Piloting CS Principles: A First Hand Experience by K-12 Teachers

http://csprinciples.org
Ann Drobnis, PhD: adrobnis@nsf.gov
Albert Einstein Distinguished Educator Fellow
The National Science Foundation
Directorate for Computer & Information Science & Engineering
Thomas Jefferson High School for Science and Technology
CSTA of Northern Virginia Chapter President
The computing community in the U.S. faces three significant and interrelated challenges in maintaining a robust IT workforce.

1. Underproduction
2. Underrepresentation
3. Lack of a presence in K-12 education
Computing is significantly under producing postsecondary degrees

**United States National Computing Data**

Comparison of CIS Degrees Earned Nationally and Projected Average Annual Computing Jobs

Projected job openings that could be filled by computing degrees: 61%

**Education Indicators**

- AP Computer Science Test-takers
  - 2009: 21,727

- Degrees Earned in Computer and Information Sciences
  - 2007-2008 Academic Year
    - Associate's: 29,808
    - Bachelor's: 39,701
    - Master's: 17,312
    - Doctoral: 1,340

**Projected Workforce Indicators (2008-2018)**

- Average Annual Computing Job Openings: 144,500
- 10-year Percent Change in Computing Jobs: 22.19%
- 10-year Change in Number of Computing Jobs: 745,700

Data: BLS and NCES, Slide: NCWIT
Overall student interest in computing is very low, but especially in females:
And computing has a long standing underrepresentation of minorities.

URMs receive just: 10.6% of undergrad, 4.8% of master’s, and 3.6% of Ph.D.s degrees in computing. —Taulbee Data, 2011
Computing does not have a presence in K-12.

The percentage of U.S. high school students taking STEM courses has increased over the last 20 years across all STEM disciplines except computer science where it dropped from 25% to 19%.

—2009 NAEP High School Transcript Study

- NCAA doesn’t count CS courses in eligibility for college sports
- No state requires a CS course for graduation.
- Only 14 states use a reasonable number of CSTA’s K-12 standards
- Just 9 states count CS a math or a science
- In 2011, only 17,413 students took the AP CS test, 267,772 took calculus, 144,984 took biology, 142,910 took statistics
- AP CS A has the worst gender balance of any of the AP tests
The **CS 10K Project** aims to transform computing in high school.
The CS 10K Project is centered on two new courses: Exploring Computer Science (ECS) and a new Advanced Placement course, called *CS Principles (CSP)*.

**Why AP?**
- Often the only CS course that carries college prep credit
- Attractive to students & schools
- 2,000 CB-audited teachers
- Single point of national leverage
- Fidelity of replication

**Why ECS?**
- Non-AP (seen by some as less intimidating)
- Broad Ideas
- College prep & CTE credit
The computing community supports the development of the CS Principles course, and has moved it past milestones.

2009-2010
  ✔ Course framework
2010-11
  ✔ Pilot I: Five colleges
  ✔ College Survey
  ✔ College attestation/support
2011-12
  ✔ Pilot II: ~20 colleges, ~40 high schools
2012-
  Train 500 teachers, Summer
NSF has made six ~$1M Awards for PD and will make another round of Awards upcoming
CS Principles Big Ideas

• Creativity
• Abstraction
• Data
• Algorithms
• Programming
• Internet
• Impact
CS Principles is focused on the fundamental concepts of computing; it is rigorous but engaging, accessible, and inspiring and focuses on problem-solving.

“Seriously, why doesn’t everybody take computer science??”

—CS Principles Student
Rebecca Dovi:

rdovi@hcps.us
Teacher, Computer Science
Patrick Henry HS, Ashland VA
President CSTA Central VA
Rich Kick:

rkick@conejo.k12.ca.us

Teacher, Computer Science
Newbury Park High School, Thousand Oaks CA

member Southern California CSTA
Internet Scavenger Hunt

Generating Binary Coding Trees

Individual projects
Deepa Muralidhar:

deepa_muralidhar@gwinnett.k12.ga.us

Teacher, Computer Science
North Gwinnett High School, Gwinnett GA

Georgia CSTA Cohort Leader
CS Principles in my classroom

• Problem Solving

• Logic Development

• Impact of computer science in society
• Group Projects : Open Ended

• STUDENT SAMPLES
  – Big Idea III: Data

  – Final Project: Flash based project
How to market consumables to teenagers as their tastes in style change. Sample Size = 22 students

Q1: Do you wear the same pair of shoes every day?

Q2: What is your shoe preference from the following brands: Nike, Adidas, Puma, or Other (a brand not listed)?

Q3: Would you like shoes with laces or no laces?

Q4: Do you prefer style over comfort or would you want both?
• Give them the tool
  or
• Give them the topic

Always:
• Give them rubrics
Baker Franke:
bfranke@ucls.uchicago.edu

Teacher, Computer Science
Chicago Lab High School, Chicago IL

Vice-President Chicago CSTA
Illinois CSTA Cohort Leader
Baker’s CS Principles Tips

1. DO NOT let it turn into a programming course

2. REMEMBER CS Principles is supposed to be a game changer

3. DESIGN projects/activities that cover as many learning objectives as possible.
Baker’s Design Process

- Unplugged Foundation
- Unplugged Creation activity
- Demonstration
- Plugged version of Creation activity
- Imitation
- Plugged Project
- Repetition

Principles
Early Course Example

• Homework: what is #hashtagging?”

Where did it come from?
Who invented it?
Why does it exist?

• Write your answers in a discussion on Piazza
Read chapter 1

Instead of taking notes in the margins, write hash tags

How would you hash tag this?
Early Course Example

Mode: User's name will be logged and shown with answers

Enter the 10 (exactly 10) tags you want to use from the Rushkoff reading.
Enter each tag on its own line.

Submit your answers
Cancel
9/9/11 Wordle Assignment

Rushkoff’s introduction summarized in a Wordle.

As defined at TeachingHistory.org, Wordle is a "program that generates a word cloud—a graphic that amplifies font sizes of words based on how frequently they are used in the material you've provided."

This Wordle is a digital summary of the key concepts proposed in the introduction to Rushkoff’s book, Program Or Be Programmed as defined by the CS Principles class. The
Websites:

- **CS Principles:**
  - [http://www.csprinciples.org/](http://www.csprinciples.org/)

- **Rebecca Dovi:**
  - [http://supercomputerscience.blogspot.com/](http://supercomputerscience.blogspot.com/)
  - [http://hcps.us/phhs/comsci/cs_principles.htm](http://hcps.us/phhs/comsci/cs_principles.htm)

- **Baker Franke:**
  - [http://tinyurl.com/brugow2](http://tinyurl.com/brugow2)

- **Rick Kick:**
  - [https://sites.google.com/a/conejo.k12.ca.us/rkick/Home/csprinciples](https://sites.google.com/a/conejo.k12.ca.us/rkick/Home/csprinciples)

- **Deepa Muralidhar**
  - [http://www.iteachcs.com](http://www.iteachcs.com)