CS 10K and CS Principles:

Towards Increased Participation in CS

Grace Hopper 2011

Amy Briggs, Professor of Computer Science Middlebury College Co-PI, CS Principles Project





CSPrinciples.org





CS Principles

- A rigorous, creative, alternative new first course in computer science for HS and college
- Introduce central ideas of computing
- Computational thinking practices
- How computing changes the world
- Engage and emphasize creativity

Appeal to a broad audience through content and pedagogy









GHC 2011, Portland, 11.10.11



CS Principles Commission

- Don Allen, Troy High School, CA
- Christine Alvarado, Harvey Mudd College
- Stacey Armstrong, Cypress Woods High School, TX
- Owen Astrachan, Duke University (PI)
- Charmaine Bentley, FDR High School, Dallas, TX
- Amy Briggs, Middlebury College (Co-PI)
- Mark Guzdial, Georgia Institute of Technology
- Rich Kick, Newbury Park High School, CA
- Jody Paul, Metropolitan State College of Denver
- Chris Stephenson, CSTA





CS Principles Advisory Group

- Duane Bailey, Williams
- Tiffany Barnes, UNCC
- Gail Chapman, CSTA
- Tom Cortina, CMU
- Stephen Edwards, Virginia Tech
- Dan Garcia, Berkeley
- Joanna Goode, Oregon
- Susanne Hambrusch, Purdue
- Michelle Hutton, CSTA
- Deepak Kumar, Bryn Mawr
- Jim Kurose, U Mass
- Andrea Lawrence, Spelman

- Richard Pattis, UC Irvine
- Eric Roberts, Stanford
- Katie Siek, U Colorado Boulder
- Beth Simon, UC San Diego
- Larry Snyder, U Washington
- Lynn Andrea Stein, Olin
- Fran Trees, Drew University
- Lien Diaz, College Board
- Cameron Wilson, ACM
- Jan Cuny, NSF
- Kathleen Haynie, Ext Evaluator





Project Timeline – past + present

- 2009-10
 - Big Ideas, Practices, Claims/Evidence
- 2010-11
 - Pilot I: Five colleges
 - College Curriculum Survey
 - College attestation/support
- 2011-12
 - Pilot II: 10+ colleges, 10+ high schools
 - Assessment of prototype test items





Project Timeline – future

- 2012
 - Pilot III: small group, high school and college
 - Portfolio-based assessment
 - Curriculum Framework finalized
- 2013 -
 - Develop exam and course
 - Professional development
- 2015-16 (?)
 - AP Course and Exam





College Curriculum Study (2011)

- Sampling plan included 100+ institutions
- Professors rated importance of evidence statements for 117 student learning objectives

Attestation process (2011)

- College credit and/or placement
- Over 80 college departments attested





Evidence-Centered Design

Big Ideas (Content)

X

Computational Thinking Practices (Skills)

Claims (Student Learning Objectives)

+

Evidence (specific evidence of claims)





Big Ideas

- 1. Computing is a creative activity
- 2. Abstraction
- 3. Data and information
- 4. Algorithms
- 5. Programming
- 6. The Internet
- 7. Global impacts of computing





Computational Thinking Practices

- Connecting computing
- 2. Developing computational artifacts
- 3. Abstracting
- 4. Analyzing problems and artifacts
- 5. Communicating
- 6. Working effectively in teams





Big Idea > Key Concept > Learning Objective

A sample learning objective under Algorithms:

Learning Objective 18:

The student can evaluate algorithms analytically and empirically.





Learning Objective > Evidence statements

Student work is characterized by:

- 18a. Evaluation of an algorithm's efficiency, correctness, or clarity.
- 18b. Location and correction of errors in an algorithm.
- 18c. Explanation of how an algorithm functions.
- 18d. Explanation of how different correct algorithms for the same problem can have different efficiencies.





CS Principles Pilot Expectations

- Develop and implement a recruitment plan – special focus on enrollment of women and under-represented minorities
- Participate in pre and post surveys
- Develop syllabus aligned to course content





CS Principles Pilot 1 Sites

- UNC Charlotte: Tiffany Barnes
- UC Berkeley: Dan Garcia & Brian Harvey
- Metropolitan State College of Denver: Jody Paul
- UC San Diego: Beth Simon
- University of Washington: Larry Snyder





CS Principles Pilot 1 Highlights

- Diverse student populations each site was unique in potential student recruitment
- Diverse class size: ranged from 20 to 600+ students in a given pilot classroom
- Diverse set of tools and languages that were used in pilot classrooms, e.g., Alice, Scratch, Python, etc.





CS Principles Pilot 2 Sites

High School, teacher	Partnered University, contact
North Gwinnett HS - Deepa Muralidhar	Georgia Tech - Charles Isbell
Northside College Prep and Chicago Lab HS - Don Yanek, Baker Franke	Illinois Institute of Technology - Matthew Bauer
Greater Hartford Academy of Math and Science - Chinme Uche	Trinity College - Ralph Morelli
Booker T Washington Magnet HS - Bill Cowles	U of Alabama - Jeff Gray
Springdale HS - Marilyn Sue Carrell	U of Arkansas at Little Rock - Remzi Seker
S Philadelphia HS - Anne Urevick	U of Pennsylvania - Jean Griffin
West HS - Andrew Kuemmel	U of Wisconsin, Madison - Andrea Arpaci- Dusseau
Patrick Henry HS - Rebecca Dovi	Virginia Tech - Manuel Perez-Quinonez
Newbury Park HS - Rich Kick	Stanford University - Nick Parlante





Big Data

Collaboration

Social impact







Creativity

Innovation

Computational Thinking

Analysis





Computer Science Principles For updates and more information...

CSPrinciples.org



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