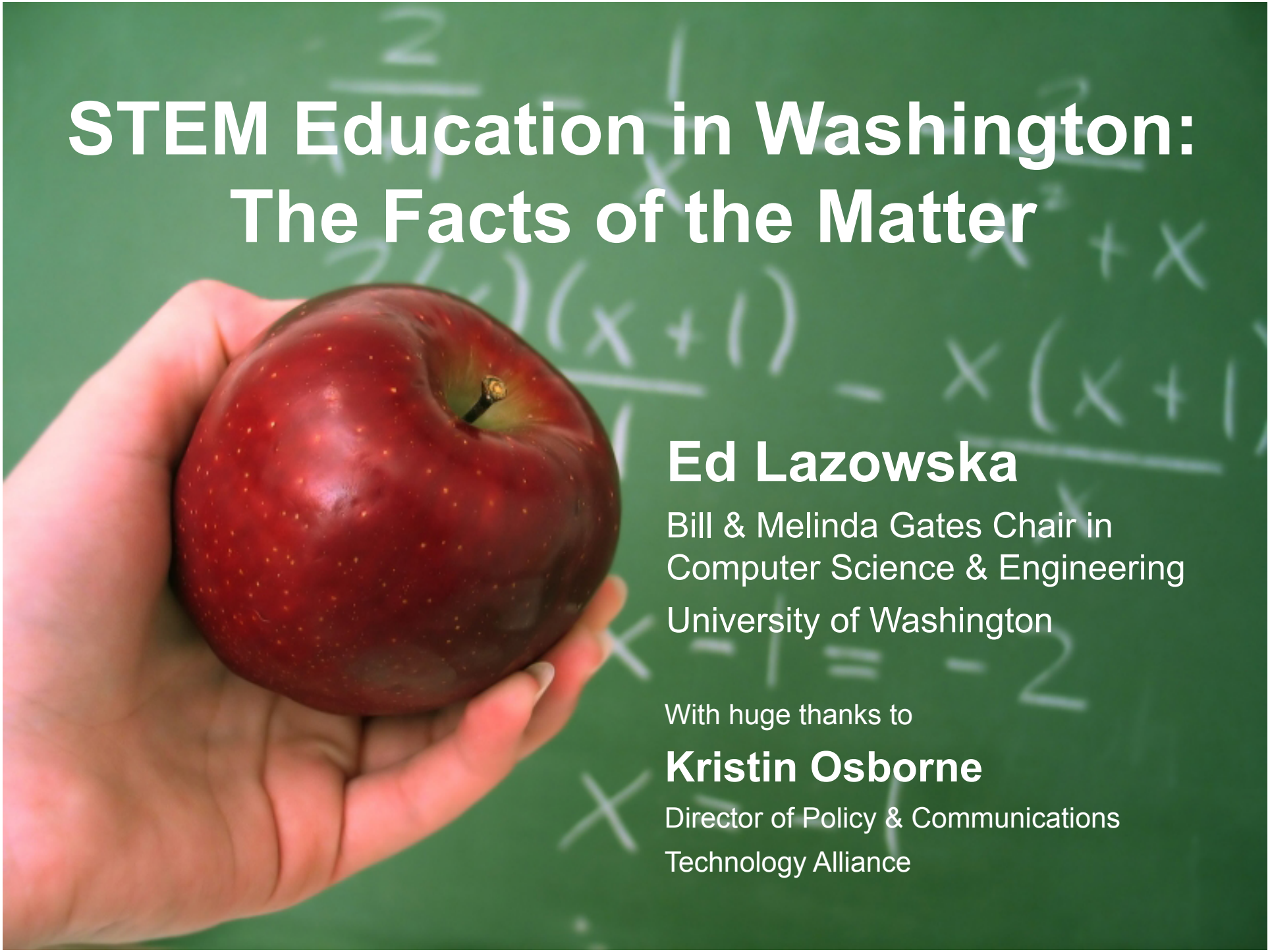
STEM Education in Washington: The Facts of the Matter



