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Texas Regional Collaboratives
THE UNIVERSITY OF TEXAS AT AUSTIN

Building a Computer Science Pipeline in your District

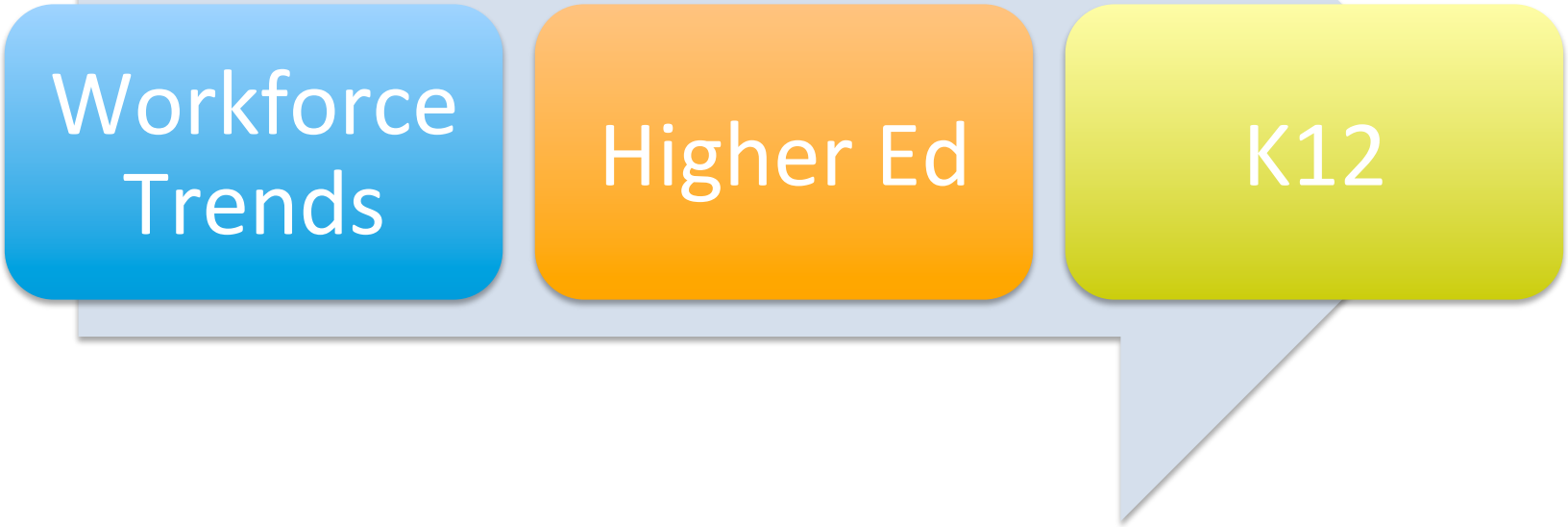
January 26, 2015

Presented by
Carol L. Fletcher, Ph.D.,UT Austin
Hal Speed, Code.org Affiliate
Phillip Eaglin, Ph.D, Code.org Affiliate

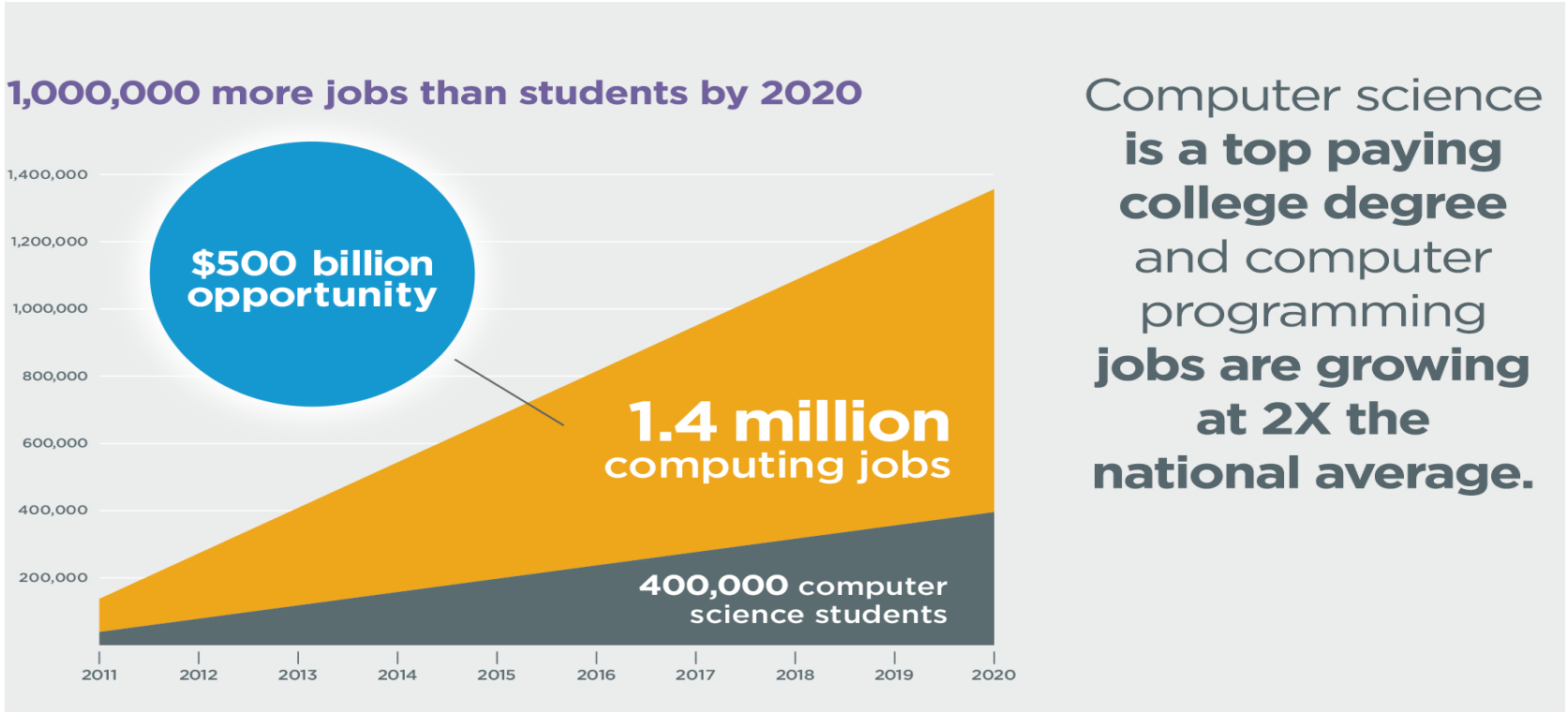
Session Goals

- Provide attendees with the resources, data and connections needed to establish and sustain a robust CS program in their school and district.
- Expose participants to numerous no- to low-cost options for accessing curriculum and professional development related to CS

Starting with the end in mind



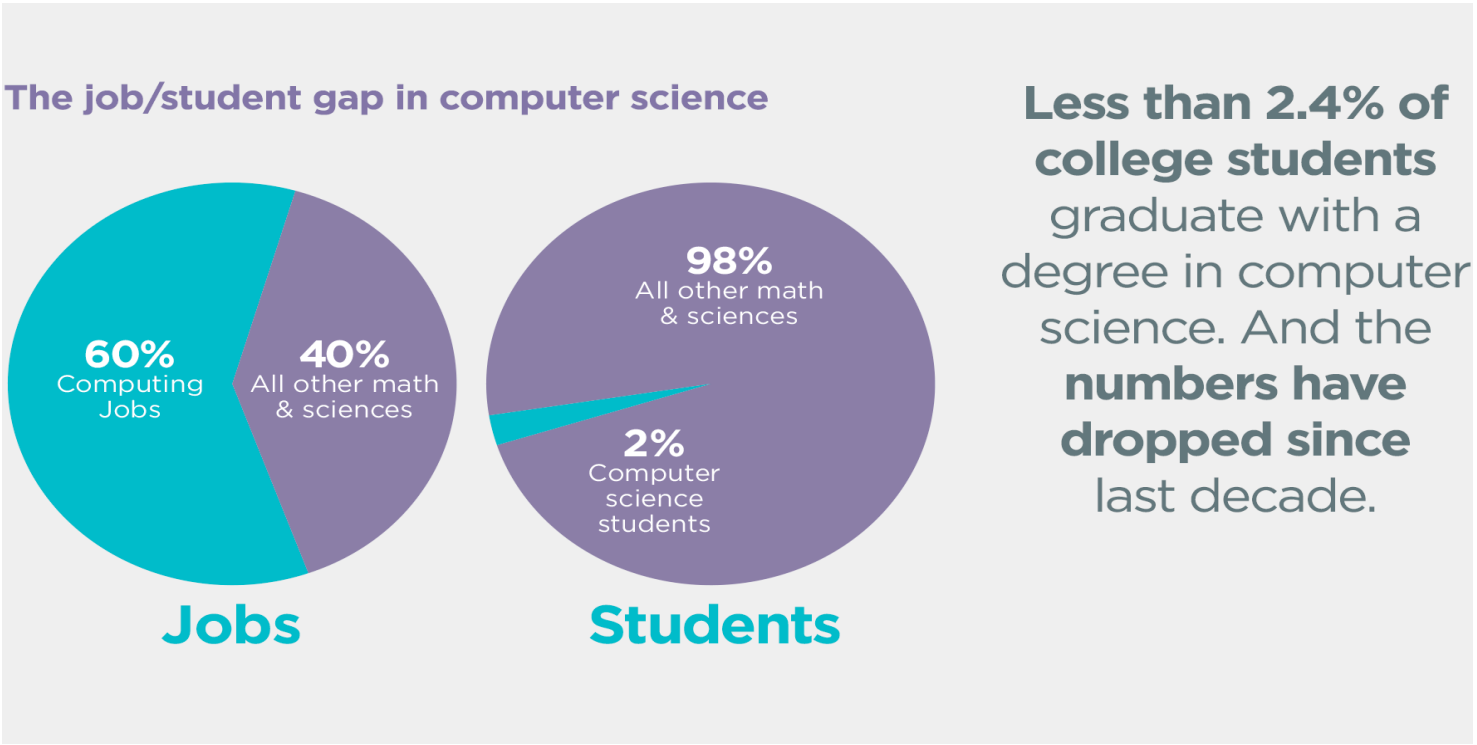
Our Country Needs One Million More Programmers



