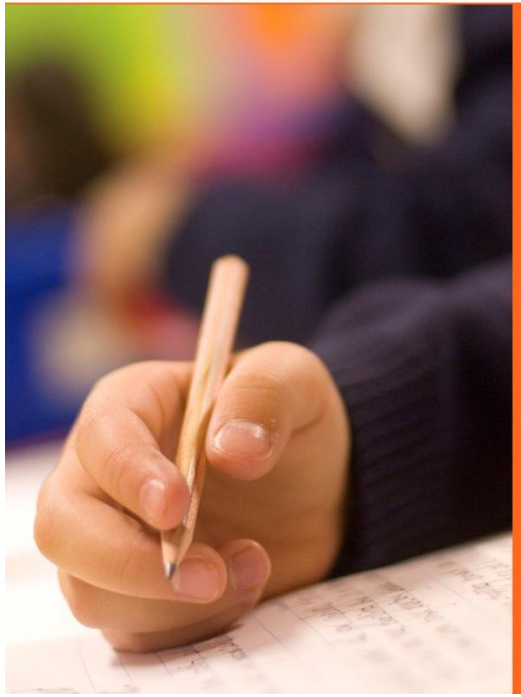
Opportunity Culture for All

BUILDING AN OPPORTUNITY CULTURE FOR AMERICA'S TEACHERS

www.opportunityculture.org

Reaching All Students with Excellent STEM Teachers



Companion to the
Education Leaders' Brief

PUBLIC IMPACT

What is STEM?

Science

+ Technology

+ Engineering

+ Math

STEM

Overview

- ✓U.S. STEM Teaching and Learning Today
- Initiatives to Address Challenges
- Opportunity Culture Can Close STEM Gaps

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STEM job growth is projected to outpace other sectors of the economy

Projected STEM job growth =

- 13% from 2012–2022 vs. 11% in all occupations
- 1 million more jobs than in 2012

5% of U.S. workers
employed in science and engineering
drive 50% of U.S. economic expansion.

5 jobs created for each new job in software and life sciences

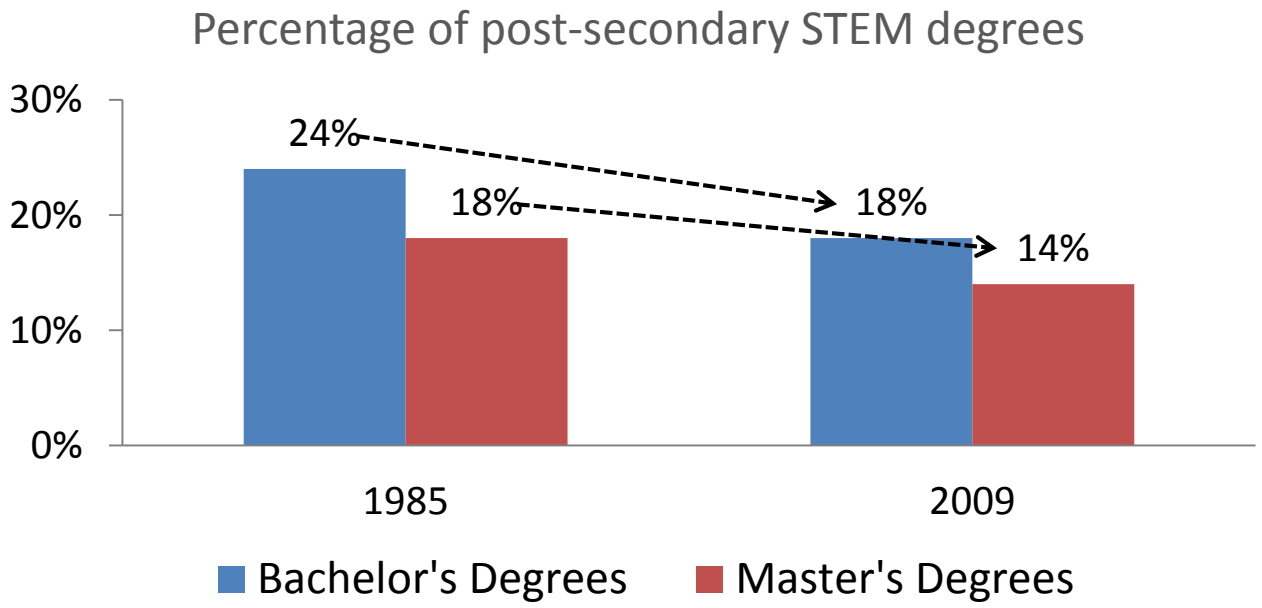
vs.

1.6 jobs created for every new job in manufacturing

92% of STEM jobs require at least some **post-secondary education.**

Too few STEM degrees for job growth

- U.S. has one of lowest ratios of STEM to non-STEM bachelor's degrees in world.
- The number of post-secondary STEM degrees has increased, but the percentage of students pursuing these degrees has decreased.



Businesses report STEM candidate shortage

… Only **16% see enough** African-American, Hispanic and American Indian **applicants with STEM degrees.**

… Only 50% find candidates with four-year STEM degrees "in a timely manner."

2013 survey of talent recruiters for Fortune 1000 companies found …

… **56% of respondents cite lower productivity** as a direct result of STEM talent shortages.

… 47% cite the shortage as limiting business growth.

