# CS10K: Providing access to computing education across the US

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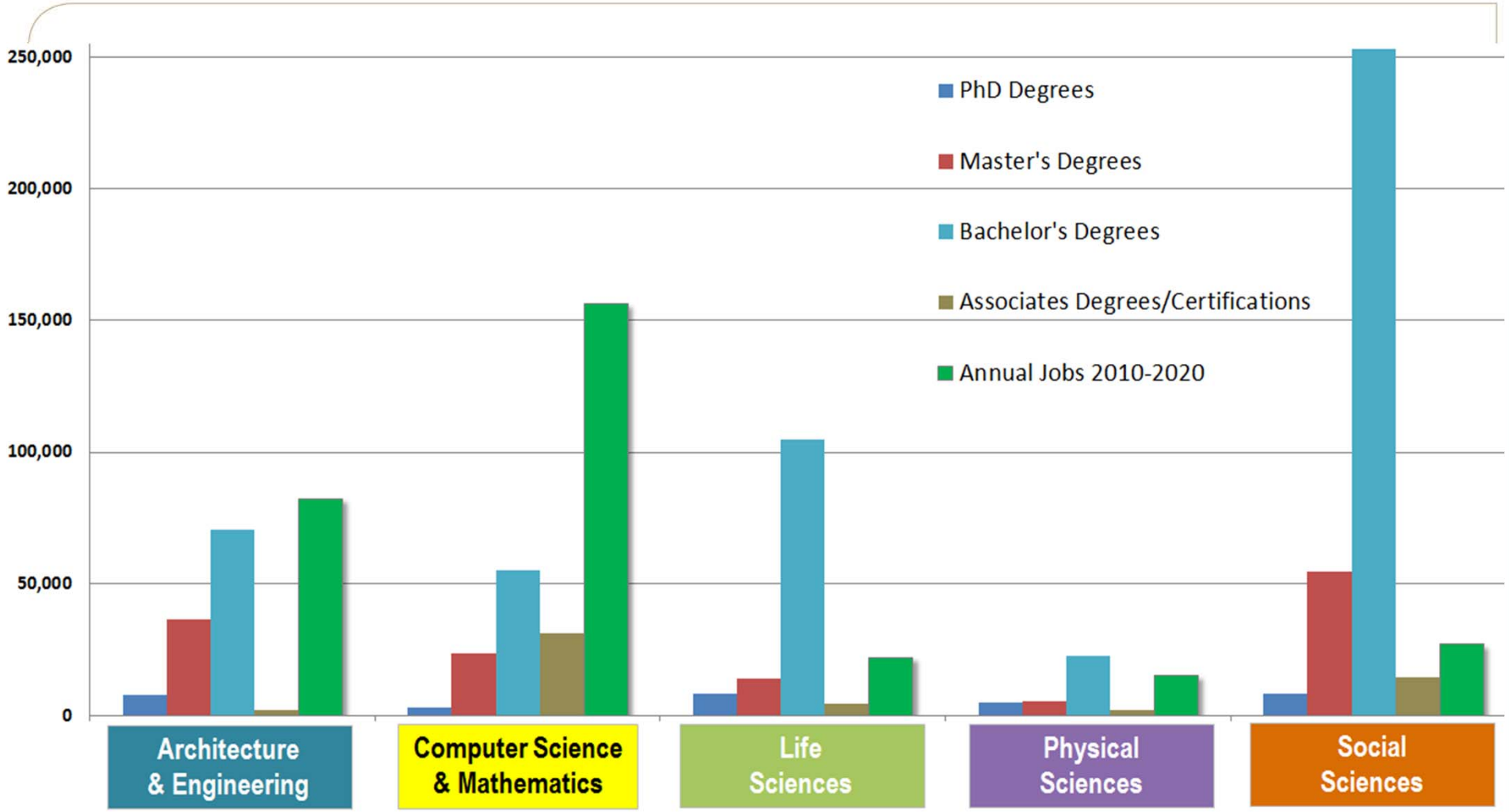
With thanks to Cameron Wilson, Jan Cuny, Rick Adrion, and Owen Astrachan for content.

# The US Challenge

- Goal: Provide computing access to all secondary school students.
- Goal: To meet growing economic needs.
- Broadening Participation in Computing (BPC) is necessary to meet both of those goals.
- Creating computing curriculum for *everyone* that is accessible *everywhere* in the US is a huge challenge.

