OVERVIEW

This is a description of how we’re moving the needle with our BJC course and professional development for high school teachers around the country!
Supporting K-12 CS
What Universities Are Doing & Can Do

OVERVIEW
This is a summary of what academics have been doing (and can do) to broaden participation in K-20 computing.

UC Berkeley
Sr Lecturer SOE
Dan Garcia
Three big challenges for our future

The computing community in the U.S. faces three significant and interrelated challenges in maintaining a robust workforce.

1. Underproduction
2. Underrepresentation
3. Lack of a presence in K-12 education

– Source of next 7 slides: Jan Cuny, NSF Program Manager
Underproduction

United States: Number of Degrees Earned in CIS vs. Projected Average Annual Number of Computing Job Openings

- 144,500 Average Annual Openings
- 88,161 Annual Degrees Earned
  - 1,340 Doctoral
  - 17,312 Master's
  - 39,701 Bachelor's
  - 29,808 Associate's

Underrepresentation: Women

- Gender % of HS Advanced Placement exams

- Biology: 58% Female / 42% Male
- Statistics: 49% Female / 51% Male
- Calculus: 51% Female / 49% Male
- CS: 19% Female / 81% Male

—Credits: NCWIT & the College Board
Underrepresentation: Ethnic Minorities

We receive just:
10.6% of undergrad, 4.8% of masters, and 3.6% of Ph.D. degrees in computing.

(but are 28.5% of US Population!)

— Taulbee Data, 2011
Consensus is to start in high school

- Things are really bad there.
- Without the HS piece, anything we do for middle school will be lost.
- Without the HS piece, anything we do at the college level will be insufficient

--- Jan Cuny, NSF
How can we 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
  - Available nationwide (IB as well)

- SINGLE SOURCE OF NATIONAL LEVERAGE!

[CollegeBoard csprinciples.org]
what is CS Principles?

7 big ideas

- computing is a **Creative** activity.
- **Abstraction** reduces information and detail to facilitate focus on relevant concepts.
- **Data** and information facilitate the creation of knowledge.
- **Algorithms** are used to develop and express solutions to computational problems.
- **Programming** enables problem solving, human expression, and creation 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 artifacts
- abstracting
- analyzing problems and artifacts
- communicating
- collaborating

check out the complete curriculum framework at: csprinciples.org
The CS10K Project

Goal: get engaging, rigorous computing curricula into computing courses in 10,000 high schools, taught by 10,000 well-prepared teachers by 2016.
UC Berkeley’s BJC
The Beauty and Joy of Computing

Grant Winner
• 2009Fa : 16 students (pilot)
• 2010Fa : 90 students
• 2011Sp : 90 students
• 2011Su : 25 HS teachers online!
• 2011Fa : 250 Students
• 2012Sp : 250 Students
• 2012Su : 70 HS teachers online!
• 2012Fa : 250 Students & 60 UCB online pilot
• 2013Sp : 250 Students
• 2013Su: 172 HS teachers in “BJC Family”!
• 2013Fa : 360 Students
• 2014Sp: 250 Students

cs10.berkeley.edu
BJC in one slide

**Big Ideas of Programming**
- Abstraction
- Algorithms (2)
- Recursion (2)
- Functions-as-data, \( \lambda \) (2)
- *Programming Paradigms*
- *Concurrency*
- *Distributed Computing*

**Beauty and Joy**
- All lab work in pairs
- Two 3-week projects in pairs
  - Of their own choice!!
- One 3-page blog
  - Of their own choice!!

**Big Ideas of Computing**
- HowStuffWorks
  - 3D Graphics
  - Video Games
  - Computational Game Theory
- Research Summaries
  - AI
  - HCI
- Apps that Changed the World
- Social Implications of Computing
- Saving the World with Computing
- How Twitter Works (guest lecture)
- Cloud Computing
- Limits of Computing
- Future of Computing
BJC curriculum and team leads

- **Dan Garcia**
  - Sr Lecturer SOE

- **Brian Harvey**
  - Sr Lecturer SOE

- **Tiffany Barnes**
  - NC State

- **Luke Segars**
  - TA Grad Student (Now @ Google)

- **Colleen Lewis**
  - TA Grad Student (Now Prof @ Harvey Mudd)

...many others @ Cal!
BJC Initial High School Collaborators

Ray Pedersen
- Albany HS

Sean Morris
- Ralph Bunche HS

Eugene Lemon

Josh Paley
- Gunn HS
What differentiates BJC?