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STEM shortage starts in K–12 schools

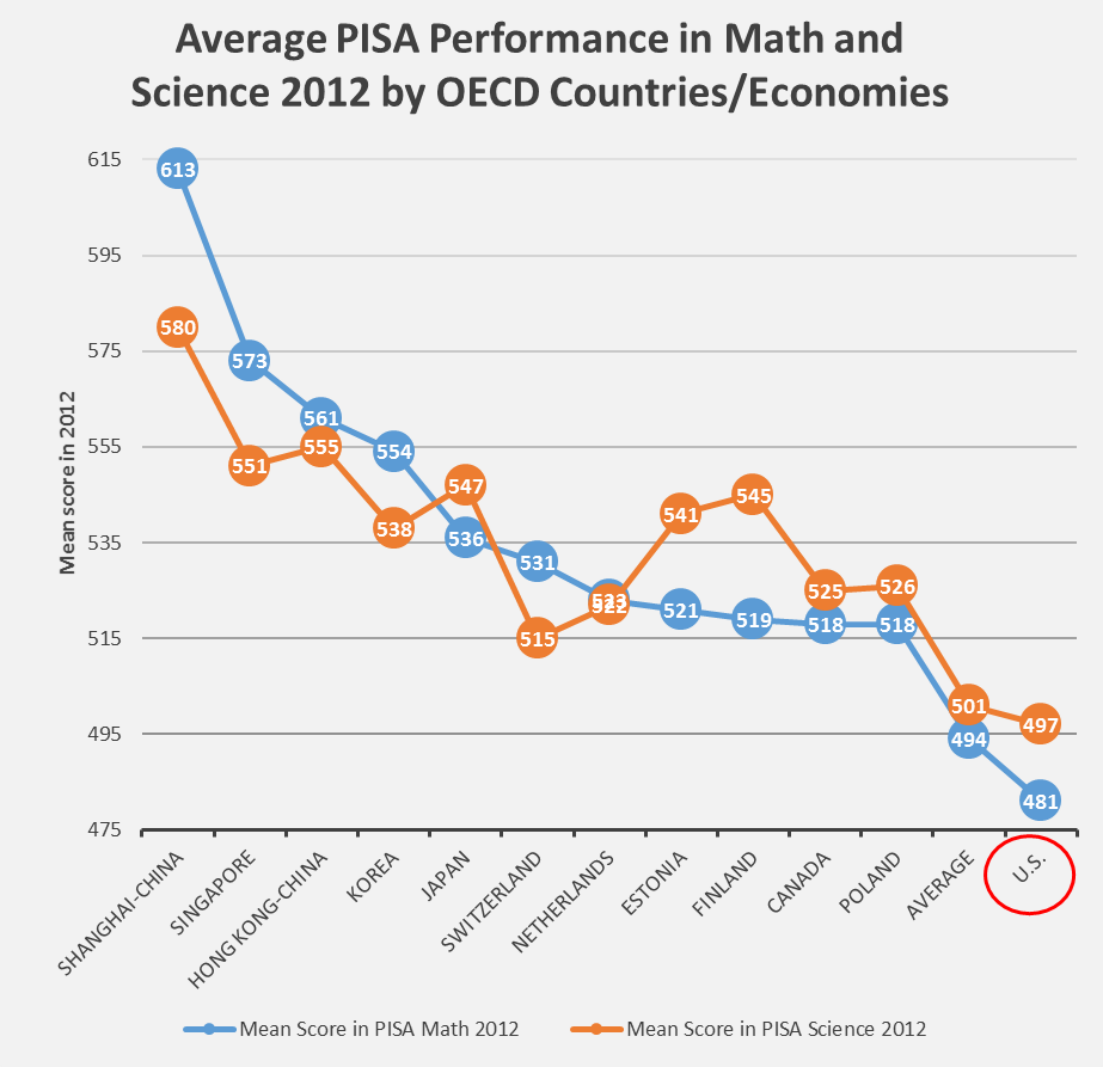
The 2012 Program for International Student Assessment (PISA) results showed lackluster performance in STEM subjects for U.S. students.

Math → **26%** of U.S. students scored **below level 2** (baseline proficiency level) compared with **8%** of students in Singapore.

Science → **18**% of U.S. students scored **below level 2** (baseline proficiency level) compared with **5%** of students in Estonia.

*The U.S. ranked **lower than 29** of the international education systems participating in math and **lower than 22** of those participating in science.*

The U.S. lags behind top performers in math and science



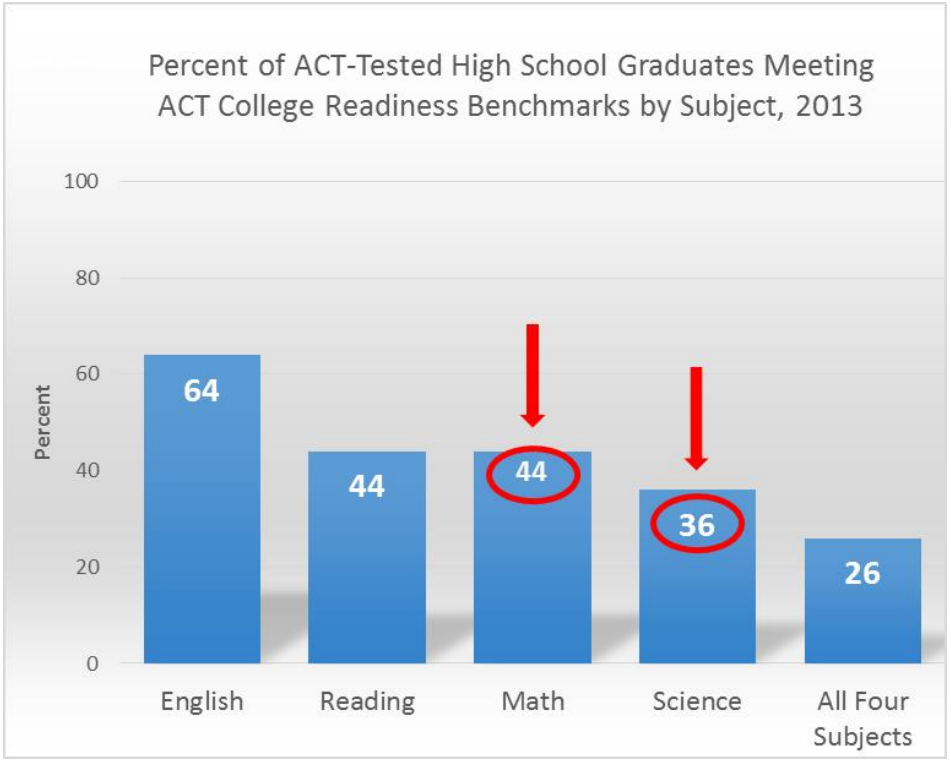
In math and science, **the U.S. lags behind:**

- Singapore
- Hong Kong
- Korea
- Japan
- The Netherlands
- Estonia
- Finland
- Canada
- Switzerland
- Poland

U.S. high school graduates are not prepared for college STEM coursework

- **Fewer than half of high school graduates are academically prepared** for first-year college science and math courses.
- In 2013, only 44% achieved or exceeded the ACT college-readiness benchmark for math, and only 36% for science.

