

# Computer Science Education for New Mexico

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## Overview

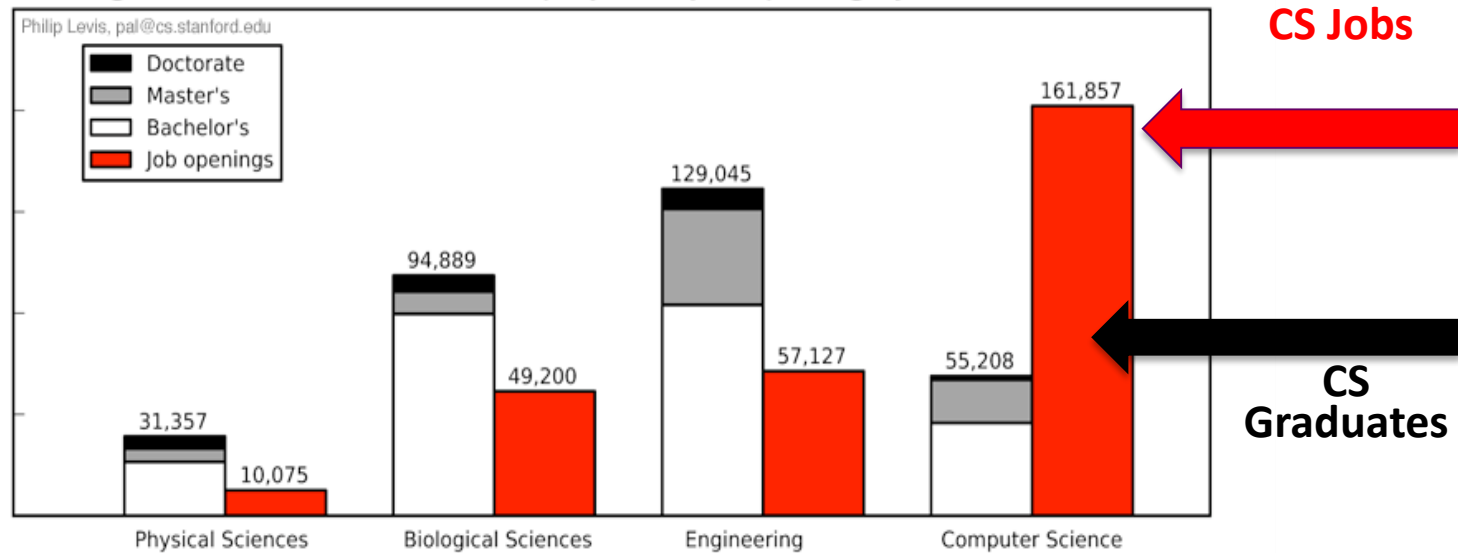
- The importance of computer science education
- Where we are today
- Where we need to go

# Why computer science education matters

- Foundation of today's innovation economy
  - Economic development and job creation
  - Technology sector (600,000 unfilled CS jobs in 2015)
  - And beyond (arts, healthcare, manufacturing, financial services, retail, medicine)
- A new basic skill
  - As important as reading/writing/arithmetic
  - Technology vs. technicians
  - Prepares students to be citizens of an interconnected technological world
- Starting CS education in college is too late, just like math, science, or language

# The Economic Landscape

**½ of STEM jobs are projected to be in CS**



So: <http://csl.stanford.edu/~pal/ed/>

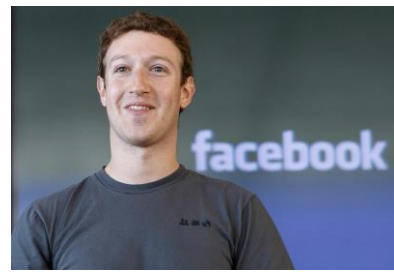
100% of UNM CS graduates have jobs when they graduate  
 Average starting salary for computer scientists is >\$70,000

## Why now?

- **\$4 Billion** CS For All initiative
  - Announced by President Obama in Jan. 2016
  - To accelerate CS education in K-12
- “Gives students opportunities to be creators---not just consumers---in the digital world and to be active citizens in our technological world”
- “Will ensure every student has access to Computer Science in their classrooms at all levels.”
- Now is the time to prepare to leverage this funding

<https://www.whitehouse.gov/blog/2016/01/30/computer-science-all>

# Who studies computer science?



- 98% of CS majors at Google took a high school CS course
  - Only 25% of U.S. high schools offer a single CS course
- In the U.S., fewer than 15% of CS majors are female
  - Fewer than 10% are Hispanic/Native/African American

# CS education in New Mexico

- CS does **not** meet any state high school graduation requirements
  - Few NM high schools offer computer programming at all
  - Students are **not** prepared or advised to study CS
- CS courses are **not** part of the core education requirements at NM state universities
  - UNM CS 108L is a (very) recent exception
- **No** statewide infrastructure for K-12 CS
  - Training teachers
  - Endorsement for CS teachers
  - Curriculum development and standards setting for courses
  - Graduation, admissions requirements
- NM CS For All **is** a successful early experiment