Ed Lazowska

Bill & Melinda Gates Chair in Computer Science & Engineering

University of Washington

With huge thanks to

Kristin Osborne

Director of Policy & Communications

Technology Alliance

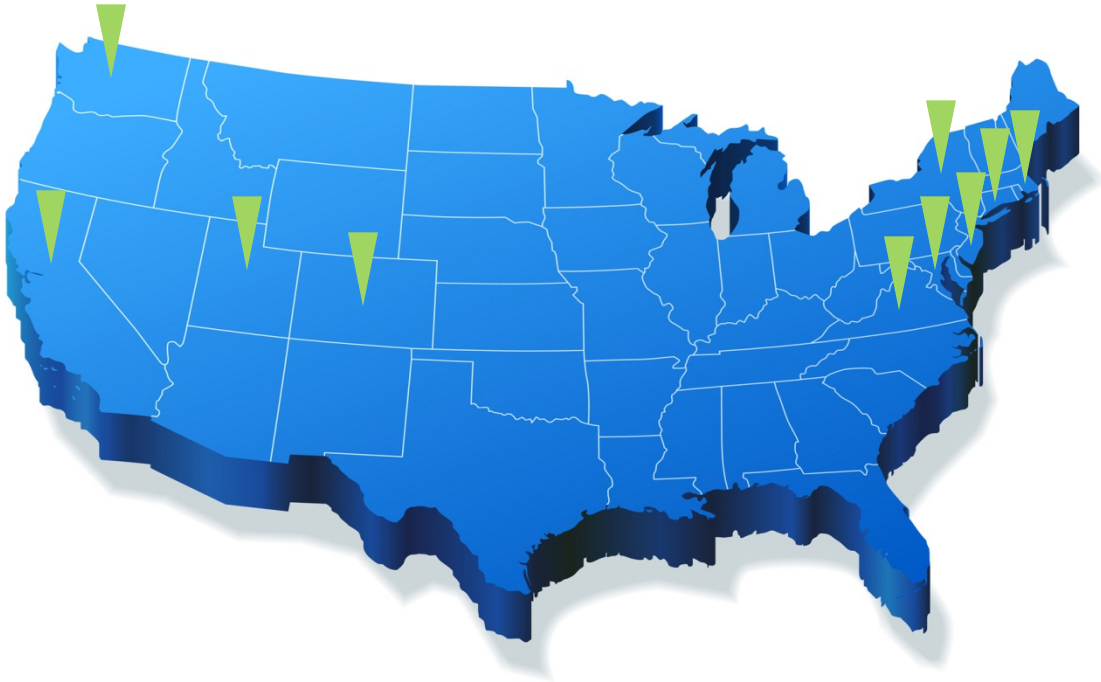
"Innovation is in our nature"

This is true of our economy
and our population.

By any measure, Washington is a leader in America's innovation economy.

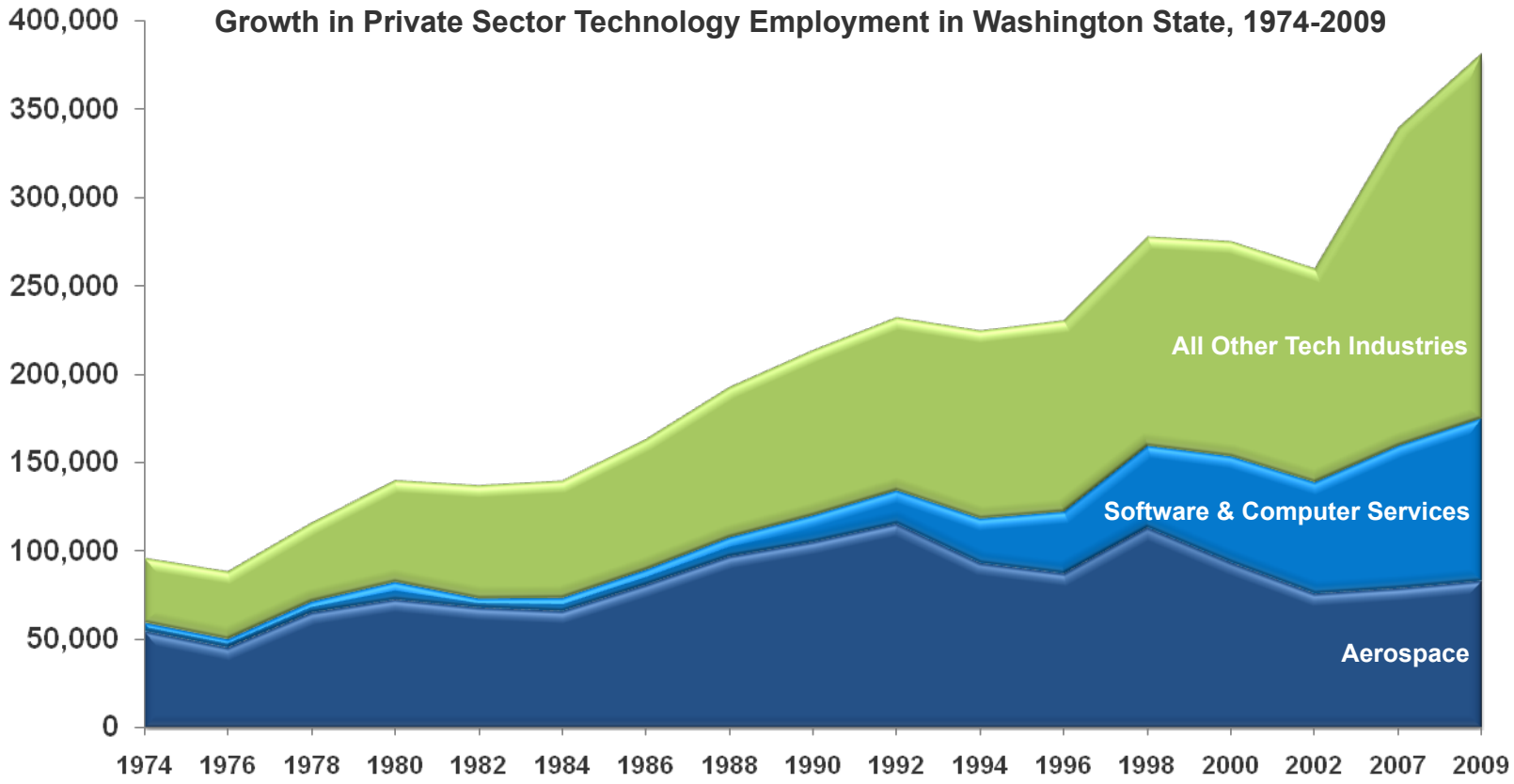
2010 Kauffman Foundation New Economy Index:*