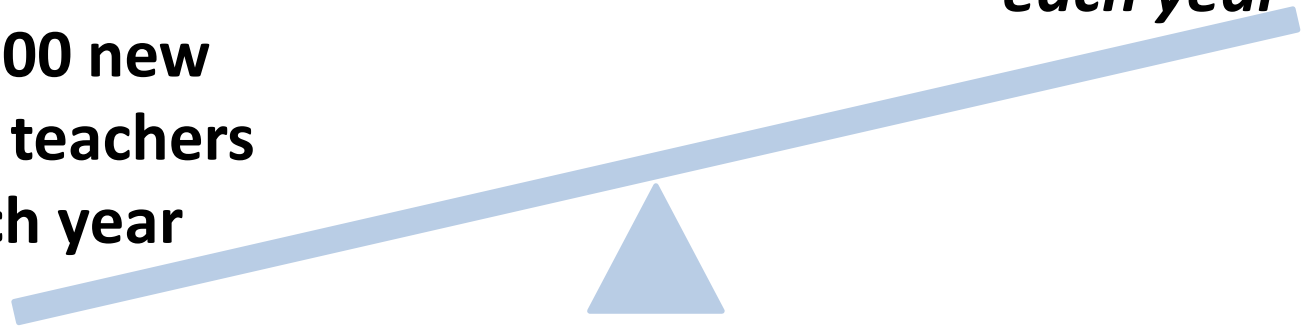
ACT benchmarks provide a tool for determining whether a student will be successful in college-level math and science courses.



Supply of STEM teachers is insufficient for K–12 STEM instructional needs

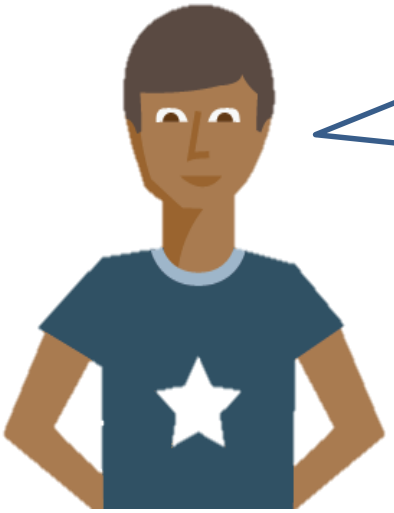
The need:
25,000 new STEM teachers each year

The supply:
less than 9,000 each year



- Challenges for STEM teacher recruitment include:
  - Too few education majors who are both interested and capable
  - Too few STEM majors who would be willing to earn less as a teacher

STEM-trained teachers teach more



Teacher credentials have a marked effect on student achievement in math—even when taking into account parent education levels and socioeconomic factors.

Students taught by teachers holding a bachelor's and master's degree in math showed **an increase in math scores of more than a third of a year of schooling compared with students whose teachers did not share these credentials.**

Student time on STEM affects learning

The Center on Time and Learning determined that **fourth-graders engaging with science lessons every day** through inquiry-based learning or project-based instruction **scored 16 points higher on the 2009 NAEP than other students.**

