The Motivation

From 2005 to 2009 we saw a **17% decrease** in the number of secondary schools offering introductory or pre-AP CS courses.

AP CS was the only AP exam with **DECLINING ENROLLMENT**.

From 2005 to 2009 we saw a **35% decrease** in the number of secondary schools offering AP Computer Science.

There is a lack of understanding of the difference between **computer applications** and **computer science**; between **using technology** and **creating technology**.
The Research

• Survey of state education authority documents in all fifty states to answer two specific questions:
  
  – To what extent have states adopted the ACM/CSTA model curriculum standards?

  – How does the state treat high school computer science courses in terms of what it “counts” for a student’s graduation requirements?

• Data was collected as of April 2010
Standards

• **Standards** - Defined competencies that provide clear learning outcomes

• Targets set by state with school districts establishing curriculum and offering courses that implement those standards

• **Assessments**
Why Standards?

“Just as new science enables new technologies, new technologies enable new scientific investigations, allowing scientists to probe realms and handle data [in] quantities previously inaccessible to them.”
Modeling links classroom mathematics and statistics to everyday life, work, and decision-making... When making mathematical models, technology is valuable for varying assumptions, exploring consequences, and comparing predictions with data.

Real-world situations are not organized and labeled for analysis; formulating tractable models, representing such models, and analyzing them is appropriately a creative process...
CCSS HS Mathematics - Modeling

Some examples of such situations might include:

– Estimating how much water and food is needed for emergency relief in a devastated city of 3 million people, and how might it be distributed.
– Planning a table tennis tournament for 7 players at a club with 4 tables, where each player plays against every other player.
– Designing the layout of stalls in a school fair so as to raise as much money as possible.
– Analyzing the stopping distance for a car.
– Modeling savings account balance, bacterial colony growth, or investment growth.
– Engaging in critical path analysis, e.g., applied to turnaround of an aircraft at an airport.
Computer Science Standards

• The good news?
  – The curriculum guidelines exist:

• The bad news?
  – They’re just not implemented!
What are the ACM Standards?

• 55 Standards for grades K-12, by Levels:
  – Level 1: Foundations of CS (K-8: 35)
    • (K-2: 12; 3-5: 11; 6-8: 12)
  – Level 2: CS in the Modern World (9-10: 10)
  – Level 3: CS as Analysis & Design (10-11: 10)

• Another taxonomy (IT Fluency, NRC 1999)
  – Skills (14, all Level 1)
  – Capabilities (22, mostly Level 1, some 2 & 3)
  – Concepts (19, split pretty evenly across Levels 1,2,3)
Understand the graph as a tool for representing problem states and solutions to complex problems (68.11)
Examples that identify the broad interdisciplinary utility of computers and algorithmic problem solving in the modern world (L2.8)
Skills-Centric Education

Technology literacy prevails in current educational standards for computing
FIGURE 3 Secondary School Standards Level II and Level III Adoption by State
Graduation Requirements

• How Computer Science courses count
  – 36 general elective
  – 8 Math
  – 1 Science
  – 6 district-determined

• Technology Literacy Requirement?
  – 28 No
  – 12 Yes
  – 5 Menu
  – 6 district-determined
Moving Forward with Reforms

• K-12 computer science education is critical for success in the 21st Century, but there are major obstacles in our way

• We need to address the key issues:
  – Clarify the role and place for K-12 computer science education
  – Lift state standards and make courses “count”
  – Support computer science teachers
  – Address diversity issues

• We need to put computer science within the core of a student’s education

• It is possible…
  – Georgia and Texas are two examples (but Texas is revising its CS TEKS…)
  – Tammy Pirmann’s success in Springfield, PA and others (MD)
Executive Summary

Computer science and the technologies it enables now lie at the heart of our economy, our daily lives, and scientific enterprise. As the digital age has transformed the world and workforce, U.S. K–12 education has fallen woefully behind in preparing students with the fundamental computer science knowledge and skills they need for future success. To be a well-educated citizen as we move toward an ever-more computing-intensive world and to be prepared for the jobs of the 21st Century, students must have a deeper understanding of the fundamentals of computer science.

The report finds that roughly two-thirds of the country have few computer science education standards for secondary school education, and most states treat high school computer science courses as simply an elective and not part of a student’s core education. 

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Modeling, finale

The Gambler's Ruin - this problem dates back to Christian Huygens, who discovered this seeming paradox:

If you play a fair game with a finite bankroll against an opponent with an infinite bankroll, you will eventually lose all your money. That is, fair games, played long enough, are losing games.