Computer science **is a top paying college degree** and computer programming **jobs are growing at 2X the national average.**

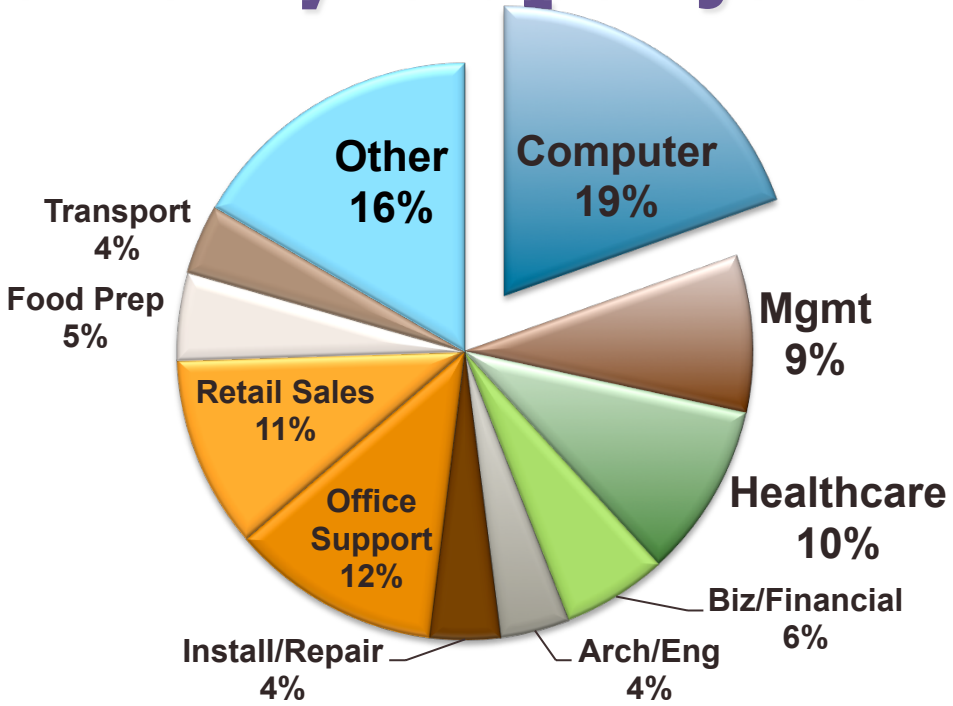
SOURCE: Code.org

STEM is not enough



SOURCE: Code.org

20% of Today's Open Jobs in Austin Are CS

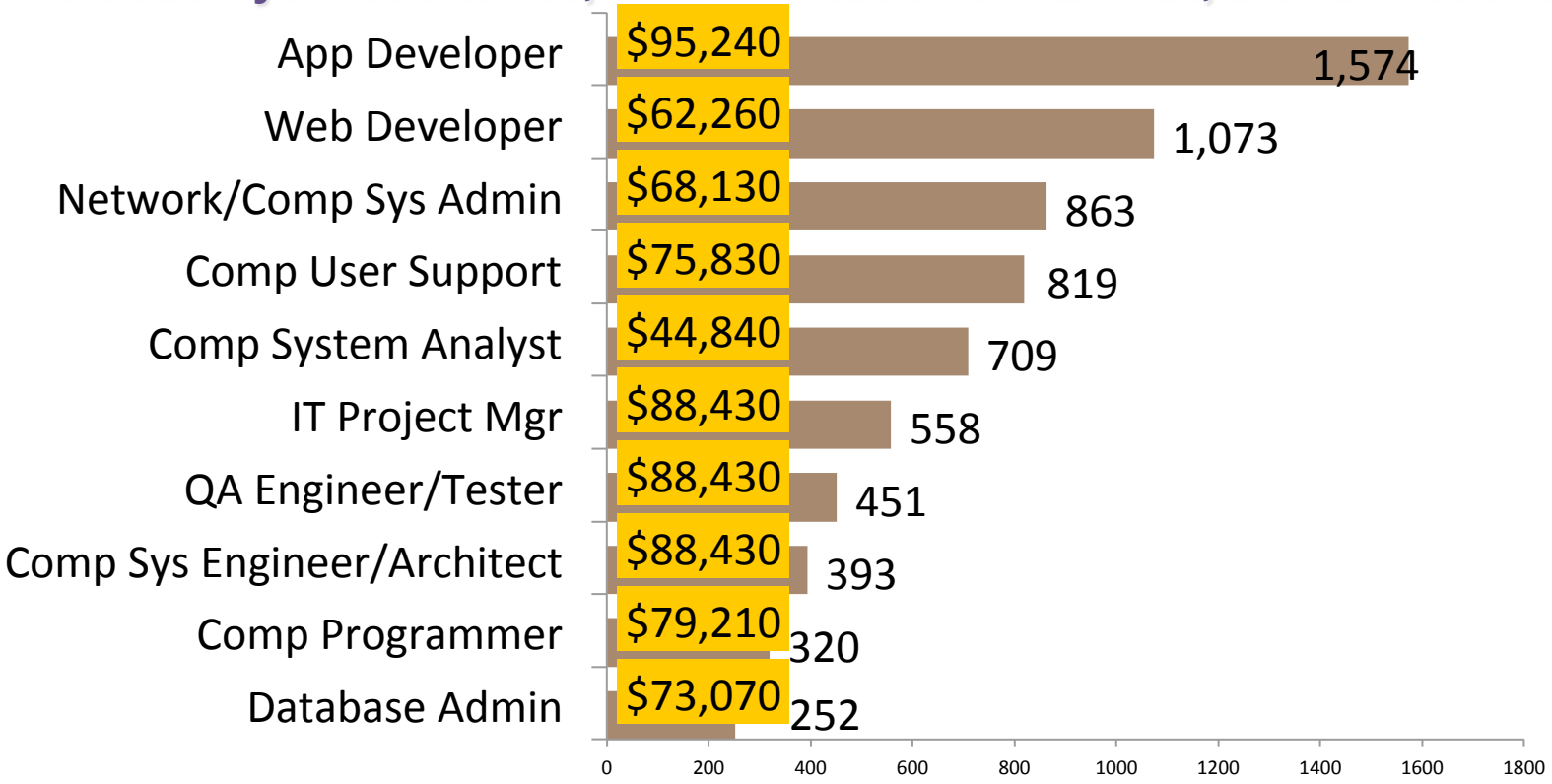


Austin company job openings

- Dell, 202
- Home Depot Data, 95
- General Motors, 82
- Apple, 75
- Cisco, 59
- VISA, 48
- Bazaarvoice, 43
- eBay, 42
- Hanger, 34
- Electronic Arts, 25
- Intel, 23

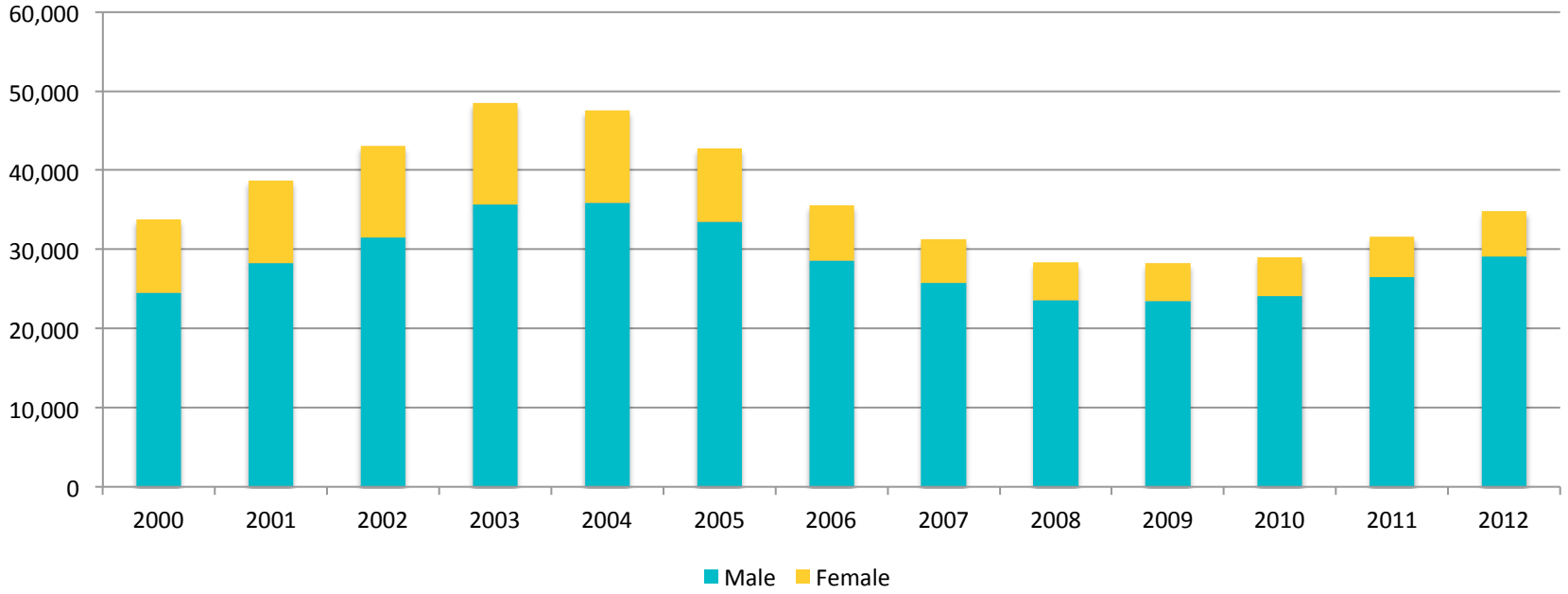
SOURCE: THE CONFERENCE BOARD HELP WANTED ONLINE ® and Austin Chamber of Commerce