1. Massachusetts
2. Washington
3. Maryland
4. New Jersey
5. Connecticut
7. California
8. Virginia
9. Colorado
10. New York
12. Utah



* Index #6 Delaware and #11 New Hampshire intentionally omitted.

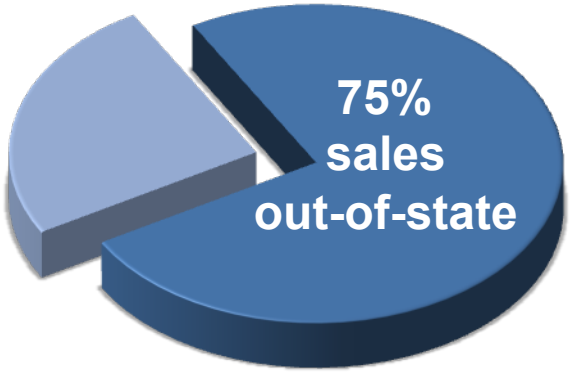
Employment in our private sector technology industries has quadrupled since 1974.



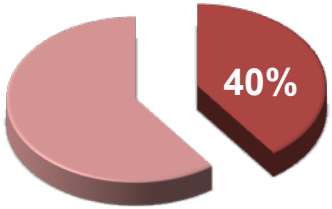
Source: Technology Alliance: *The Economic Impact of Technology-based Industries in Washington State*, 2010

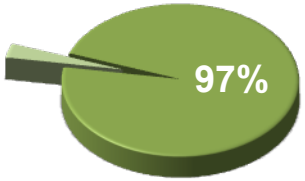
Technology industries are a major driver of Washington trade.

Technology Industries

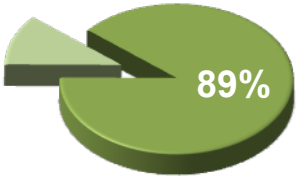


All Industries

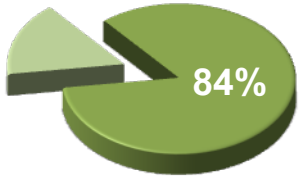




Aerospace



Computers, Electronics, Electrical Equipment



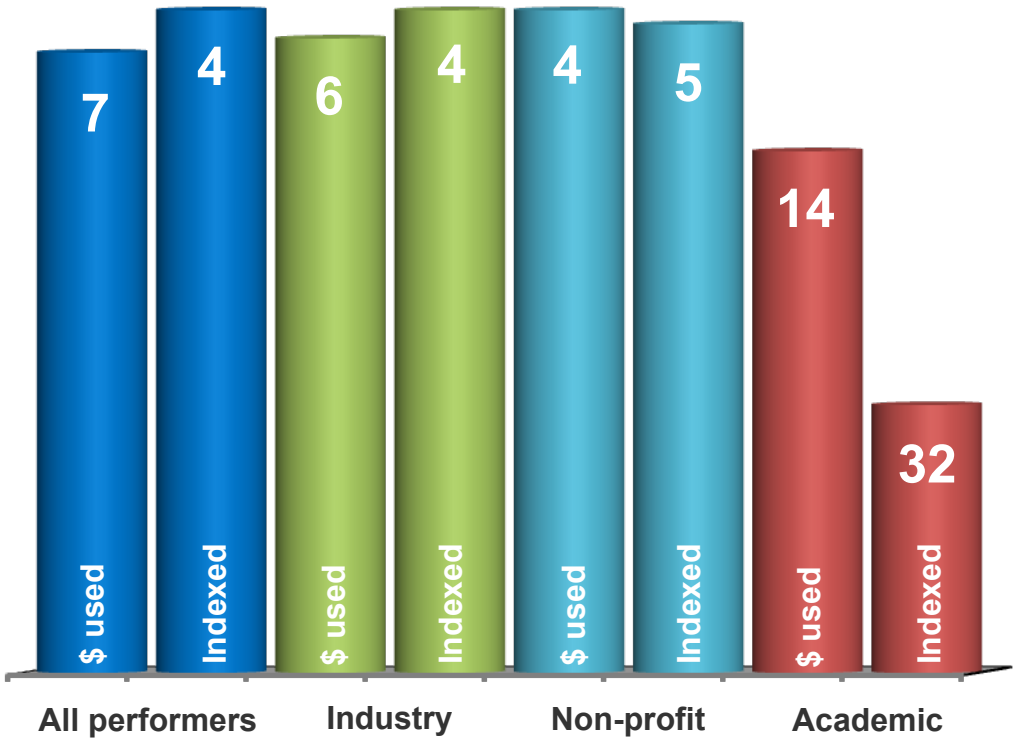
Software, Data Processing, Computer Systems Design

