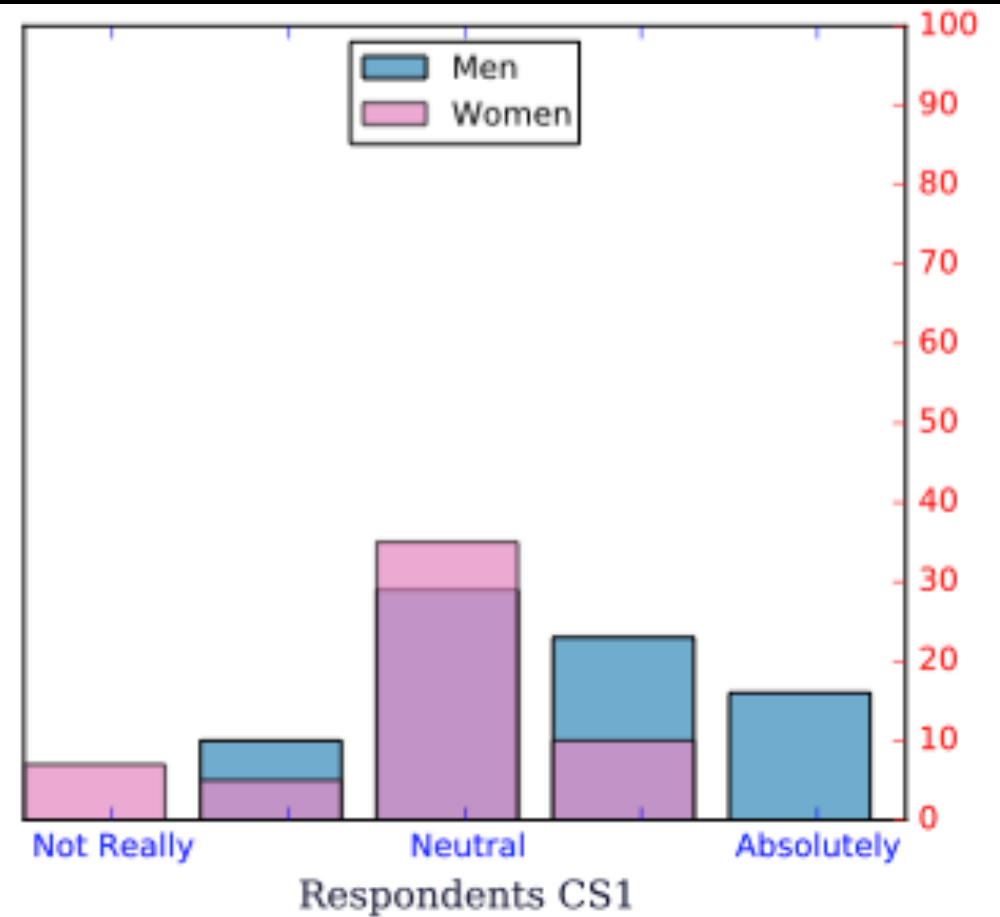
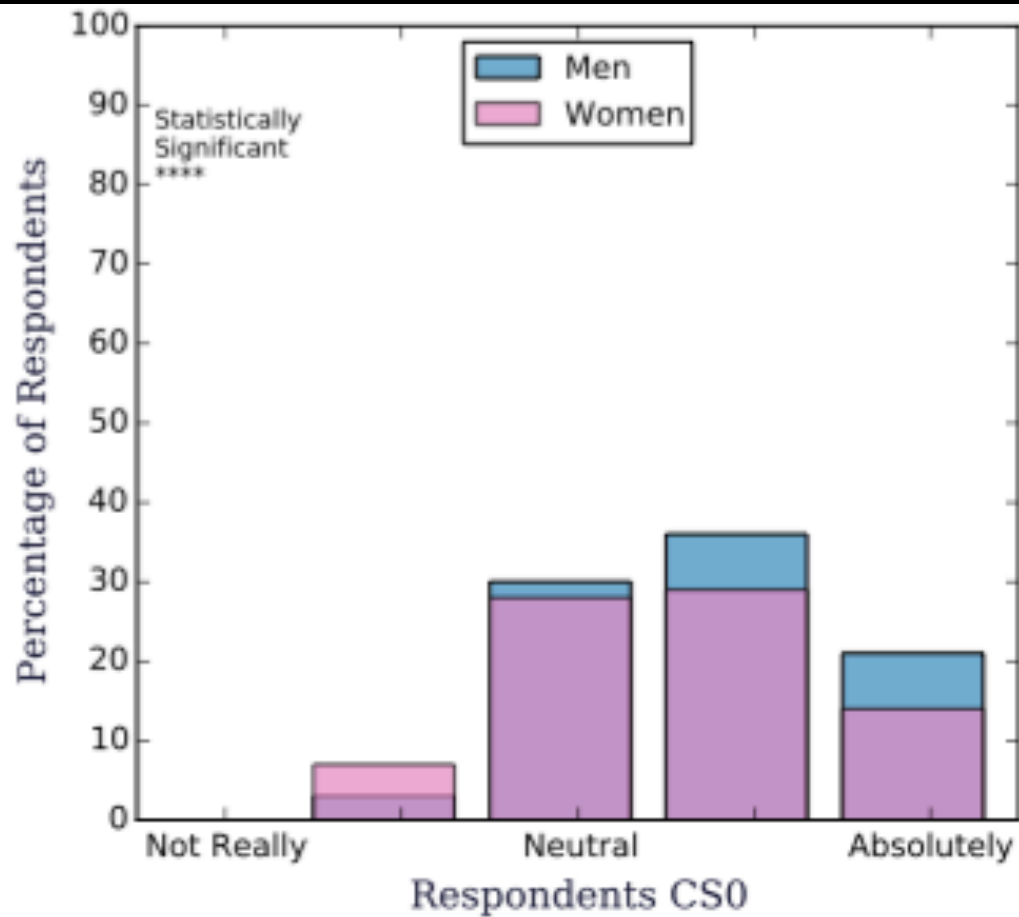