AUSTIN' S TECH JOB OPENINGS, ANNUAL MEDIAN SALARIES, # OPENINGS: NOV 2014



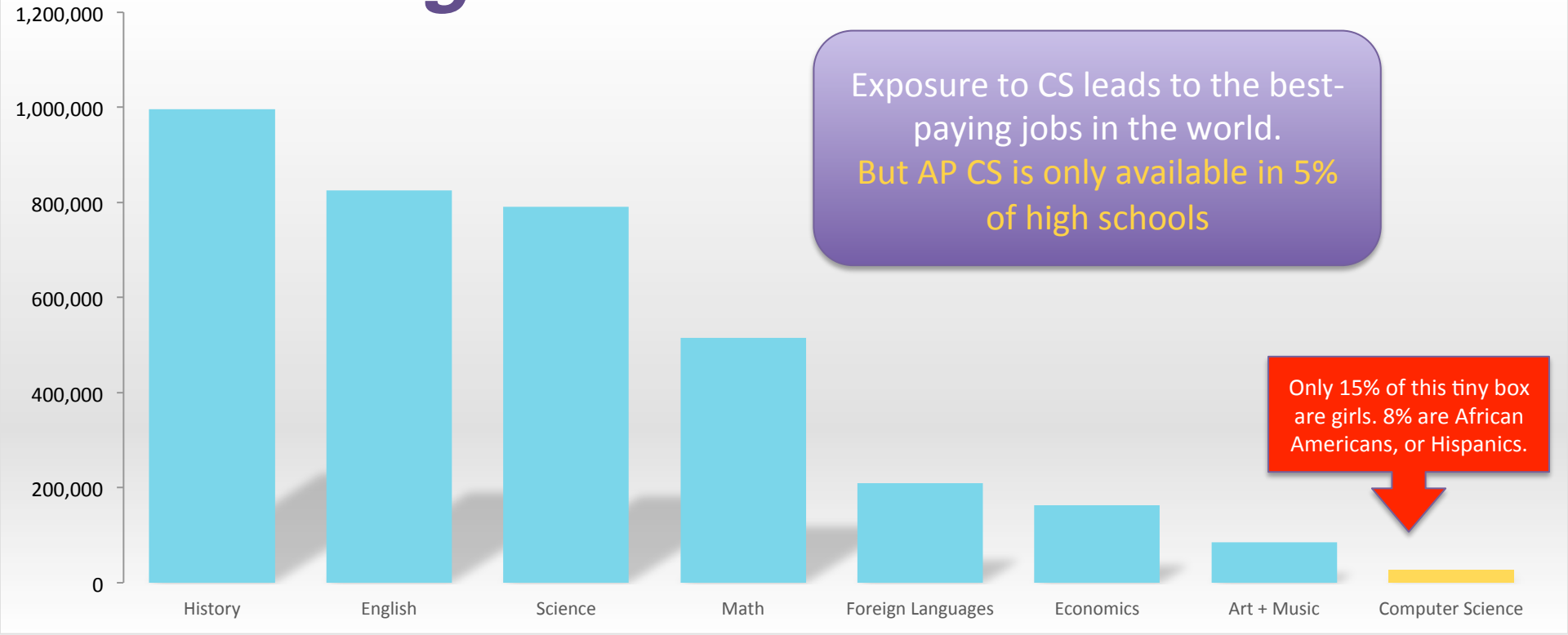
SOURCE: THE CONFERENCE BOARD HELP WANTED ONLINE ® 2014,, BUREAU OF LABOR STATISTICS, MAY 2013 and Austin Chamber

Fewer CS majors than 10 years ago
(and a shrinking % are women)