# Where the STEM Jobs Will Be

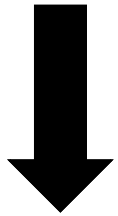
## Degrees vs. Jobs Annually




Sources: Degree data are calculated from the National Science Foundation (NSF), Science and Engineering Indicators 2012, available at http://www.nsf.gov/statistics/seind12/appendix.htm. Annual jobs data are calculated from the Bureau of Labor Statistics (BLS), Employment Projections 2010-2020, available at http://www.bls.gov/emp/. STEM is defined here to include non-medical degrees and occupations.

Georgia Tech College of Computing

25%



19%

Georgia Tech College of Computing

Disproportionately affects minorities and girls

Women

African Americans

Hispanics

\+ Native Americans

Persons with Disabilities

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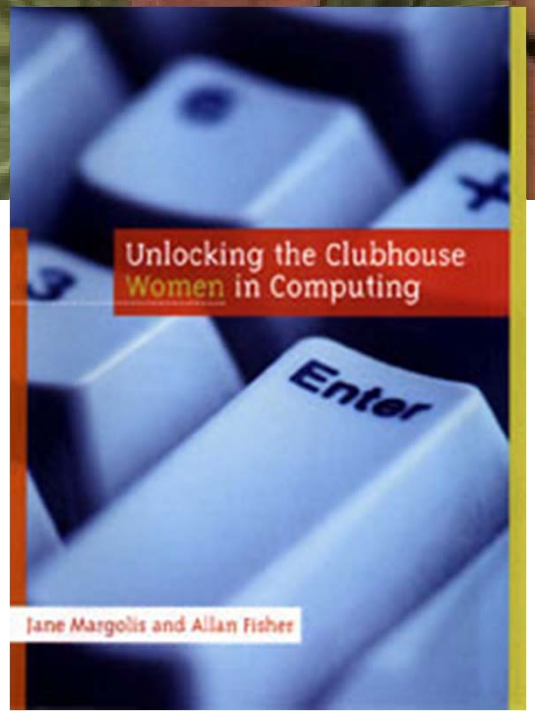
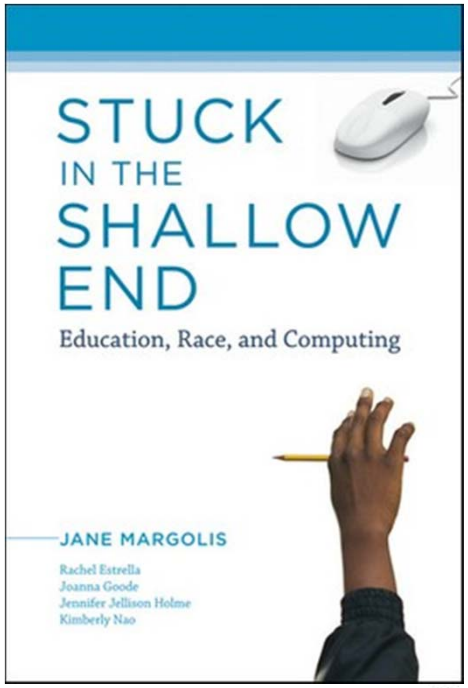
# The Missing 70%

Georgia Tech College of Computing




Jane Margolis &
Into the Loop

# Changing education in the US is hard

- Distributed education system: 25K secondary schools.
  - Decisions are made at the level of the individual state (50).
  - In Georgia, the state decides the curriculum and secondary school graduation requirements.
    - Individual schools pick which part of the curriculum they'll offer.
  - In California, each individual school district (almost 10,000) picks their own curriculum and graduation requirements.

# National Science Foundation effort

# CS 10K

10,000 teachers

10,000 schools

Spring 2017

# CS Principles & Exploring CS

- Conceptually-based
- Engaging
- Accessible
- Rigorous
- Inspiring

Georgia Tech College of Computing

# CS: Principles

A new first course in computer science

Designed to be an Advanced Placement course

Collaborative: CollegeBoard, NSF, Academia (6-12/University)

Alternative to college Introduction to Computer Science, not a replacement

# Why work toward *AP* CS:Principles?

- Why does it have to be AP?
  - The US has a distributed education system
  - National standard for curriculum and for the test
  - Entry into high schools *and* colleges
- Single point of national leverage

# Who?

# Themes

- Creativity
  - Students creating digital artifacts
- Technology and computing as means for solving problems
  - Not focused on particular tool/language
- People and Society
  - Not just systems and machines

# Big Ideas of CS: Principles

- 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.