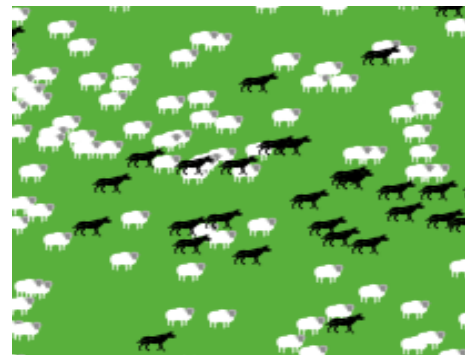
## NM CS for All

- The first in the nation!
  - 2012 NSF grant to the Santa Fe Institute in partnership with UNM
  - 2016-2017 supplemental funding award
- Dual credit course offered to high school students through UNM
- Scalable hybrid model
  - Teach the teachers (on-line + in person workshops)
  - High school teachers teach hands-on CS labs using UNM on-line course material



# NM CS For All: Content

- Intro CS for teachers and students
  - Computer programming
  - Computational thinking
    - Problem solving, abstraction, and analysis
- Scientific modeling and simulation of complex systems
  - Provides linkages to National Laboratories and scientific research institutions.
  - Modeling is crucial in today's natural sciences
- Integrated STEM skills



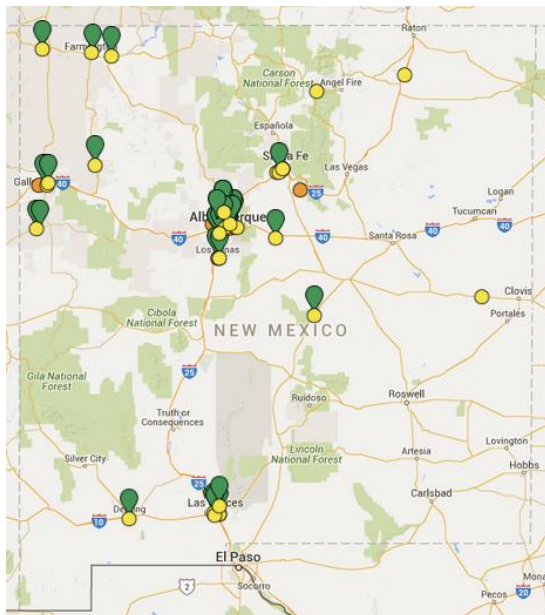
# CS For All: 2012-2016

- Trained 50 high school teachers
- Taught 1000 NM high school students
- 50% enroll for UNM dual credit
- 80% of students pass
- 88% “like” the course
- Significant increases in learning objectives



# CS For All 2012-2016: Demographics

- CS majors in U.S.
  - < 15% Female
  - < 10% Hispanic/Native / African American
- NM CS for All
  - 35% female
  - 60% Hispanic/Native/African American
  - 76% underrepresented groups



# NM CS For All: Assessments

High school teachers said:

- *It was the **best PD (Professional Development)** I have ever been to”*
- *The student was not college material, but last year **decided to go to college** after ‘getting into’ the CS108 course.”*
- *“[CS108] not only increases computer science skills and knowledge, but helps with math and science. It helped my students **connect the dots.**”*
- *“This is so perfect for our state...it helps [students] to **leapfrog poverty.**”*

# The roadmap

- Change state education requirements (high school and university)
  - Draft legislation by Rep. McCamley
- CS high school courses
  - Develop certification procedures for courses
  - Need legitimate courses, not technical training
- Formal endorsement program to train/certify teachers
- Sustained funding for successful programs
- A CS champion in PED
- University admissions/graduation requirements



# NM CS For All is Growing

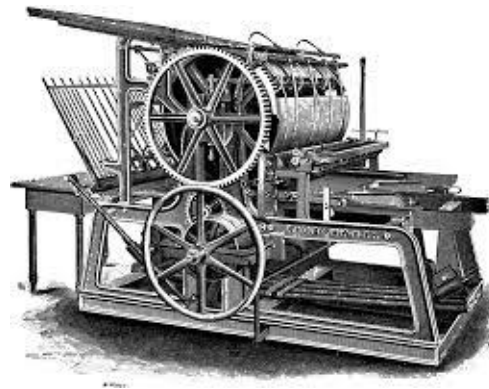
- CSforAll now satisfies a UNM Natural Science core requirement
  - Encourages all UNM students to learn some CS
- Currently UNM's largest dual credit course
  - 300 students in 2015/16
- Goal:
  - Available to every NM high school student who wants to enroll
  - 2000 students per year by 2020
  - Train 20-40 teachers per year
- Currently developing a 2<sup>nd</sup> semester course

# Challenges

- CS education is not training
  - Certification courses ↔ vocational school
  - Engineer vs. technician
  - Coding camps are not sufficient
- Sustainability and scalability
  - Even good ideas are hard to implement at scale
  - Federal funds help develop and launch programs
  - NM funds and infrastructure needed to grow and sustain successful programs



# Computers are Transforming Our World



Unprecedented technological change necessitates  
unprecedented access to technological education



## NM CS For All program costs today (Currently covered by UNM)

- \$50,000
  - Instructor for both courses (\$15K)
  - Tuition per teacher (\$1K)
  - Stipends for Sat. teacher workshops (\$200 each)
  - ¼-1/2 time administrator (\$10K – 20K)
- Tuition per student (\$0.0)
- Refresh and maintain content
  - Faculty summer salary
  - TA salaries