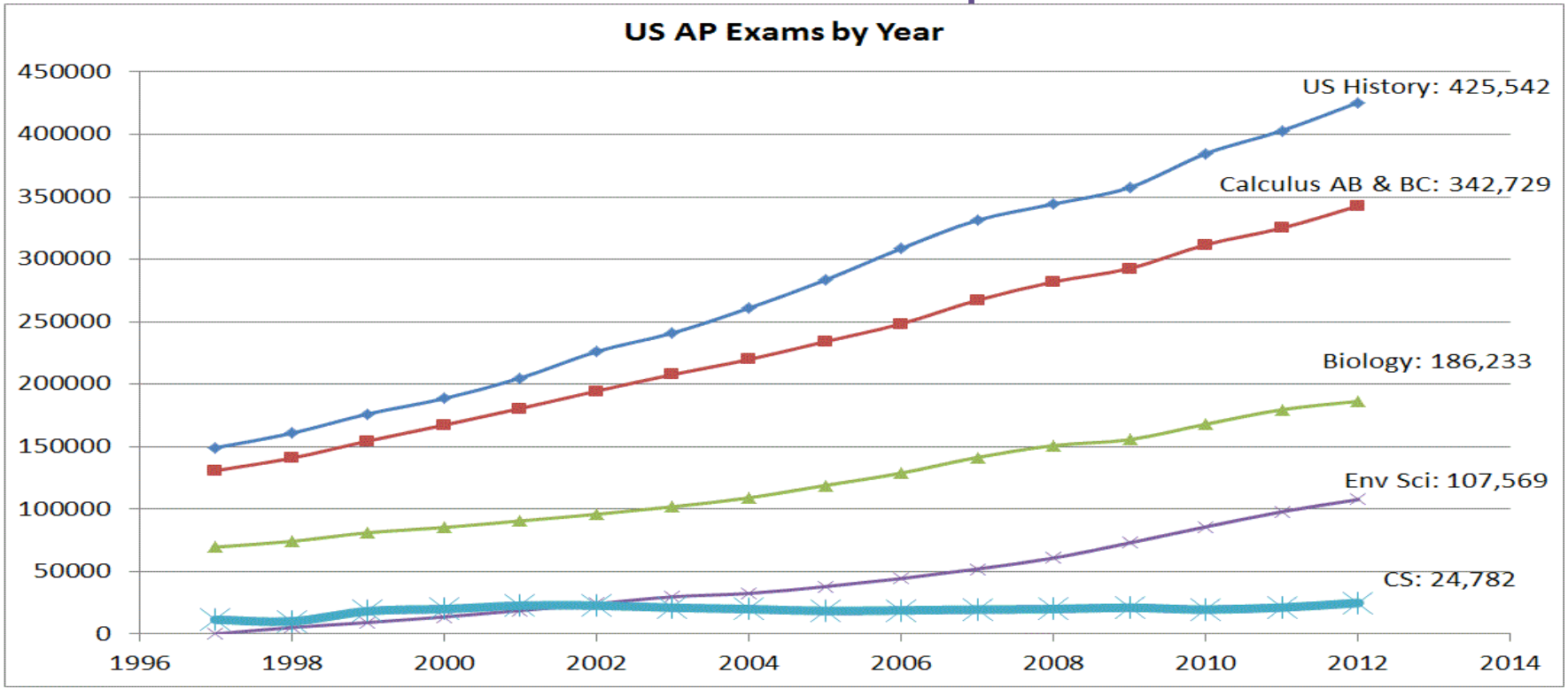
Sources: National Science Foundation

2012 High School A.P. Enrollment

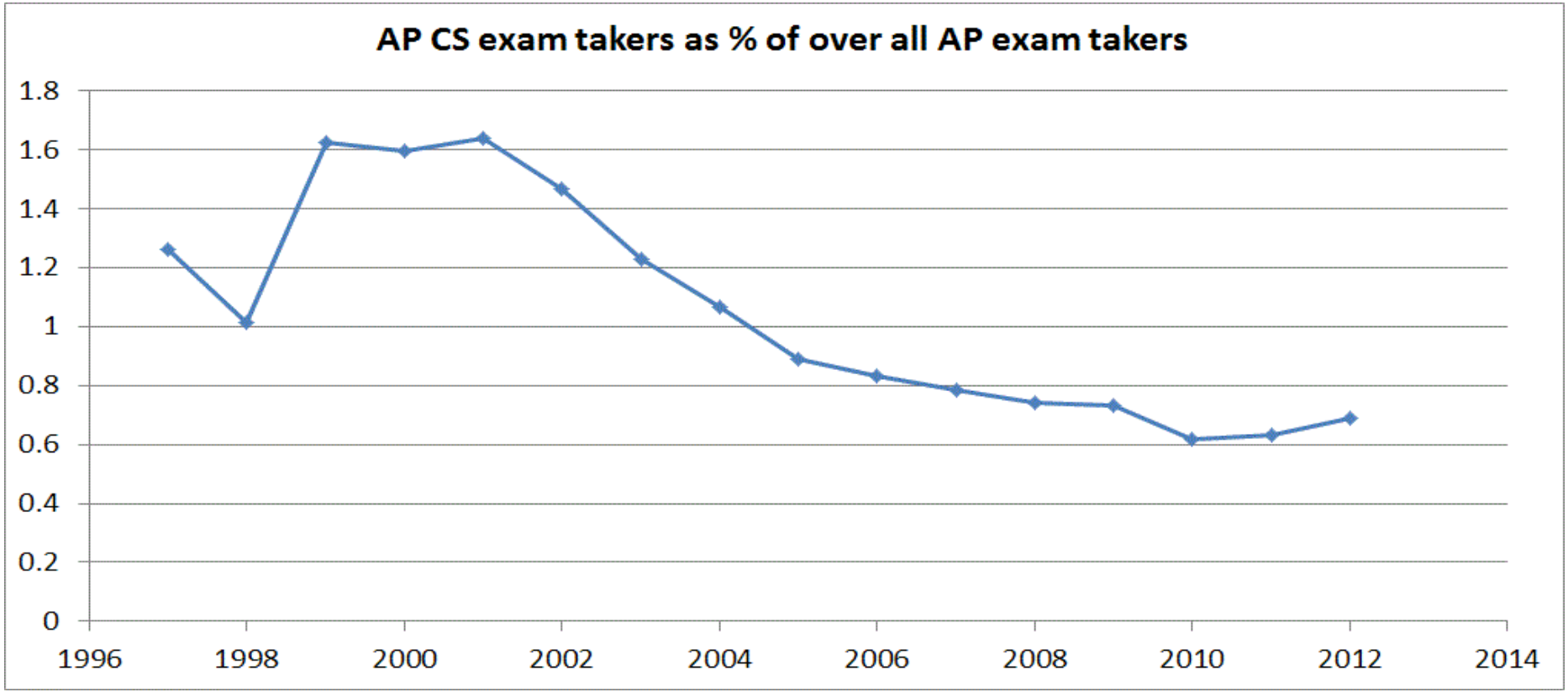


Sources: College Board

What is the Status of AP Computer Science?



SOURCE: www.TEALSK12.org and College Board

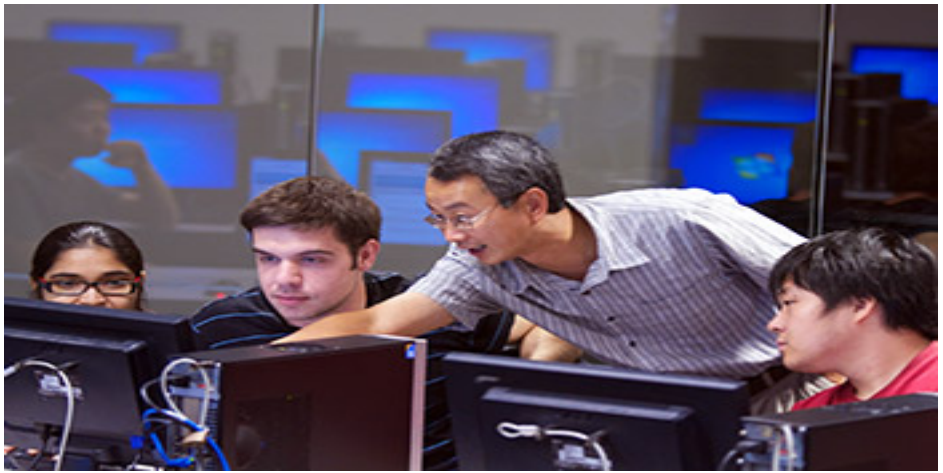


SOURCE: www.TEALSK12.org and College Board

CS enrollment is falling

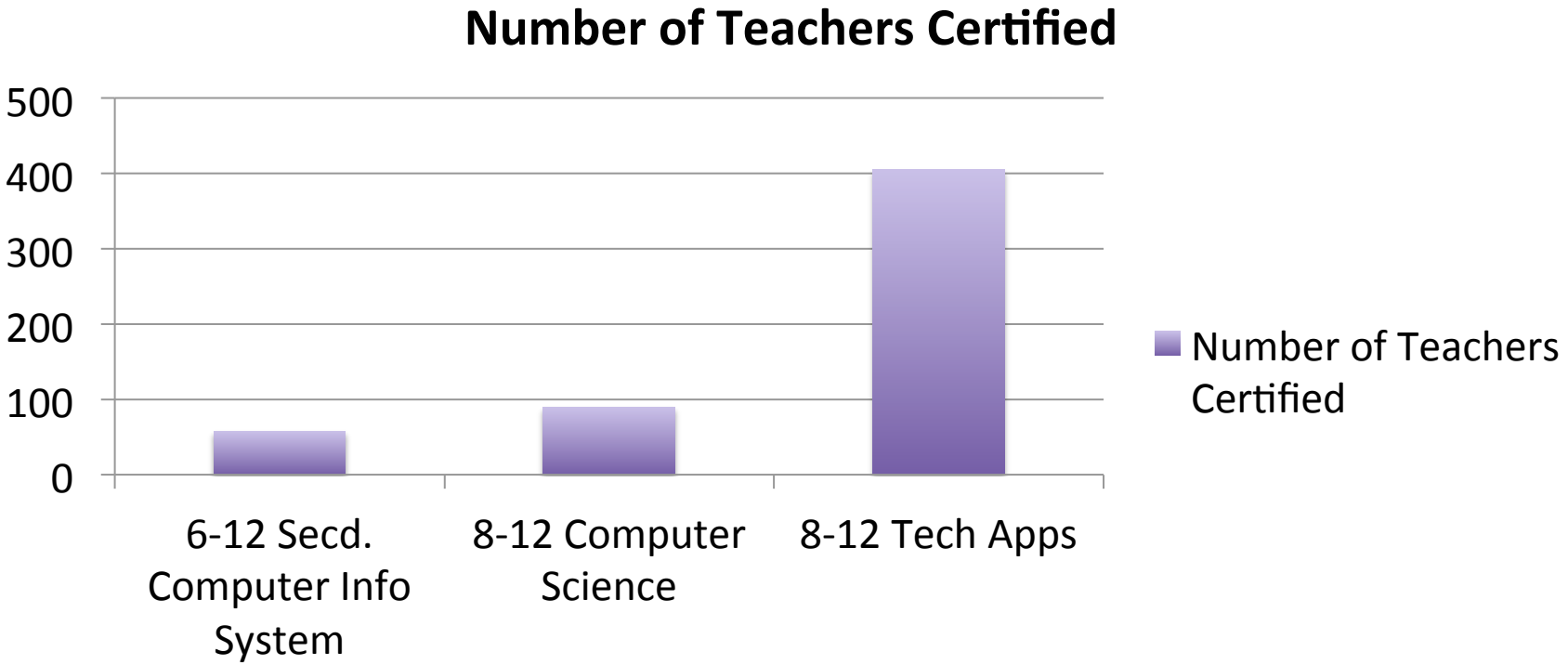
The percentage of graduates who earned credits in high school computer science classes fell to 19 percent in 2009 from 25 percent in 1990, making it the only subject among science, technology, engineering and mathematics courses to experience such a drop,
according to the U.S. Department of Education

Not Enough Teachers



- It's been shown that students' positive exposure to CS in high school correlates to majoring in CS in college.
- Unfortunately, only 1 out of 10 schools in the U.S offer programming classes.
- Our high schools fail to offer CS because there are not enough qualified CS teachers to meet demand.

Texas Teacher Certifications Earned in 2013-14



CS Offerings in Texas 2013-14

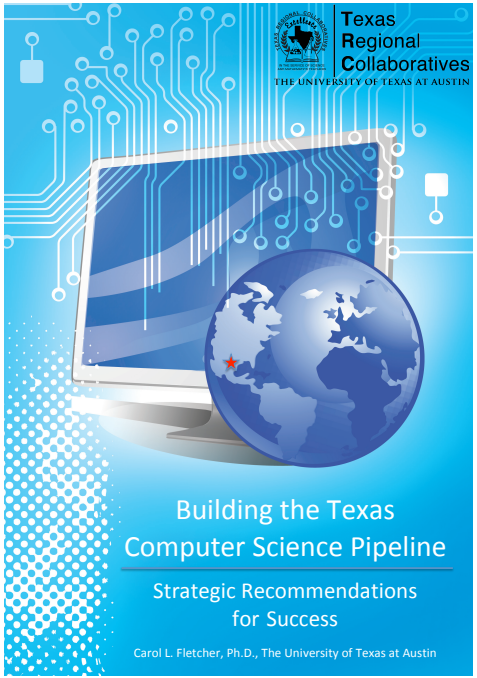
PEIMS #	Course	FTEs	Student Enrollment
03580200	Computer Science I	68.47	9,132
03580300	Computer Science II	13.14	879
A3580100	AP Computer Science A	51.54	5,572
TOTAL		**133.15**	**15,583**

- Based on data obtained from Teacher FTE Counts and Course Enrollment Reports
- http://ritter.tea.state.tx.us/adhocrpt/adfte.html