# CS Principles

- Introduce central ideas of computing
- Computational thinking *practices*
- How computing changes the world
- Rigorous, college-level course
- Engage and emphasize creativity

*Appeal to broad audience through content and pedagogy*

# Comparison to Danish curriculum

- Similar *knowledge areas*
  - Danish curriculum has greater emphasis on *Importance and Impact* and *Innovation.*
  - Danish curriculum emphasizes creation more than CS: Principles: *Digitisation* and *Interaction Design*
- CS:Principles expects the didactical design principles to develop separately.
- Exploring Computer Science does place an explicit focus on inquiry-based learning.
- Neither ECS nor CS:P have *outside-in* or *consume-before-produce* aims.

# Parallel effort: BPC Alliances

- Targeting the needs of specific under-represented groups:
  - NCWIT: Women
  - AccessComputing: Disabled
- Targeting states
  - “Georgia Computes!”
  - Commonwealth Alliance for IT Education (CAITE)
  - => Expanding Computing Education Pathways (ECEP)

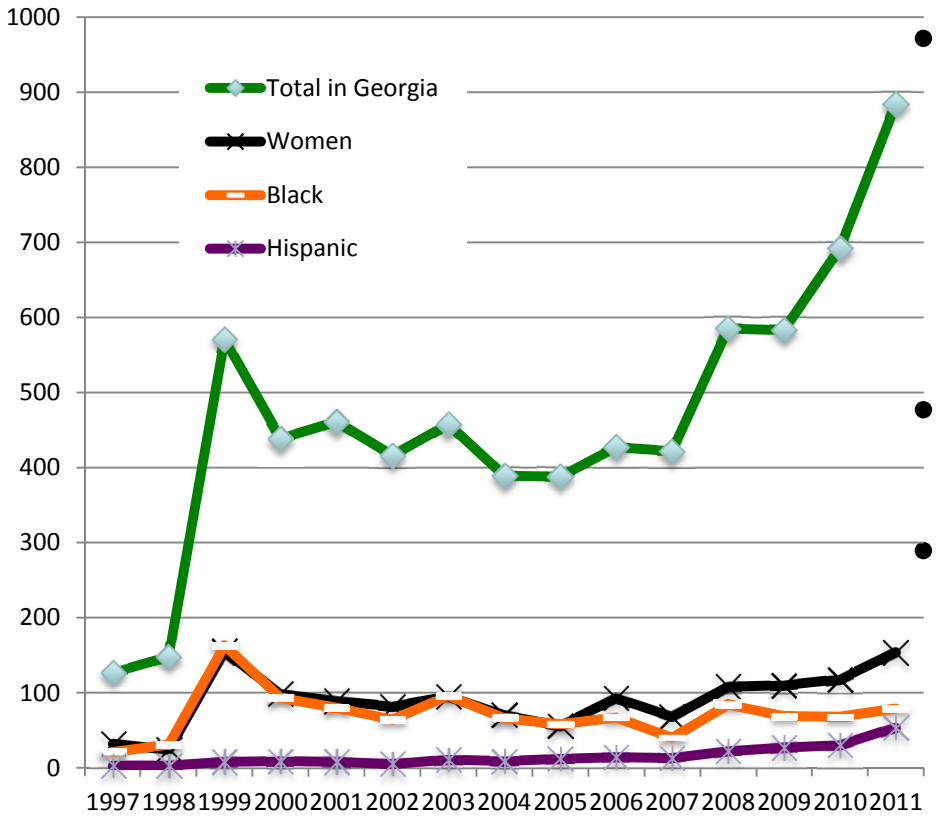
## ECEP History

- 2 successful regional alliances (CAITE & Georgia Computes!)
  - All primary and secondary school decisions in US are at the *state* level.
- High-Level Plan
  - Refine and integrate CAITE and Georgia Computes interventions
  - Be a service organization to help other states

## CAITE and GaComputes Programs:

- GaComputes: Most success in Grades 4-12 (ages 9-18)
  - Summer camps that cross levels
  - Professional development for teachers
- CAITE: Most success in Community College (2 year) to University (4 year) transition
  - Pathways (recruiting, retention, advising, alignment, institutional change) in underserved regions
  - Regional outreach