But excellent math and science teachers aren't easy to retain …

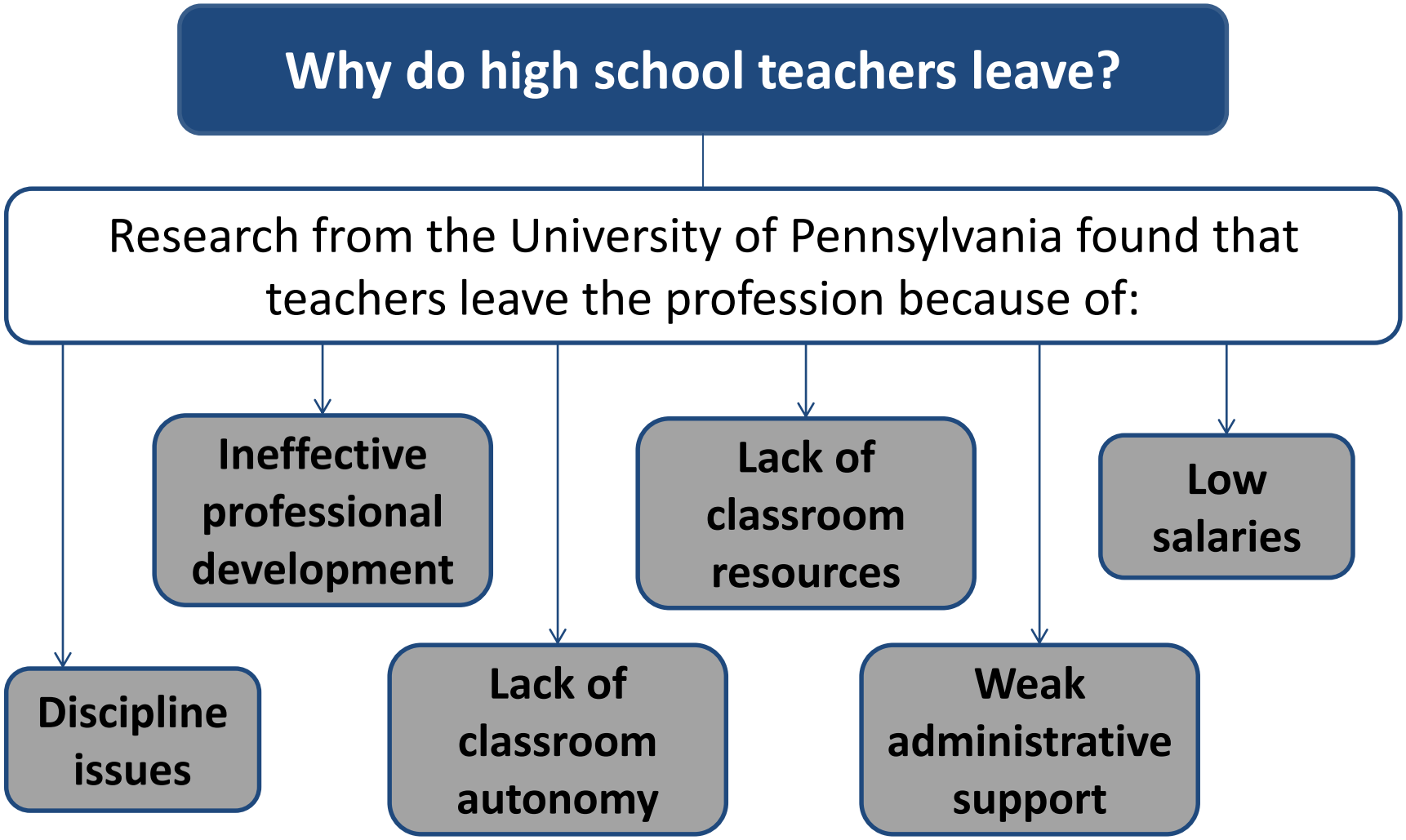
High school STEM teachers don't stay

NCES data from 2007–08 shows that **70%** of high school math teachers **held a major in their subject area,** and **82%** of high school science teachers **held a postsecondary degree in their subject area**.

However …

… more than 40% of high school STEM teachers **leave the profession within their first five years of teaching.**

High school STEM teachers don't stay



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High school STEM course shortfall hurts all—but students of color lose most

Need is particularly acute at high-poverty and high-minority schools.

According to 2009–10 Department of Education Office of Civil Rights data …

In only 50% of high schools sampled in the 20 largest school districts.

Calculus

- Offered in schools where Hispanic students make up **20%** of students... ***but...*** …only **10%** of students are enrolled in calculus.
- Offered in **55% of schools** with the **lowest minority enrollment.** ***vs.*** Offered in **29% of schools** with the **highest minority enrollment.**

Algebra II

Offered in **82% of schools** with the **lowest minority enrollment.** ***vs.*** Offered in **65% of schools** with the **highest minority enrollment.**

Physics

Offered in **66% of schools** with the **lowest minority enrollment.** ***vs.*** Offered in **40% of schools** with the **highest minority enrollment.**

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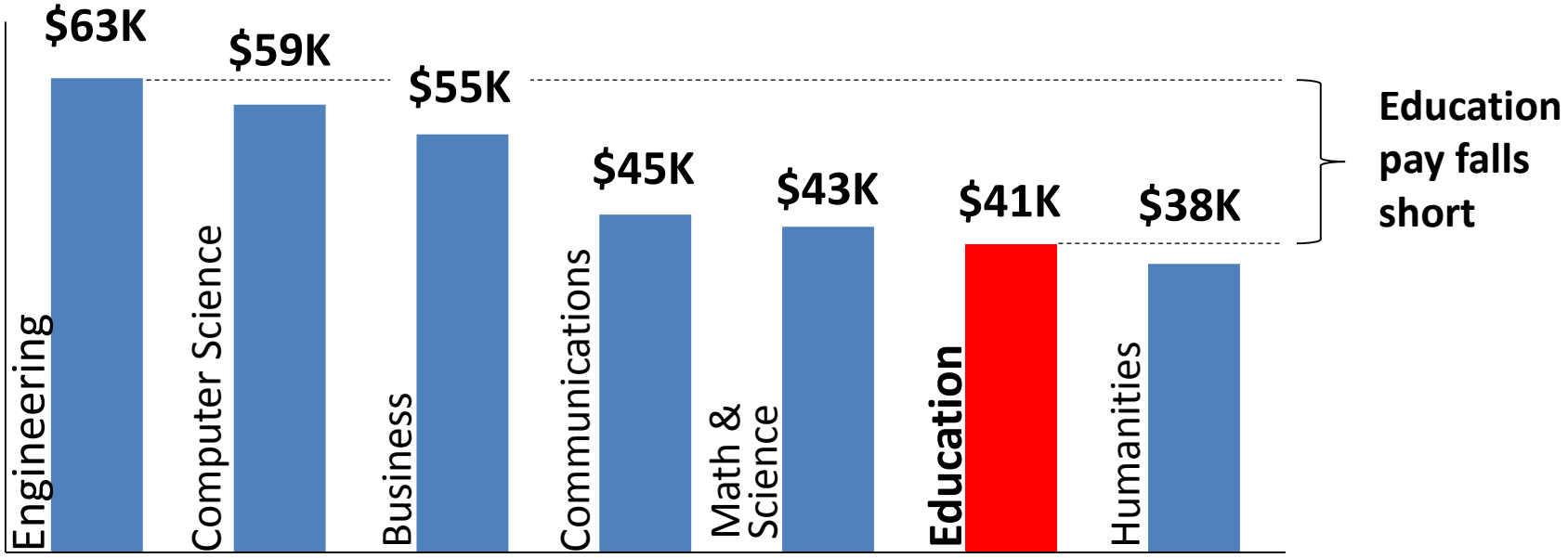
Salaries for education majors can't compete with other STEM jobs

Class of 2013 **Starting Salary** by Undergraduate Degree



Median earnings for wage/salary workers over age 25 with a bachelor's degree:

Science & Engineering **$66,000**

vs.