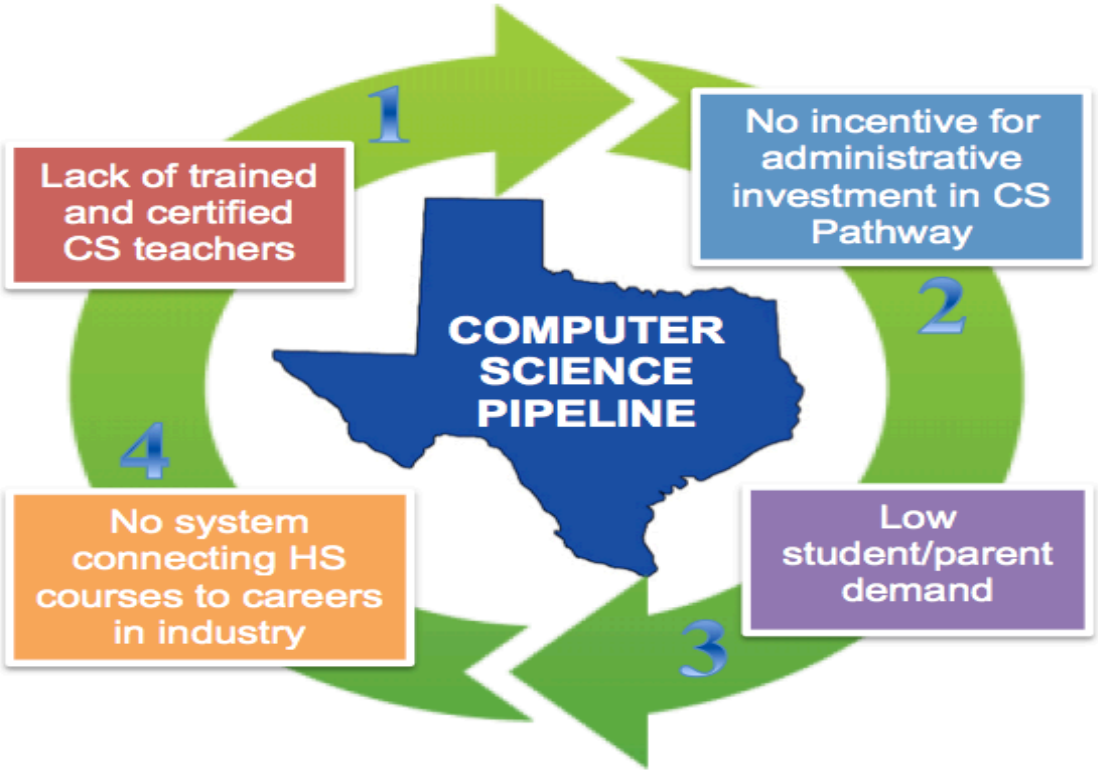
rock bottom is a
beautiful start

Texas Computer Science Task Force

- Met on Oct 8, 2014 at Austin Chamber of Commerce
- 15 people representing CS teachers, edtech business, higher ed, TCEA, CTAT, Code.org, College Board, ISD leaders and policymakers
- Built consensus around key barriers and recommendations



Four major issues impacting the computer science pipeline in Texas



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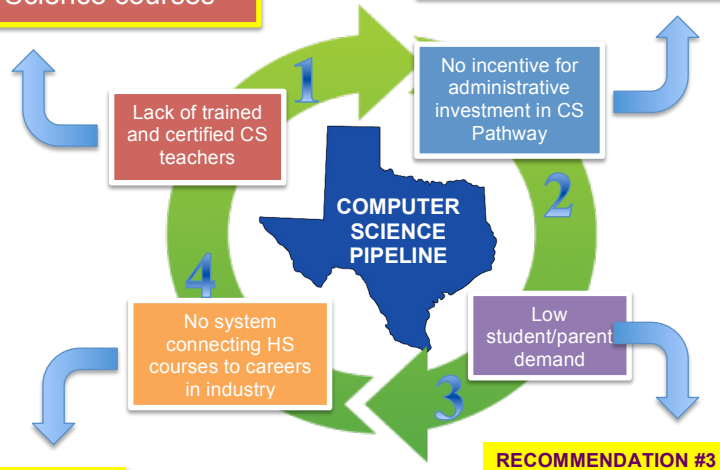
RECOMMENDATION #1

Support professional development that prepares currently certified educators to teach high school Computer Science courses

RECOMMENDATION #2

Move computer science courses out of Technology Applications and into CTE

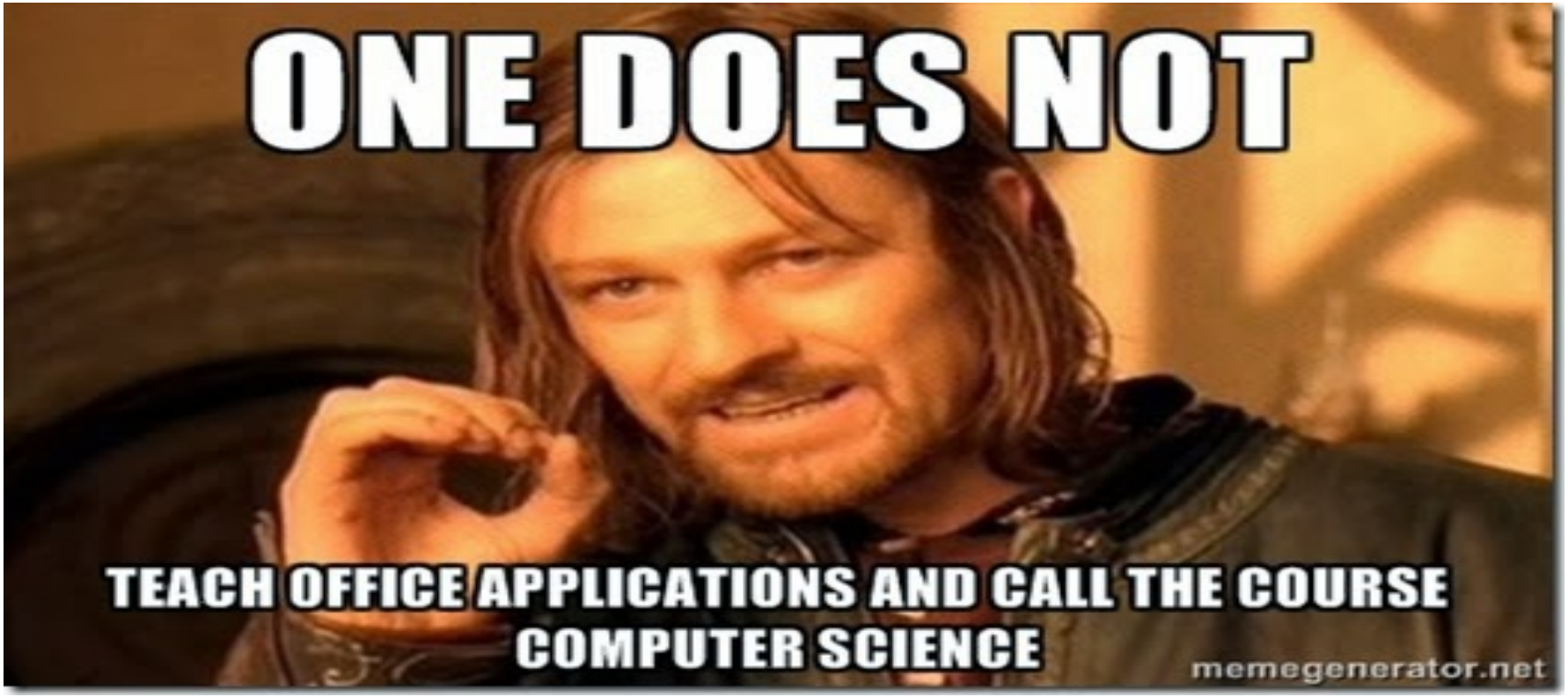


RECOMMENDATION #4

Develop a robust and scalable online system that connects high schools to careers and professionals in computer science fields

RECOMMENDATION #3

Expand options for core computer science to include additional engaging, project-based courses such as AP Computer Science Principles


ONE DOES NOT
TEACH OFFICE APPLICATIONS AND CALL THE COURSE COMPUTER SCIENCE
memegenerator.net

Resources for Texas

texascomputerscience.weebly.com

thetrc.org/computer-science-resources

TRC Project

Keep Calm and Java On

www.theTRC.org

New Cohort – Summer 2015

Summer 2015 Session

- Online Java Fundamentals
- 4-week synchronous course June 8 - July 2, 2015
- Monday through Thursday (2 hours daily)
- Two Sections:
  - 9-11 am CST
  - 3-5 pm CST

To apply

- Eligible applicants include currently certified Texas secondary teachers.
- Apply February 2, 2015 through March 27, 2015
- www.thetrc.org/computer-science-resources to add a person to the notification list

Free UT Austin CS Principles Curriculum

- Thriving in Our Digital World
- http://www.cs.utexas.edu/~engage/index.html
- Blended, project-based course taught by a classroom teacher in partnership with UT faculty through the UT OnRamps project
- UT faculty developed curriculum available for free
- https://canvas.instructure.com/courses/884561
- Summer teacher professional development
- Fee for dual enrollment

TEALS – www.tealsk12.org

- TEALS (Technology Education And Literacy in Schools) is a grassroots program that recruits, trains, mentors, and places high tech professionals from across the country who are passionate about computer science education into high school classes as volunteer teachers
- TEALS volunteers team teach with ISD teachers
- Teach AP CS A or CS Principles
- Embedded PD that builds teacher capacity

Additional NSF Funded Online PD

- Harvey Mudd College MOOCs for CS Teachers
  - Middle-Years Computer Science (MyCS)
  - Programming in Scratch

HARVEY MUDD COLLEGE

- Mobile CS Principles using App Inventor
- Online and F2F
- Summer 2015
- http://mobile-csp.org/participate

Mobile CSP

Building the Computer Science Pipeline

Grades K-8 Computer Coding Courses

Phillip G. Eaglin, PhD
Founder and CEO
Changing Expectations Corp
Code.org Affiliate

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Texas Regional Collaboratives for Excellence
THE UNIVERSITY OF TEXAS AT AUSTIN

CODE STUDIO

FREE 20-hour Coding Courses

All ages: Course 1 is for Pre-Readers. Courses 2, 3, 4 are for Beginners in Elementary School and Middle School.