Sense of Belonging CRITICAL

- Student-led projects foster a deep sense of it
 - "In this class, I feel I belong"

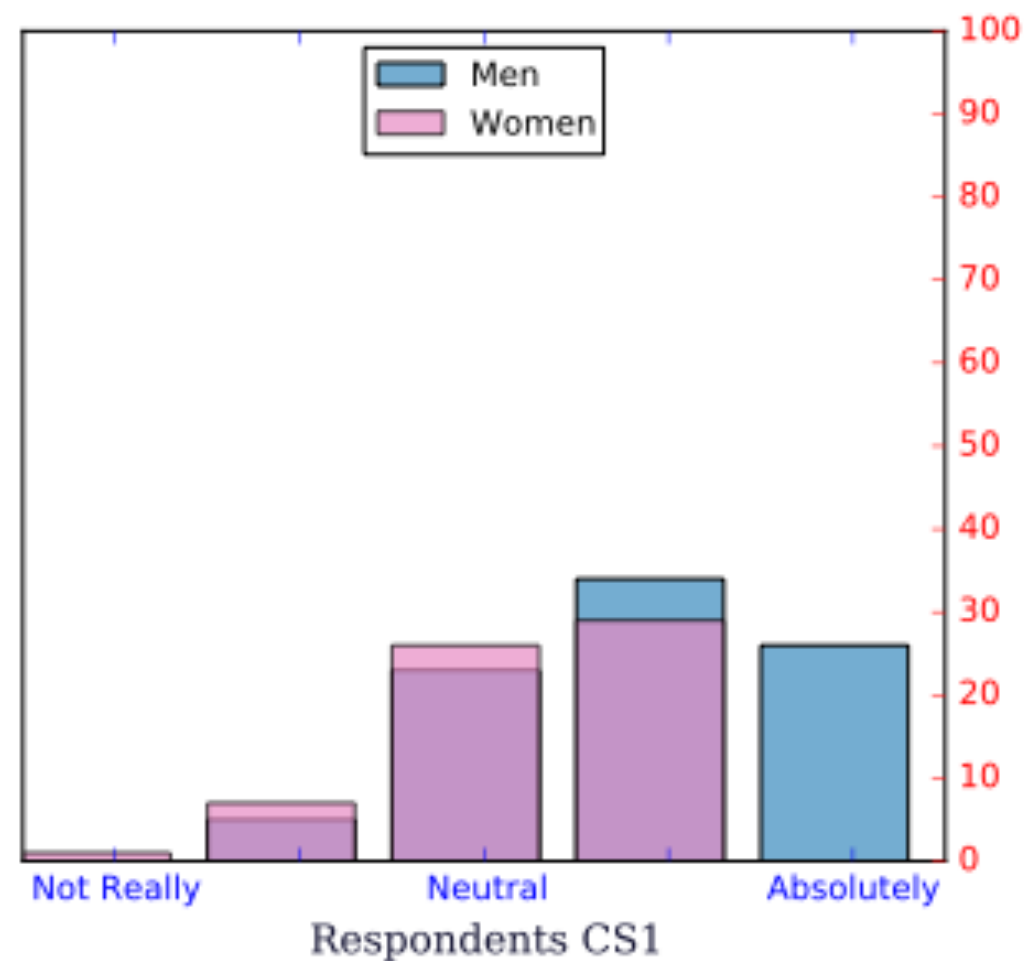
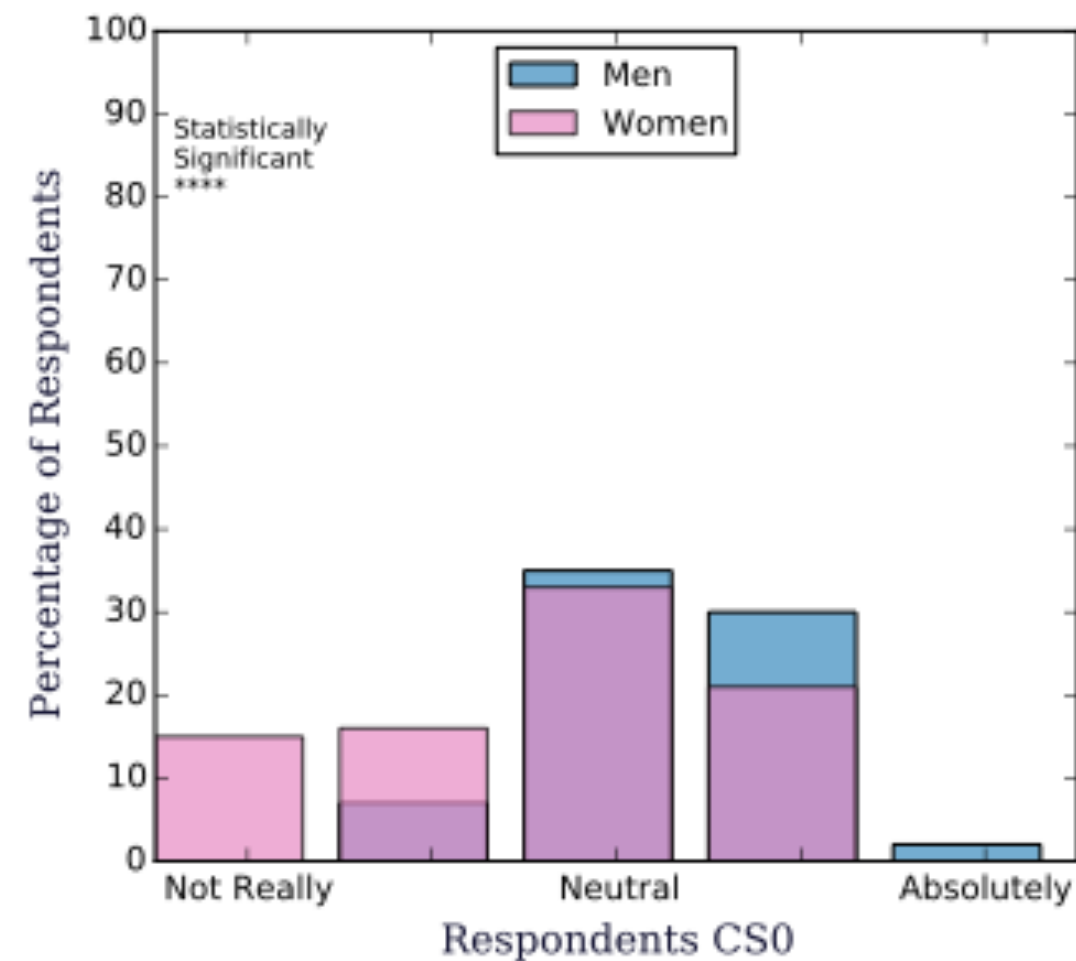