Education **$44,000**

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STEM teachers lack basic prep

4th-graders with math teachers who majored in math	2%
8th-graders whose math teachers majored in math	30%
8th-graders whose science teachers have an undergraduate major in science	48%
8th-graders with science teachers who took three or more advanced science courses	63%

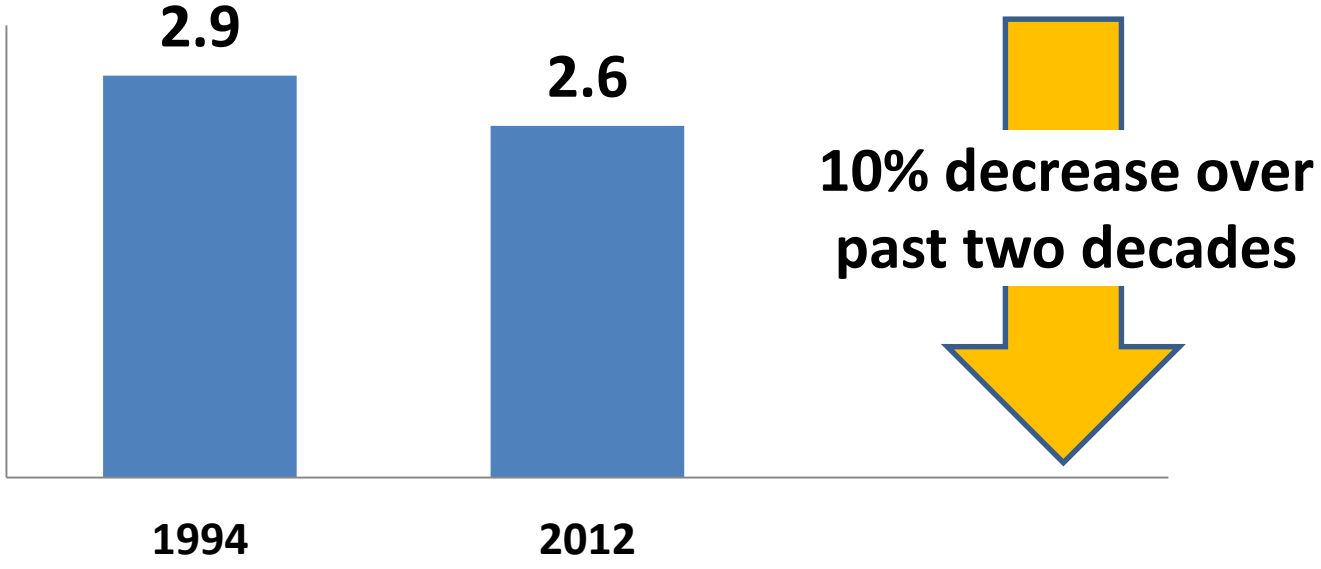
STEM teachers lack basic prep

Only 11% of teachers from the bottom 25% of university education schools take the courses they need to teach middle school math by international standards…

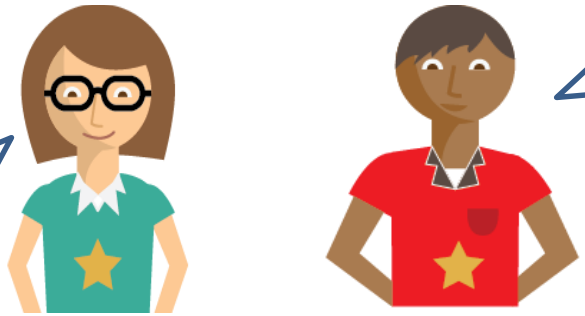
…but that bottom 25 percent of schools produces *60%* of middle school math teachers.

Too few classroom hours on science

Classroom hours spent on science by 1st – 4th grade students



How many 8th-graders **spend 5 or more hours a week on science?**



As of 2011, **only 35%.**

Overview

- ✓U.S. STEM Teaching and Learning Today
- ✓Initiatives to Address Challenges
- Opportunity Culture Can Close STEM Gaps

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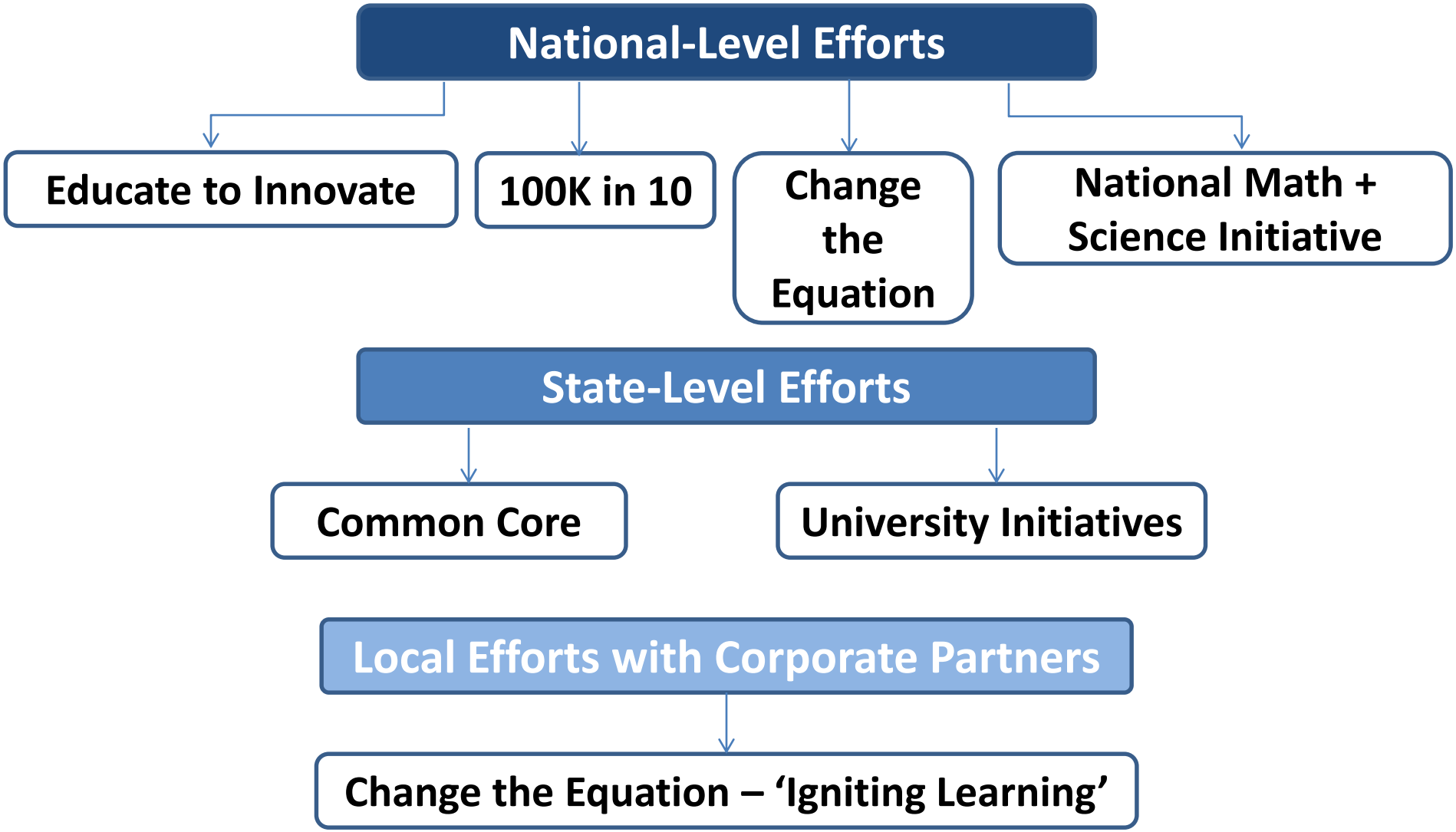
Current STEM initiatives