Course 1

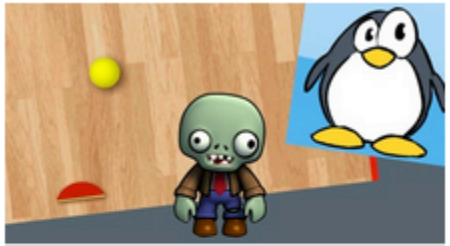
Course 1 is designed for early readers.

Ages 4+ (pre-readers)

Course 2

Course 2 is designed for students who can read.

Ages 6+ (reading required)



Course 3

Course 3 is a follow-up to Course 2.

Ages 8+ (after Course 2)

Course 4

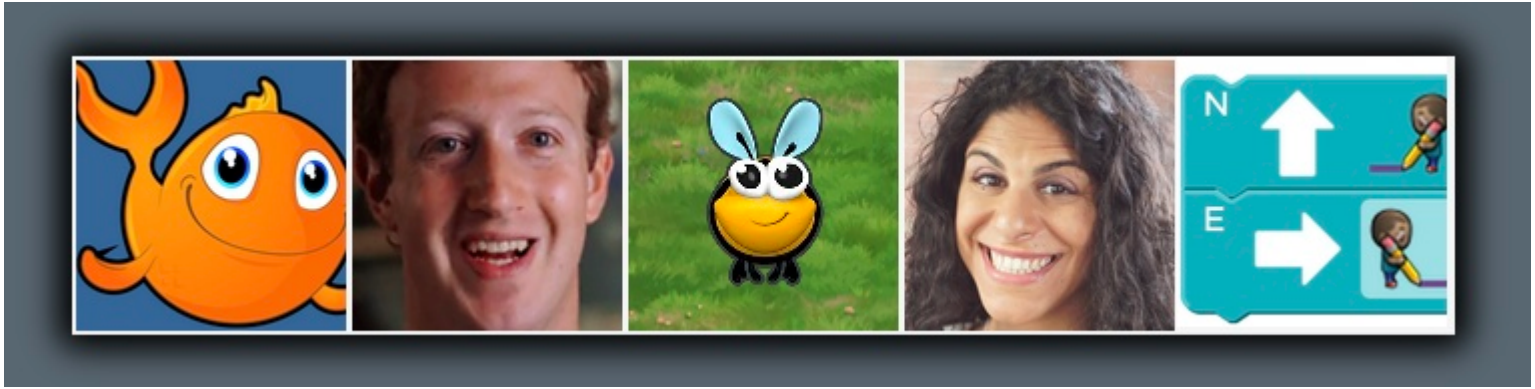
Students taking Course 4 should have already taken Courses 2 and 3.

Ages 10+ (after Course 3)

Online and Unplugged Lessons

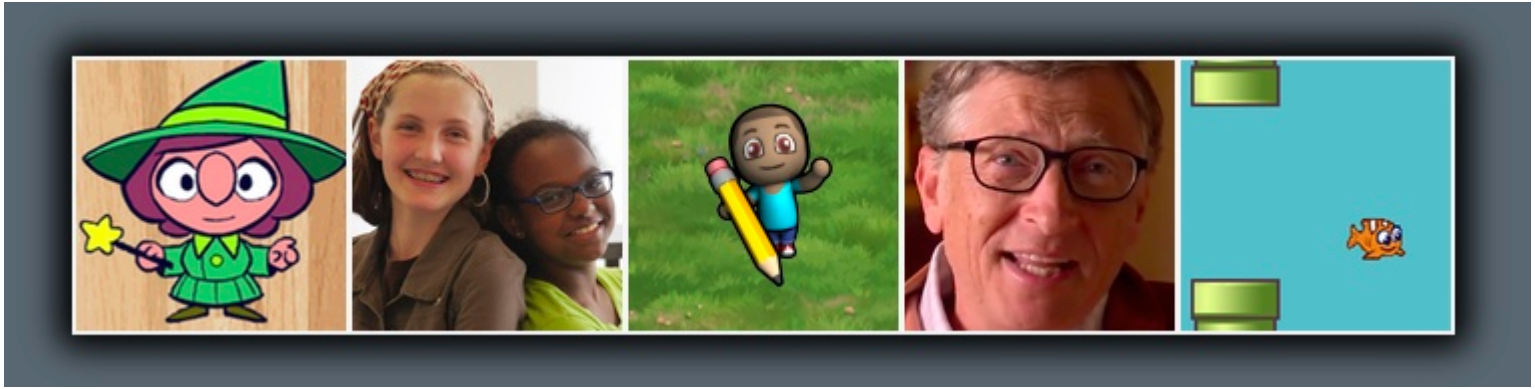
- Each course experience is a blend of online activities and "unplugged" activities, lessons in which students can learn computing concepts with or without a computer.
- The unplugged lessons take a hands-on, often kinesthetic approach, making use of physical manipulatives to model computational concepts.

Course 1 – K-1, Pre-Readers, 4+



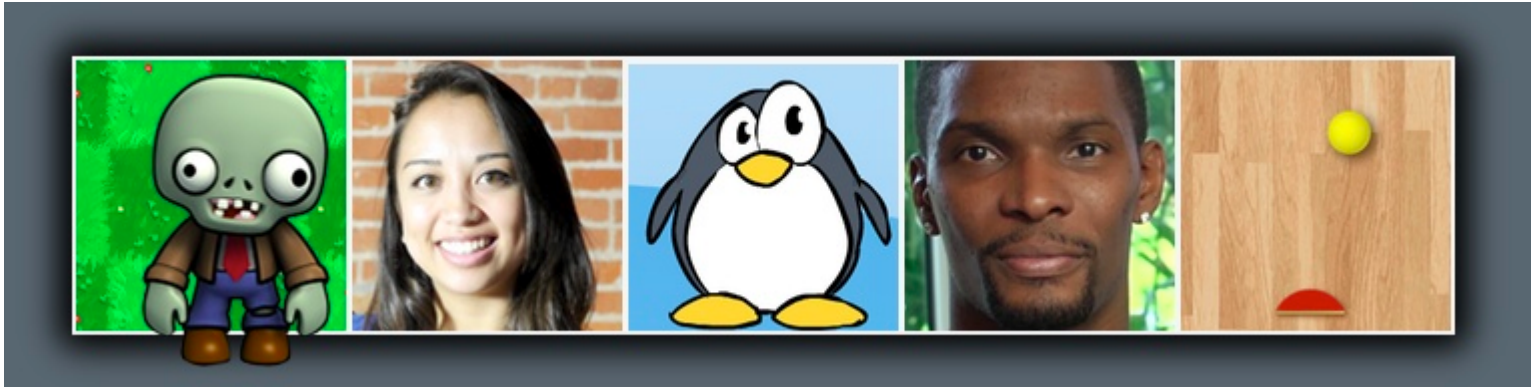
- Sequences
- Loops and Events
- Meaningful collaboration
- Unplugged & Online
- Problem-solving and perseverance techniques
- Internet safety

Course 2 - Beginners, Readers, 6+



- Conditionals
- Algorithms
- Binary code
- Debugging
- Unplugged & Online
- Societal impacts of computing
- Grades 2-5, Beginners in
  - Middle School

Course 3 - After Course 2, 8+



- Problem decomposition
- Functions
- Digital citizenship
- Nested loops and conditionals
- Internet transmission methods
- Grades 4, 5, Middle School

Course 4 – Beta, After Courses 2, 3

- Variables
- For loops
- Functions with parameters
- Grades 4-8, Ages 10+
- Upper Elementary &
  - Middle School
- Unplugged & Online

Creativity
Collaboration
Communication
Persistence
Problem Solving

CODE STUDIO

Computational thinking practices that are emphasized in lessons.

Let's Do Pair Programming

Pair Programming

- Working with a partner on ONE computer, go to
  - https://studio.code.org/

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Ages 4+ (pre-readers)

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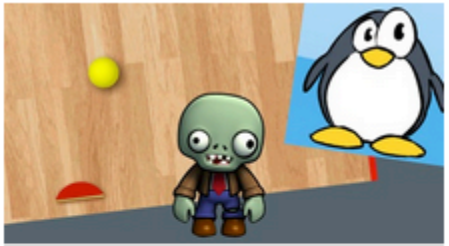

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Ages 8+ (after Course 2)

Course 4

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Ages 10+ (after Course 3)

K-5 Mathematics TEKS Correlations to Code.org Studio Lessons

- http://goo.gl/tpaJiL

- Anyone who knows the K-5 math TEKS and Code Studio lessons, please see me.
  - We need your feedback on this!

Objectives of the FREE K-8 Code.org PD

- Discuss and identify effective practices for teaching computer science in a developmentally appropriate way for elementary and middle school students.
- Engage in the curriculum lesson plans as a learner and as a teacher, as well as get feedback from an experienced facilitator.
- Learn about the background concepts and define the terms in the K-8 curriculum.
- Create a teacher account, complete coding tutorials, and explore the classroom data and resources available in the teacher dashboard.
- Identify issues related to equity in a CS classroom and share effective practices to promote a safe and equitable environment for student learning.
- Identify challenges and plan for practical implementation given the teacher's school schedule.

