Building a Computer Science Pipeline in your District

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Presented by
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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

- Workforce Trends
- Higher Ed
- K12
Our Country Needs **One Million** More Programmers

1,000,000 more jobs than students by 2020

$500 billion opportunity

1.4 million computing jobs

400,000 computer science students

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

The job/student gap in computer science

- 60% Computing Jobs
- 40% All other math & sciences

Students

- 2% Computer science students
- 98% All other math & sciences

Less than 2.4% of college students graduate with a degree in computer science. And the numbers have dropped since last decade.

SOURCE: Code.org
20% of Today’s Open Jobs in Austin Are CS

Computer 19%
Other 16%
Healthcare 10%
Office Support 12%
Retail Sales 11%
Install/Repair 4%
Arch/Eng 4%
Biz/Financial 6%
Transport 4%
Food Prep 5%

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

<table>
<thead>
<tr>
<th>Job Category</th>
<th>Median Salary</th>
<th># Openings</th>
</tr>
</thead>
<tbody>
<tr>
<td>App Developer</td>
<td>$95,240</td>
<td>1,574</td>
</tr>
<tr>
<td>Web Developer</td>
<td>$62,260</td>
<td>1,073</td>
</tr>
<tr>
<td>Network/Comp Sys Admin</td>
<td>$68,130</td>
<td>863</td>
</tr>
<tr>
<td>Comp User Support</td>
<td>$75,830</td>
<td>819</td>
</tr>
<tr>
<td>Comp System Analyst</td>
<td>$44,840</td>
<td>709</td>
</tr>
<tr>
<td>IT Project Mgr</td>
<td>$88,430</td>
<td>558</td>
</tr>
<tr>
<td>QA Engineer/Tester</td>
<td>$88,430</td>
<td>451</td>
</tr>
<tr>
<td>Comp Sys Engineer/Architect</td>
<td>$88,430</td>
<td>393</td>
</tr>
<tr>
<td>Comp Programmer</td>
<td>$79,210</td>
<td>320</td>
</tr>
<tr>
<td>Database Admin</td>
<td>$73,070</td>
<td>252</td>
</tr>
</tbody>
</table>

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

Sources: National Science Foundation
2012 High School A.P. Enrollment

Exposure to CS leads to the best-paying jobs in the world. But AP CS is only available in 5% of high schools.

Only 15% of this tiny box are girls. 8% are African Americans, or Hispanics.

Sources: College Board
What is the Status of AP Computer Science?

SOURCE: www.TEALS12.org and College Board
AP CS exam takers as % of over all AP exam takers

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

Number of Teachers Certified

- 6-12 Secd. Computer Info System
- 8-12 Computer Science
- 8-12 Tech Apps

Number of Teachers Certified
CS Offerings in Texas 2013-14

<table>
<thead>
<tr>
<th>PEIMS #</th>
<th>Course</th>
<th>FTEs</th>
<th>Student Enrollment</th>
</tr>
</thead>
<tbody>
<tr>
<td>03580200</td>
<td>Computer Science I</td>
<td>68.47</td>
<td>9,132</td>
</tr>
<tr>
<td>03580300</td>
<td>Computer Science II</td>
<td>13.14</td>
<td>879</td>
</tr>
<tr>
<td>A3580100</td>
<td>AP Computer Science A</td>
<td>51.54</td>
<td>5,572</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>133.15</td>
<td>15,583</td>
</tr>
</tbody>
</table>

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

1. Lack of trained and certified CS teachers
2. No incentive for administrative investment in CS Pathway
3. No system connecting HS courses to careers in industry
4. Low student/parent demand
Lack of trained and certified CS teachers

No incentive for administrative investment in CS Pathway

Low student/parent demand

No system connecting HS courses to careers in industry

Recommendations for Building a Robust Texas Computer Science Pipeline

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 #3
Expand options for core computer science to include additional engaging, project-based courses such as AP Computer Science Principles

RECOMMENDATION #4
Develop a robust and scalable online system that connects high schools to careers and professionals in computer science fields
ONE DOES NOT
TEACH OFFICE APPLICATIONS AND CALL THE COURSE
COMPUTER SCIENCE
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](http://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
- 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](https://canvas.instructure.com/courses/884561)
- Summer teacher professional development
- Fee for dual enrollment
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
- Mobile CS Principles using App Inventor
  - Online and F2F
  - Summer 2015
  - http://mobile-csp.org/participate
Building the Computer Science Pipeline

Grades K-8 Computer Coding Courses

Phillip G. Eaglin, PhD
Founder and CEO
Changing Expectations Corp
Code.org Affiliate
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
- Grades 4, 5, Middle School

- Nested loops and conditionals
- Internet transmission methods
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

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

- [http://goo.gl/tpaJiL](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

Phillip G. Eaglin, PhD
Changing Expectations Corp
(512) 496-6824
phillip.eaglin@changeexpectations.org
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!
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

<table>
<thead>
<tr>
<th>Fundamentals of Computer Science</th>
<th>AP Computer Science Principles (coming in 2016, optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(e.g. Exploring Computer Science curriculum)</td>
<td>(e.g. Thriving in our Digital World curriculum)</td>
</tr>
</tbody>
</table>

- **Java Programming**
  - CS and/or Computer Programming
  - AP CS A

- **Mobile App Development**

- **Web Design / Technology**

- **Game Design / Development**

- **Robotics**
<table>
<thead>
<tr>
<th>Course</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>Prerequisite</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundamentals of CS</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Proficiency in Tech Apps</td>
</tr>
<tr>
<td>CS I</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Algebra I</td>
</tr>
<tr>
<td>CS II</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>Algebra I &amp; either CS I or Fundamentals CS</td>
</tr>
<tr>
<td>CS III</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>CS II or AP CS</td>
</tr>
<tr>
<td>AP CS A</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>CS I or Algebra II</td>
</tr>
<tr>
<td>Game Programming &amp; Design</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Algebra I</td>
</tr>
<tr>
<td>Mobile App Development</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>Proficiency in Tech Apps</td>
</tr>
<tr>
<td>Web Design</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>None</td>
</tr>
<tr>
<td>Web Game Development</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td>Web Design (recommended)</td>
</tr>
<tr>
<td>Video Game Design</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Art I, Digital Interactive Media &amp; Animation</td>
</tr>
<tr>
<td>Computer Programming</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Keyboarding proficiency</td>
</tr>
<tr>
<td>Advanced Computer Programming</td>
<td></td>
<td>X</td>
<td></td>
<td>X</td>
<td>Computer Programming</td>
</tr>
<tr>
<td>Web Technologies</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>Keyboarding proficiency and Prin IT or BIM</td>
</tr>
<tr>
<td>CS and Software Engineering</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>None</td>
</tr>
<tr>
<td>CS Applications</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td>CS and Software Engineering</td>
</tr>
</tbody>
</table>
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
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
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

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

- 8M Students
- 43% Female students
- 37% African American or Hispanic Students

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
District Partnerships

In Partnership with Code.org
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
Partner Commitments

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 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