National Efforts: Educate to Innovate

- Launched in 2009 by President Obama

Educate to Innovate

Goal—move U.S. students from the middle to the top of the world in science and math over the next decade

- Increase STEM literacy for students
- Improve the quality of STEM teaching
- Expand STEM education and career opportunities for under-represented groups, including women and minorities

National Efforts: 100K in 10

- Aims to prepare 100,000 STEM teachers in 10 years
- Backs the creation of next generation of innovators
- Led by the Carnegie Corporation of NY, more than 150 foundations and coalitions working in partnership to help improve the supply of excellent STEM teachers

National Efforts: 100K in 10 Projects

- **Research Design Competition**

  Led by U. Chicago Urban Education Lab to generate evidence about which practices work in training and supporting STEM teachers. 2013's winners, CSU and Mathalicious, work with school districts to analyze efforts to support teachers' transitions to Common Core standards.

- **Shared Measures Annual Survey**

  Asks questions about partners' work in each stage of a professional teacher's life from recruitment to advancement. Goal—to find out what is working with STEM teachers, bringing to light the STEM successes.

- **Convenings**

  Collaborative learning opportunities that include regular forums for sharing key strategies, emerging research, and issues related to excellent STEM teaching and learning.

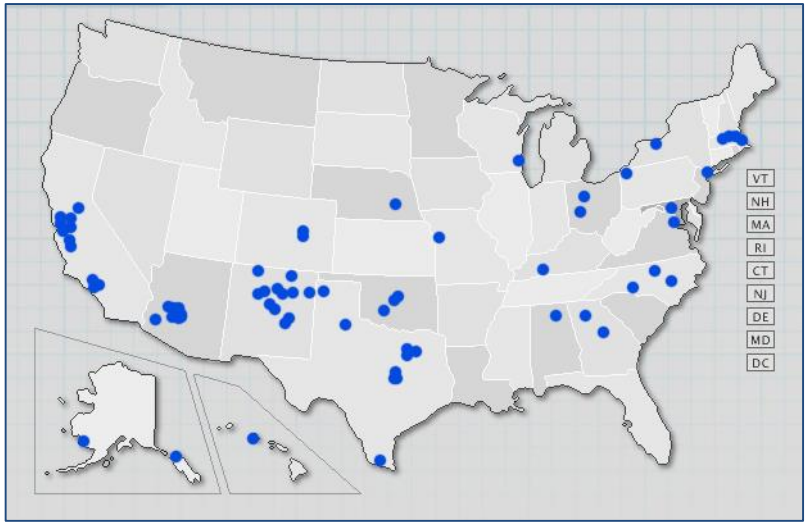
- **Notables**

  Series of case studies illustrating good practices. Includes programs from U. Chicago, U. Colorado, American Museum of Natural History and others.

National Efforts: Change the Equation

- CEO-led initiative launched in 2010 to motivate the business community to improve STEM learning quality.
- Created 'Vital Signs'—an interactive tool providing a picture of the supply and demand of STEM skills in every state.
- Helps more than 100 members collaborate with philanthropic and advocacy efforts to motivate students in STEM learning and improve teacher quality in STEM subjects.

134 sites use 5 'Igniting Learning' STEM programs



National Efforts: Change the Equation

'Igniting Learning' Projects: Increasing interest in STEM subjects at schools	
Eisenhower High School, Lawton, OK	Grumman Corporation helped implement the APTIP program, expanding access and enrollment in AP courses for underrepresented groups
Enos Garcia Elementary School, Taos, NM	Intel funded "Math Progressions," an innovative professional development program to improve math instruction
Knox Elementary School, Chandler, AZ	Intel launched 'Engineering is Elementary' integrating engineering into the elementary curriculum and allowing students to build their own engineering projects
Rochester STEM High School, Rochester, NY	With support from Motorola, a rigorous academic program integrates STEM focused project-based learning across all subjects for 9th- and 10th-graders

National Efforts:
National Math + Science Initiative

- Nonprofit organization provides increased instruction and teacher support for Advanced Placement courses
  - Training and mentoring teachers
  - Tutoring students
  - Holding study sessions
  - Providing access to videotaped lessons
- Results: The organization reports that the number of passing AP scores at 566 partner high schools rose 10 times faster than the national average, especially among female, African-American, and Hispanic students.
- Implications: Stronger and more frequent instruction in STEM is the key to better outcomes

State Efforts: Common Core Standards

Increased Focus on Higher-Order STEM Thinking

- MetLife survey of middle and high school teachers:
  - 56% said there is a great deal of focus in their school on application of math skills to solve everyday problems
  - 52% said there is focus on how to reason abstractly and quantitatively
  - These areas of focus are higher for teachers using the Common Core in their teaching

- Common Core Standards
  - Emphasize the importance of challenging content
  - Include trigonometry and calculus
  - Propose more advanced STEM standards
  - In math, overlap 90% with the content of standards in countries whose students perform best in math

University-Based Efforts: UTeach

WHAT STARTS HERE CHANGES THE WORLD
THE UNIVERSITY OF TEXAS AT AUSTIN

UTeach

We Prepare Teachers. They Change the World.