Request FREE Private Code.org PD for 15 or more K-8 Educators

- Summer PD for schools and districts
- During school day, afterschool, and Saturdays
- 7 hours, over 1 or 2 days
- School day substitute teacher coverage provided by school/ district
- TCEA Tots & Tech Conference, Summer 2015
- Killeen ISD
- Austin ISD
- Dallas ISD

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(512) 496-6824
phillip.eaglin@changeexpectations.org

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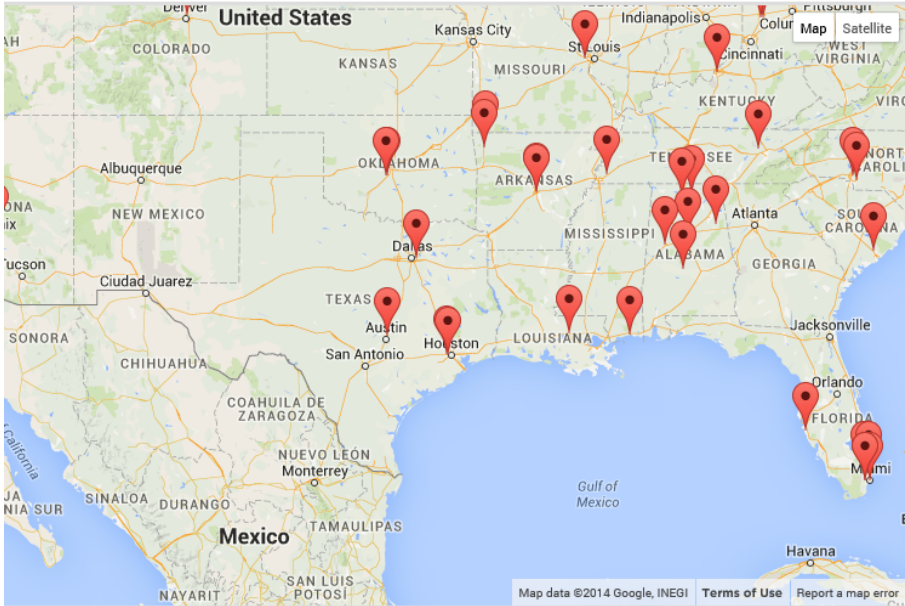
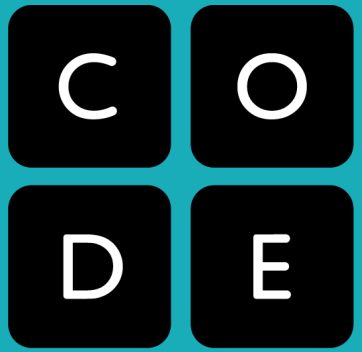
Sign up for FREE Public Code.org PD for K-8 Educators

- 7 hours, Teachers, Librarians, Specialists, Aftsch.
- Saturdays at the Microsoft Store, Austin
- FREE curriculum
- FREE teacher videos
- FREE classroom
  - supplies for unplugged
  - activities
- Code.org Support
- FREE CPEs and Swag!





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Computer Science in Texas High Schools

Hal Speed

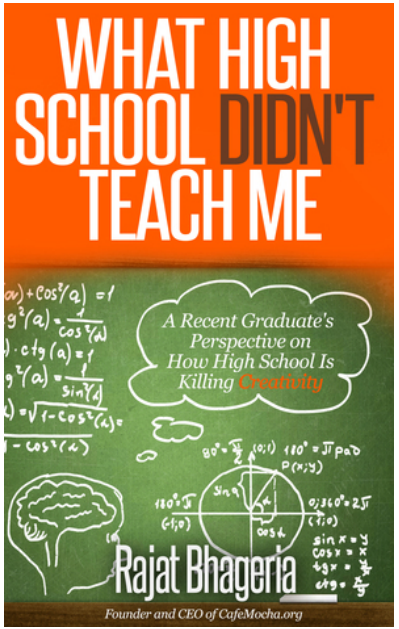
Austin Affiliate

TRC Computer Science Network Training

16 January 2015

High School Grad's Take on CS

- Software is everywhere
- Computer science teaches you how to think and efficiently solve problems
- Students can apply computer science to any field
- Programming is actually fun
- Computer science pays off with high paying jobs
- And is a good foundation for entrepreneurship



74.3(b)(2)(I) Tech App Curriculum Requirement – every district must offer, and 74.3(b)(4) each student must have the opportunity to participate in the following:

Computer Science I

Computer Science II or AP Computer Science

At least two (2) of the following:

- Computer Science III
- Digital Art and Animation
- Digital Communications in the 21st Century
- Digital Design and Media Production
- Digital Forensics
- Digital Video and Audio Design
- Discrete Mathematics for Computer Science
- Fundamentals of Computer Science
- Game Programming and Design
- Independent Study in Evolving/ Emerging Technologies
- Independent Study in Technology Applications
- Mobile Application Development
- Robotics Programming and Design
- 3-D Modeling and Animation
- Web Communications
- Web Design
- Web Game Development

CS High School Pathway

Fundamentals of Computer Science
(e.g. Exploring Computer Science curriculum)

AP Computer Science Principles (coming in 2016, optional)
(e.g. Thriving in our Digital World curriculum)

Java Programming	Mobile App Development	Web Design / Technology	Game Design / Development	Robotics
• CS and/or Computer Programming • AP CS A				

Course	9	10	11	12	Prerequisite
Fundamentals of CS	X	X	X	X	Proficiency in Tech Apps
CS I	X	X	X	X	Algebra I
CS II			X	X	Algebra I & either CS I or Fundamentals CS
CS III			X	X	CS II or AP CS
AP CS A		X	X	X	CS I or Algebra II
Game Programming & Design	X	X	X	X	Algebra I
Mobile App Development	X	X	X	X	Proficiency in Tech Apps
Web Design	X	X	X	X	None
Web Game Development			X	X	Web Design (recommended)
Video Game Design		X	X	X	Art I, Digital Interactive Media & Animation
Computer Programming		X	X	X	Keyboarding proficiency
Advanced Computer Programming			X	X	Computer Programming
Web Technologies		X	X	X	Keyboarding proficiency and Prin IT or BIM
CS and Software Engineering	X	X	X	X	None
CS Applications		X	X	X	CS and Software Engineering

Computing Education for the 21st Century

- Federal program through the National Science Foundation
- Three tracks:
  - Computing Education Research
  - CS 10K – cs10kcommunity.org
    - Train 10,000 computer science teachers by fall 2015
    - 25,000 teachers to teach computer science by fall 2016
    - Two courses:
      - Exploring Computer Science
      - AP Computer Science Principles
  - Broadening Participation

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Exploring Computer Science

- Human Computer Interaction
  - Introduction to the concepts of computing
- Problem Solving
  - Computational thinking
- Web Design
  - Web page design
- Introduction to Programming
  - Design programming solutions to a variety of problems
- Computer and Data Analysis
  - Use computers to translate, process and visualize data
- Robotics
  - Build and program a robot

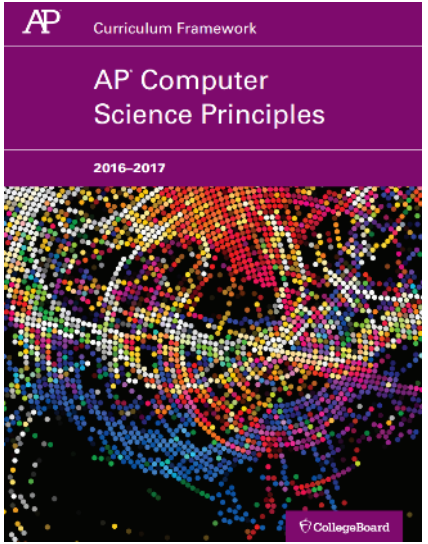
ECS Exploring Computer Science

exploringcs.org

AP CS Principles

- Computational Thinking Practices
  1. Connecting Computing
  2. Creating Computational Artifacts
  3. Abstracting
  4. Analyzing Problems and Artifacts
  5. Communicating
  6. Collaborating

- Big Ideas
  1. Creativity
  2. Abstraction
  3. Data and Information
  4. Algorithms
  5. Programming
  6. The Internet
  7. Global Impact



CS PRINCIPLES

apcsprinciples.org

AP Computer Science A	AP Computer Science Principles
Curriculum is focused on object-oriented programming and problem solving	Curriculum is built around fundamentals of computing including problem solving, working with data, understanding the internet, cyber security, and programming
Java is the designated programming language	Teachers choose the programming language(s)
Encourages skill development among students considering a career in computer science and other STEM fields	Encourages a broader participation in the study of computer science and other STEM fields
AP assessment experience • Multiple-choice and free-response questions (written exam)	AP assessment experience: • Two performance tasks students complete during the course to demonstrate the skills they have developed (digital artifacts) • Multiple-choice questions (written exam)

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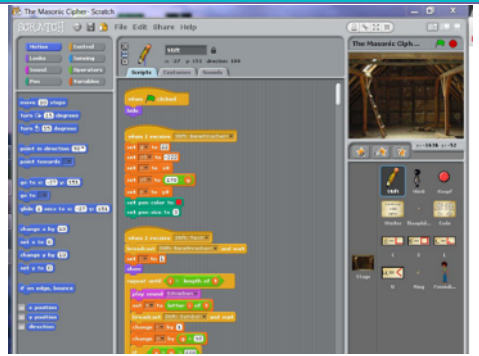
Texas Regional Collaboratives