# Broadening Advanced Placement CS in Georgia

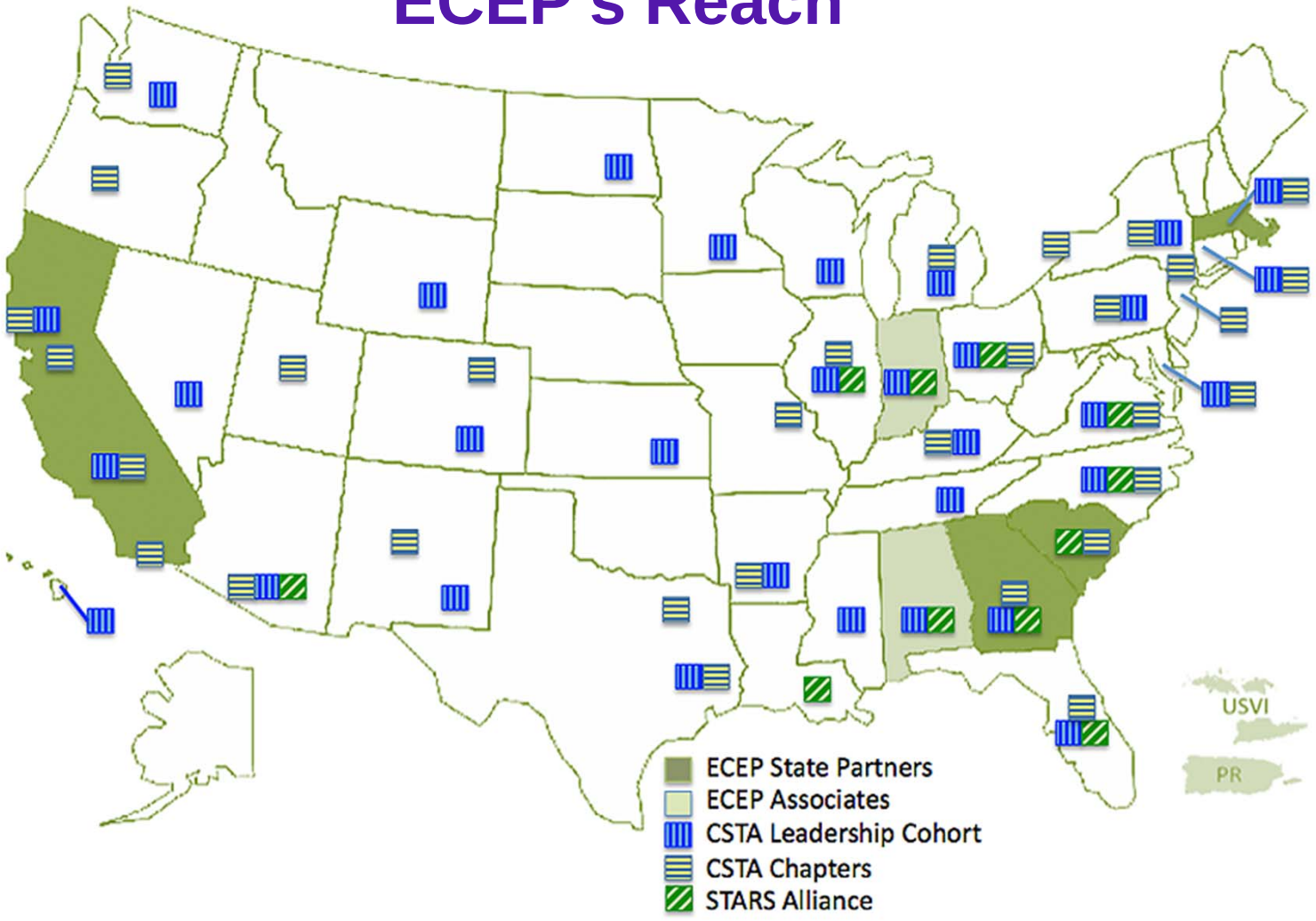



- In 2011 the largest number of students ever took the existing AP CS exam in Georgia
  - 422 in 2007 => 882 in 2011
- The # of women increased
  - 68 in 2007 => 154 in 2011
- The # of Hispanics increased
  - 13 in 2007 => 54 in 2011

ECEP

EXPANDING COMPUTING EDUCATION PATHWAYS

# ECEP's Reach



# Conclusion

- Desperate need to improve computing education access, especially for under-represented groups.
- Education in the United States is distributed.
  - Makes reform difficult.
- National Science Foundation is leading the charge, led by Jan Cuny.
  - Defining and testing two course curricula.
  - Providing teacher professional development.
  - Conducting research on what works.
  - Funding alliances to explore other kinds of needs.

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