- Began 1997 at University of Texas, Austin
- 88% UTeach graduates are math and science teachers
- **80% are still teaching after 5 years** (compared with 65% non-UTeach graduates)
- 35 universities currently have UTeach programs
- Program attracts bright science and math majors into secondary teaching careers
- Offers an advanced curriculum and provides intensive field experiences and rigorous content area degrees
- Professional development and induction support encourage retention

University-Based Efforts: Stony Brook

- Making significant advances in boosting graduation rates of minorities
- "STEM SMART" provides support for disadvantaged high school and college graduates desiring to pursue degrees in hard sciences
- From 2004–10, graduation rates for Hispanic students increased from 42% to 58%.
- College students attend career prep workshops and many are offered internships or research opportunities.
- Other STEM Smart programs at SUNY Louis Stokes Alliance and Technology Entry Program (CSTEP) (both funded by the New York State Education Department)

Overview

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Teacher Effectiveness Varies

Two Years Ahead

Two students start 1st grade two years behind:

- One has excellent teachers every year, and achieves honors.
- The other has good, solid teachers every year—and stays behind.

Still Two Years Behind

Current Strategies: Not Enough

Recruiting STEM Teachers

Developing STEM Teachers

Retaining STEM Teachers

These strategies are important, but even if they are *dramatically* successful, they will, *if done alone*, still leave most classrooms without excellent STEM teaching.

Could New School Models Help?

Yes, if they:

- Extend the **reach** of excellent STEM teachers to more students
- Enable great STEM teachers—and eventually *all* teachers—to **earn more**, sustainably
- Make **development on the job** easier—e.g., via **collaborative teams, led by excellent teachers**
- Give great teachers **more authority to lead peers** and **clear accountability** for the students they reach

Opportunity Culture Principles

Teams of teachers and school leaders must choose and tailor models to:

1. Reach more students with excellent teachers and their teams
2. Pay teachers more for extending their reach
3. Fund pay within regular budgets
4. Provide protected in-school time and clarity about how to use it for planning, collaboration, and development
5. Match authority and accountability to each person's responsibilities

Model: Multi-Classroom Leadership

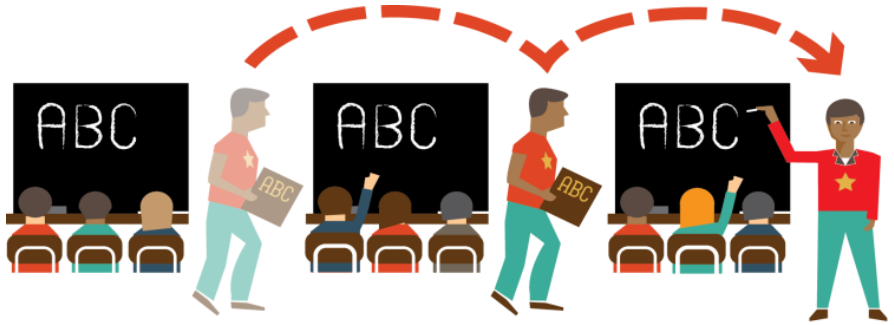
Teachers with leadership skills both teach and lead teams of teachers & assistants, sharing strategies and best practices.

These 3 teachers serve 100 students with an additional paraprofessional on the team. All teachers earn more, without bigger classes

The teacher-leader determines how students spend time and tailors teachers' roles according to strengths. Accountable for the results of all students in her "pod," she earns far more.

Based on Models for Extending the Reach of Excellent Teachers

Model: Elementary Specialization



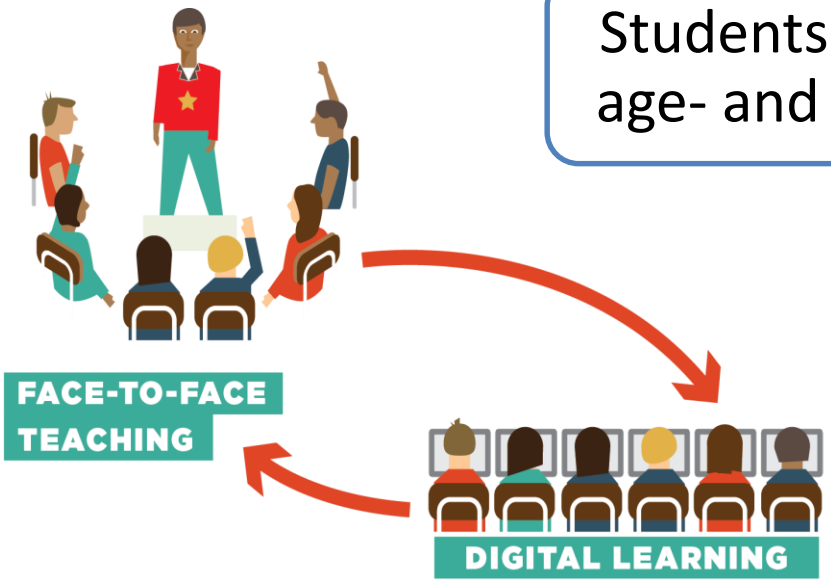
Excellent teachers specialize in high-priority subjects and the most crucial, challenging roles.

Teammates take care of students the rest of the time and cover administrative paperwork.

Specializing teachers instruct up to three times the students, earn more, and gain time for planning, development, and collaboration.

Based on Models for Extending the Reach of Excellent Teachers

Model: Time-Technology Swaps



Students spend part of the day engaged in age- and child-appropriate digital learning.

Digital instruction and offline homework-at-school—as little as an hour daily—replace enough teacher time that they can teach more students, plan more, and earn more.

Teachers use face-to-face teaching time for higher-order learning and personalized follow-up.

Based on Models for Extending the Reach of Excellent Teachers

How *Should* Schools Extend Reach?