THRIVING IN OUR DIGITAL WORLD

UNIVERSITY OF TEXAS AT AUSTIN

Impact



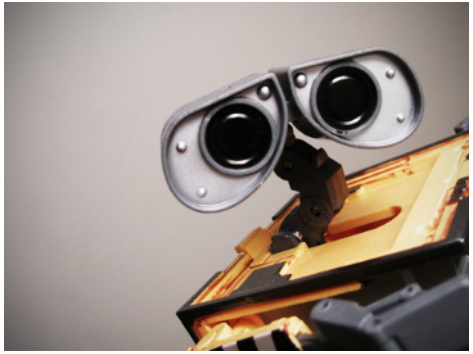
Programming

Representation

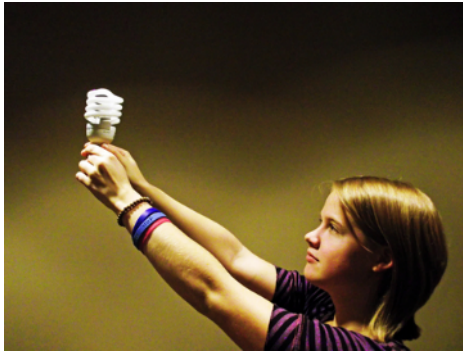
Digital Manipulation

Computers

Big Data

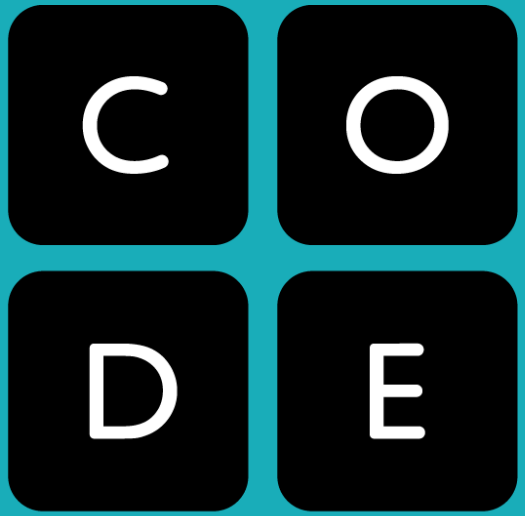


Artificial Intelligence



Innovation

www.cs.utexas.edu/~engage



In Partnership with Code.org®

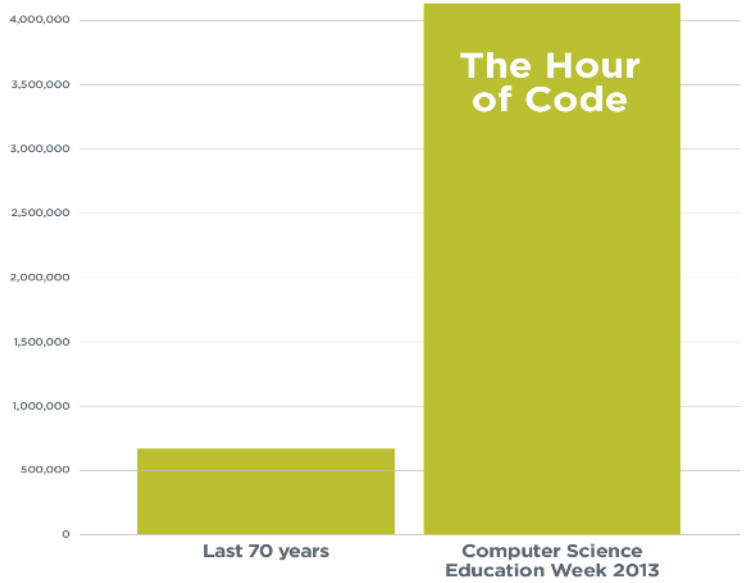
@codeorg #hourofcode

Who is Code.org?

- A public 501c3 nonprofit dedicated to bringing computer science to every school, and increasing participation by by women and underrepresented students of color.
- Producer of online courses in 30,000 classrooms
- The computer science PD partner for 30 of the largest districts nationwide, including NYC, LA, and Chicago
- The organizer of the Hour of Code campaign

96,497,610
have tried an Hour of Code

Anybody can learn.



More girls participated in computer science in US schools **than in the last 70 years.**

60 school districts partnered with Code.org, including all 7 largest US school districts:

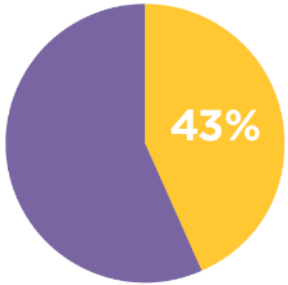
1. New York City Department of Education
2. Los Angeles Unified School District
3. Chicago Public Schools
4. Miami-Dade County Public Schools
5. Clark County School District
6. Broward County Public Schools
7. Houston Independent School District

8M Students

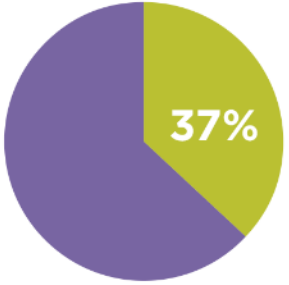
8. Hillsborough County Public Schools
9. Hawaii Department of Education
10. Orange County Public Schools

These 7 districts reach 15% of all African American + Hispanic students in the US

Moving the needle on diversity in tech



Female students

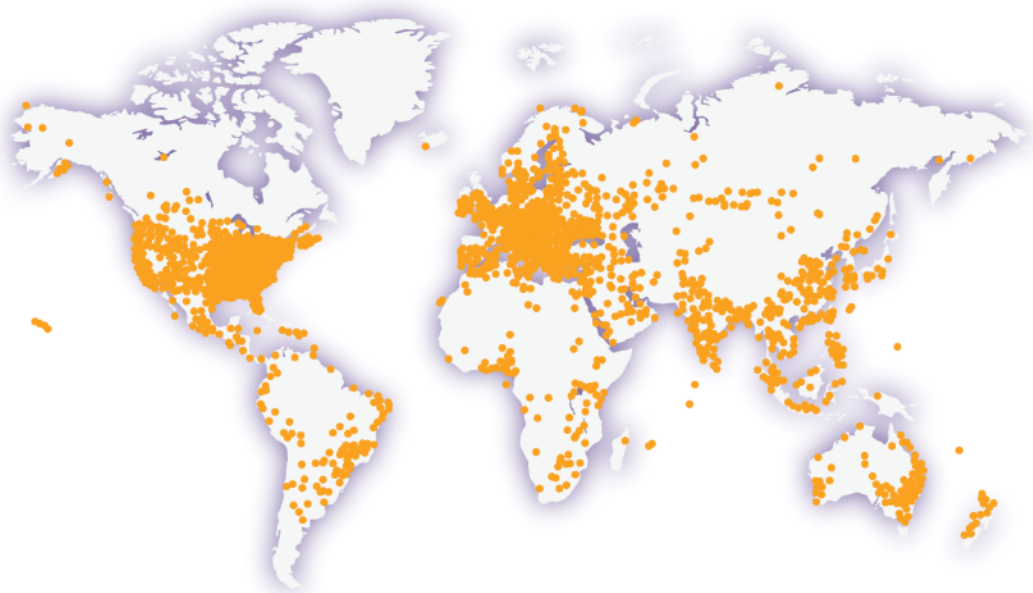


African American or Hispanic Students

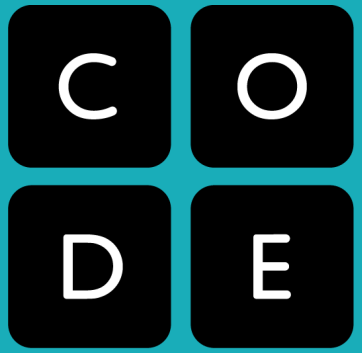
CODE STUDIO

Over 1M girls and over 1M African American + Hispanic students enrolled in Code Studio courses

In 2014 alone, **60 million students** tried the Hour of Code



Required Secondary Curriculum



In Partnership with Code.org®

District Partnerships

MS Blended PD: 3 phases, 12 months

- Spring: Online knowledge building and pedagogy reflection
- Summer: In-person workshop
- School: Online community and in-person workshops

Workshop costs and
teacher stipends covered by Code.org

Beyond one hour: high school

- Code.org district partnership model:
  - Two levels of courses
    - Exploring Computer Science (Intro) – (Fundamentals of CS)
    - Computer Science Principles (AP)

HS Blended PD: 4 phases, 15 months

- Spring: Online knowledge building and pedagogy reflection
- Summer: In-person workshop
- School: Online community and in-person workshops
- Summer: In-person reflection and follow-up

Workshop costs and
teacher stipends covered by Code.org

Code.org Commitments (at no cost to the district)

- Provide all curricular resources for K-5, 6-8 and high school
- Provide an online platform for curriculum
- Pay teacher stipends (not taxes and benefits) for time spent in professional development (except K-5)
- Organize all professional development activities associated with Code.org courses
- Provide marketing materials for promotion of the courses
- Develop leadership and capacity
- Provide materials to support Hour of Code™ events
- Advocate for state and local policy changes to support computer science
- Leverage our volunteer network to provide grassroots support for computer science in the community

In Partnership with Code.org

Partner Commitments

Texas Regional Collaboratives
THE UNIVERSITY OF TEXAS AT AUSTIN

District

- Offer computer science curriculum package and courses to students (High school computer science is required, middle/elementary is recommended but optional
- Establish a strong working partnership (marketing, establishing CS program director, holding district-wide Hour of Code™ event each year, implement key program details)
- Participate In Code.org's Professional Development Program (having at least one teacher, counselor and principal from participating schools, provide limited travel support, allow code.org)
- Sustain the program after the term of the agreement (Offer Core Credit (math/science) for Computer Science Principles, Establish or connect with a Community of Practice)
- Allow Code.org and its evaluators to assess the program

Teacher and School

- Participate in all all phases of PD
- Teacher who takes PD teaches a course
- Set up classroom for success (meet minimum technology requirements, provide the necessary materials to support ECS course)
- Promotion to staff, students, and community