- More programming-heavy
  - Recursion
  - Functions-as-data, \( \lambda \)
  - Concurrency, Distributed computing
- **Graphic language** makes difficult coding concepts easier
- **Unintended implications** of computing technology
  - Balanced optimism with pessimism
We started from Scratch, literally…

**BYOB/Snap! add functions, generic lists, \( \lambda \)**

- **BYOB (Build Your Own Blocks) → Snap!**
  - developed by Jens Mönig w/design input and documentation from Brian Harvey & others @ Cal
  - Leverages awesomeness of Scratch (design, simplicity, multi-media, community of users)
  - Snap! is in Javascript, in-the-browser

Building a For Loop and calling it. What other languages make it this easy?
How we teach Recursion … Vee
You can make a mobile app too!

tinyurl.com/bjctapia
BJC Testimonials (x17)

Justin Barnes (L) & Ian Birnam (R)

The class itself was amazing... I had a really fun time... building our own projects was great... The lectures were really interesting... I never really got into computing... but because of this class I'm really interested in computing and being a possible major...

Justin: The class is incredibly engaging. The atmosphere is unlike anything I've ever taken here. I would recommend it in anyone even remotely interested in computers should take it.
CS10: Beauty & Joy of Computing

Highest % Women in intro CS…

ever! (over 50%)
Recognition for BJC’s Diversity success

For the First Time, Women Outnumber Men in a UC-Berkeley Computer Science Course

We need a moon shot to propel women into computer science careers

Women Outnumber Men For The First Time In Berkeley’s Intro To Computer Science
BJC in High School Testimonial

From Nathan Mattix (Piedmont HS)

“BJC totally rocks! We are having a blast this year and it is only going to get better from here. The students love it and their projects are amazing. This may be the best course ever invented. We have five times more girls than last year, and we smashed our enrollment record for girls. We retained all of the BJC girls. Girls almost always are one and done at PHS.”
PD Model

- **Cluster:** University hub, strong CSTA chapter
  - “Petals around flower”
- **We train 1 week F2F**
  - Show them AP CS:P, online tools, hard prog ideas
- **4 wks online course**
  - Intensive, subsample of course, TA help, weekly calls
- **1 Epilogue F2F week**
  - Wrap up, exam, project, map to HS situations, CoP, PCK
- **Monthly support**
  - Through local CSTA chapter
We’re reaching 150+ teachers & profs!

Year 1: We come to them (> 20)
Year 2+: Bring them to us
TEALS brings 44 more teachers this yr!

Fostering Tech Talent in Schools

"We are taking the kids farther than I could do," said Michael Braun, a teacher who is working with the Microsoft volunteers.

By NICK WINGFIELD
Published: September 30, 2012

SEATTLE — Leandre Nsabi, a senior at Rainier Beach High School here, received some bluntly practical advice from an instructor recently.
BJC Future: CS Education Group @ Cal

- **Dan Armendariz**
  - Nonlinear edX lets you “test out” of units you know

- **Omoju Miller**
  - Culturally-relevant curricular unit on Big Data

- **Zack MacHardy**
  - Adaptive assessment

- **Jon McKinsey**
  - Remote Pair-Programming
BJC Future: edX SPOC

- SPOC: “Small Private Online Course”
  - Hybrid MOOC
  - Think of MOOC = ebook
  - Teacher signs up class, picks parts they want
  - The forum discussions are self-contained
  - Teacher gets analytics of only their students
  - Teacher is in control
BJC Summary

- BJC has been transformational
- On giants’ shoulders...
  - AP CS:Principles Framework
  - Scratch
  - Blown to Bits
- Future: Bright!
  - Improvements to Snap!
  - edX driving our PD
  - edX MOOC SPOC