Benefits of Combined Models

- *All* teachers who extend reach can **earn more**
  - Teacher-leaders *still* earn substantially more
- Naturally funded **career advancement** for great teacher who lead peers
- Rigorous, **job-embedded learning** for all—co-plan, co-teach, and co-learn in teams fully accountable for all students' outcomes
- **Reach *all* students** with accountable, excellent teachers in charge of their learning

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New Roles When Extending Reach

Summary of Teacher Career Paths and Roles in Opportunity Culture School Models

Path	Direct-Reach Teacher			Multi-Classroom Leader	Support Teacher	District- Funded Teacher-Leader
Roles	Elementary Specialized Teacher	Blended-Learning Teacher Expanded- Impact Teacher (low-tech)	Large-Class Teacher	Multi-Classroom Leader	Team Teacher Professional Tutor	Design Specialist* Leadership Coach (of Multi-Classroom Leaders) Video Teacher Digital Designer
How is reach extended?	Teaching best subject to more classes, while reducing other duties	Swapping portion of time with paraprofessional-supervised skills practice and projects— digital or offline—to teach more students	Increasing class sizes, within limits and by choice	Leading multiple classrooms' worth of students with a teaching team for whom leader is responsible	Supporting multi-classroom leader or efficient team, and/ or addressing subject or teaching role(s) delegated by team leader	Producing materials that reach students across schools in the district, or coaching multi-classroom leaders across schools
School Model	Subject Specialization (Elementary)	Time-Tech Swap Time-Time Swap	Class-Size Changes	Multi-Classroom Leadership		All School Models

*Curriculum and assessment designers are common examples.

District-Level Teacher-Leaders

- **Combine extended-reach roles at school level…**
- **With district-level functions**, such as:
  - curriculum & assessment planning
  - coaching multi-classroom leaders
  - digital content development
- **Keep great teachers teaching** part time
- **Keep district-level staff connected** to classroom
- **Provide another career path**

Potential to Increase Pay, within Budget

Ways to Extend Reach →	Multi-Classroom Leadership	Direct-Reach Models: Elementary Specialization, Time-Swaps, Etc.
	Teacher-Leader Can Earn:	*Specialized, Blended-Learning & Expanded-Impact Teachers Can Earn:*
Potential Pay Increase Percentages	Up to 100%+ More than average teacher pay	Up to 40%+ More than average teacher pay

- Teachers earn this sustainably, within budget—no grants needed.
- Sites conservatively paying up to 50% more to teacher-leaders; up to 25% more to teachers who extend reach directly.

How to Pay More, within Budget

Most common methods:

- Swap a team-teaching position with a paraprofessional (saves time & allows collaboration)
- Shift some non-classroom teaching specialists back into classrooms (except for ESL and special needs)

Other methods:

- Reallocate other spending to teachers (e.g., hybrids)
- Reduce new facilities costs by building fewer walls
- Offer some team-teaching roles with shorter hours
- Increase class sizes slightly (within limits, by choice)

Career Pathways when Extending Reach

Schools can pay larger supplements as teachers progress in their careers to reach more students.

Career Pathways when Extending Reach

Career Ladder Example for Highly Differentiated Structure

LEVELS	SUPPORT		DIRECT REACH		TEACHER-LEADERSHIP	
					Multi-Classroom Leader IV	75%
					Multi-Classroom Leader III	65%
					Multi-Classroom Leader II	50%
			Master Reach Teacher	22%	Multi-Classroom Leader I	22%
			Senior Reach Teacher	10%		
	Team Teacher II	6%	Advanced Reach Teacher	6%		
	Team Teacher I	3%	Reach Teacher	3%		
	Effective Teachers		Upper 2 Levels: Highly Effective Teachers Lower 2 Levels: Effective Teacher		Highly Effective Teachers	

Note: Pay supplements are examples only and are expressed as a percent of average pay.

BUILDING AN OPPORTUNITY CULTURE FOR AMERICA'S TEACHERS

Overview of All Reach Models

OPPORTUNITY CULTURE SCHOOL MODEL OVERVIEW TABLE
HOW DO EXCELLENT TEACHERS REACH MORE STUDENTS & HELP PEERS SUCCEED?

	In-Person *The teacher accountable for learning is in the school, teaching face to face, and may lead peers.*	**Remote** *In schools with shortages, the teacher accountable for learning uses technology to teach and connect with students, and may lead others. An in-person monitor is required.*
MULTI-CLASSROOM LEADERSHIP		
Excellent teacher leads a teaching team and is accountable for all students.	Multi-Classroom Leadership (In-Person Pods)	Multi-Teacher Leadership (Remote Pods)
SPECIALIZATION		
Excellent teachers specialize in high-priority subjects and roles, with new paraprofessional support.	Subject Specialization | Role Specialization	Subject Specialization | Role Specialization
CLASS-SIZE CHANGES		
Excellent teachers teach larger classes, within limits and by choice, ideally without increasing instructional group size.	Class-Size Increases | Class-Size Shifting	Class-Size Increases | Class-Size Shifting
TIME-TECHNOLOGY SWAPS		
*Digital instruction **or** offline skill practice and projects save teachers time to teach more students and collaborate. Students spend an hour (elementary) or more (secondary) daily in paraprofessional-supervised learning.*	**In-Person Swaps** Rotation* Alternating teacher and digital or other instruction on a fixed schedule. Flex* Digital, small-group, and large-group learning time individualized	**Remote Swaps** Rotation* Alternating remote teacher and digital or other instruction on a fixed schedule. Flex* Digital, small-group, and large-group learning time individualized
COMBINATIONS		
✱ Schools committed to reaching every student in every valued subject with the excellent teachers will use Multi-Combinations ✱ Combinations let schools optimize current students' learning and teachers' development on the job.		

Note: Shaded items may require new technology. Students are in school buildings in all models in this table.
*The terms Rotation and Flex are widely used to describe "blended learning" models.

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An Opportunity Culture for All

Additional Resources

For more information on school models that extend the reach of excellent teachers and teaching teams, please visit www.opportunityculture.org

- Reaching All Students with Excellent STEM teachers: Education Leaders' Brief—companion brief to this slide deck
- Teacher Pay and Career Paths in an Opportunity Culture—design guide for districts
- Two-pager for teachers—just imagine a profession like this
- Redesigning Schools—summarizes reach model options
- School Models—model details and schedules
- How to Pay Teachers More—within budget while giving more students access to excellent teachers
- Teacher Career Paths—sustainable, paid career advancement using reach school models
- Tools for School Design Teams—regularly updated list of all OC materials
- Selection, Development, & Evaluation Tools

See OpportunityCulture.org for a list of current funders of this initiative.

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