Belonging "I feel my ideas count"



Gender Matters

- Gender challenges still persist
 - “I know how to write a computer program to solve a problem”



Adding Value to Community

- **Have student share their work with external community**
 - Let them get used to getting feedback
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 - Kano World
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CSTA Golden Gate chapter @ UC Berkeley
(we gather Bay Area HS Computing teachers monthly)



CS Education Day @ UC Berkeley
(during CS Education Week, first week every December)



BJC Award-winning Projects being demonstrated at CS Ed Day 2010
Let older students show younger students great examples of what can be done!



BFOIT Middle-School (SCI-FY) and High-School (ITLP) Summer Graduations
2-week Summer Institute in August, Monthly meetings
Let them demo their (choose-your-own) final projects to friends and family!



CS Scholars Program follows a cohort model; these students take the same courses and are placed in the same discussion sections in our CS program.

Keep a cohort together so folks never feel isolated!

One way to get computing into K-12...

- **New Course: “Computer Science : Principles”**
 - **Engaging, accessible, inspiring, rigorous**
 - Focused on the fundamental concepts of computing (Computational Thinking)
 - An impetus for college curriculum reform
- **SINGLE SOURCE OF NATIONAL LEVERAGE!**



csprinciples.org



what is CS Principles?

7 big ideas

computing is a **Creative** activity.

- **Abstraction** is used to manage complexity and detail to facilitate focus on relevant

Data and information facilitate the organization of knowledge

- **Algorithms** are used to develop and express solutions to computational problems.

Programming enables problem-solving through human expression

of knowledge

- the **Internet** pervades modern computing

- computing has global **Impacts**.

check out the complete curriculum framework at : csprinciples.org

what is CS Principles?

6 computational thinking practices

connecting computing

developing computational

tracting

artifacts

- communicating
- collaborating

check out the complete curriculum framework at : csprinciples.org

Two Performance Task Assessments

- **Explore PT**

- "...you will explore a computing innovation of **your choice**"

- **Create PT**

- "This performance task requires you to develop a program **on a topic that interests you.**"



From the Curriculum Framework

- **EK 7.4.1A** The innovation and impact of social media and online access **varies in different countries and in different socioeconomic groups.**
- **EK 7.4.1C** The global distribution of computing resources **raises issues of equity, access, and power.**
- **EK 7.4.1D** Groups and individuals are affected by the **“digital divide” — differing access to computing and the Internet based on socioeconomic or geographic characteristics.**





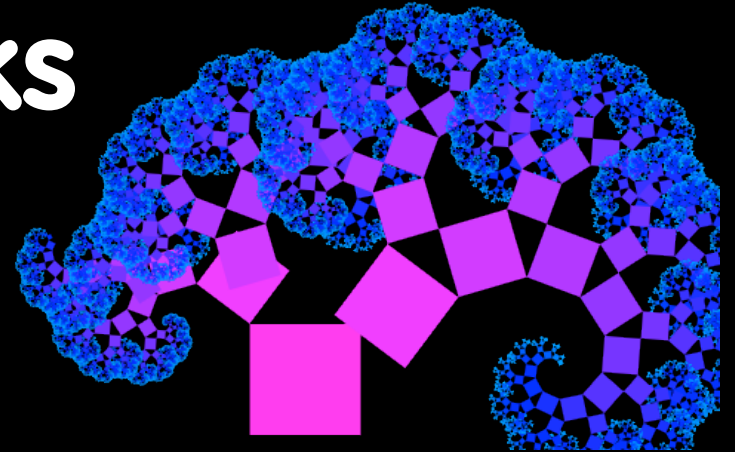
UC Berkeley's BJC

The Beauty and Joy of Computing



What we've found works

- Make **"Fun"** a learning objective!
- Name your course accurately
- Pair Programming throughout
- Read & comment about each others work
- Make the class free (no barriers to entry)
- Awesome TAs as role models (50-50)
- Lab-centric instruction, enthusiasm!
- Program powerful ideas with blocks
- Have open-ended projects



bjc.berkeley.edu