Source: Technology Alliance: *The Economic Impact of Technology-based Industries in Washington State*, 2010

Robust research and development underpins our state economy.

Washington's National Rankings

R&D Activity (2007):
Absolute $, and
Indexed to Gross State Product

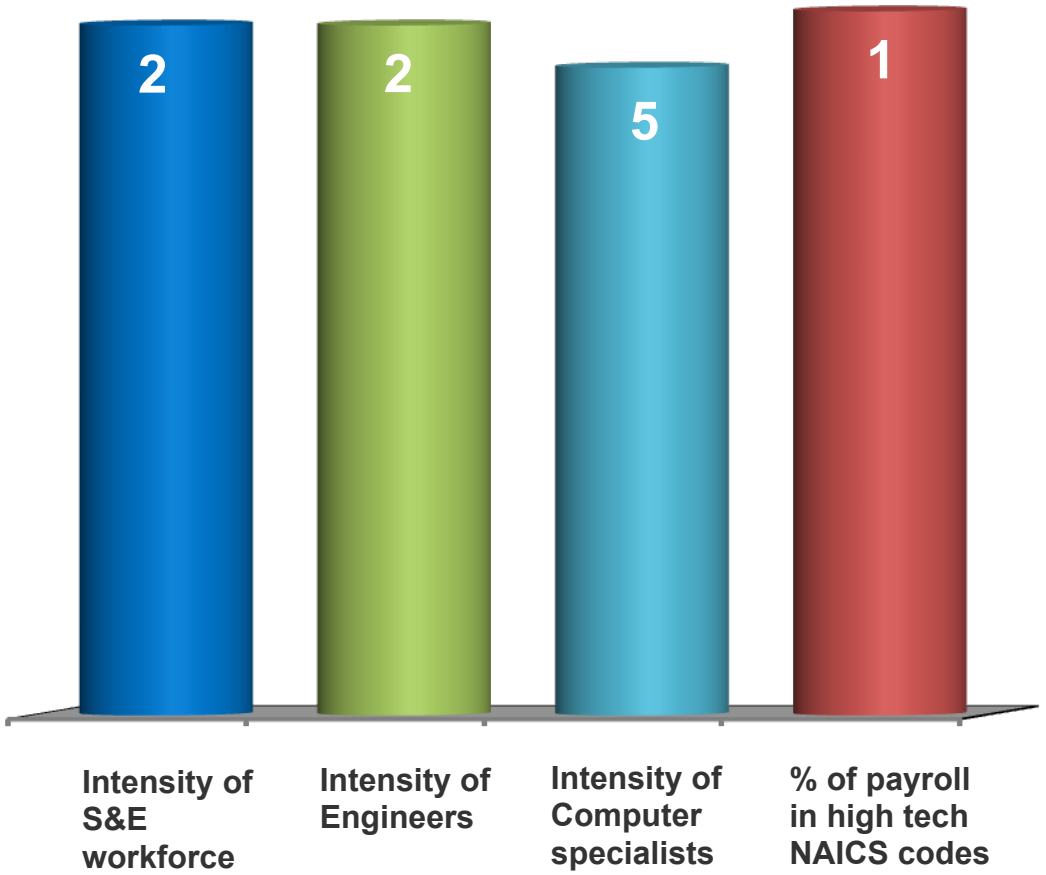


Source: Technology Alliance: *The Economic Impact of Technology-based Industries in Washington State*, 2010/ National Science Foundation

An economy driven by a highly educated, innovative workforce.

Washington's National Rankings

Human Capital

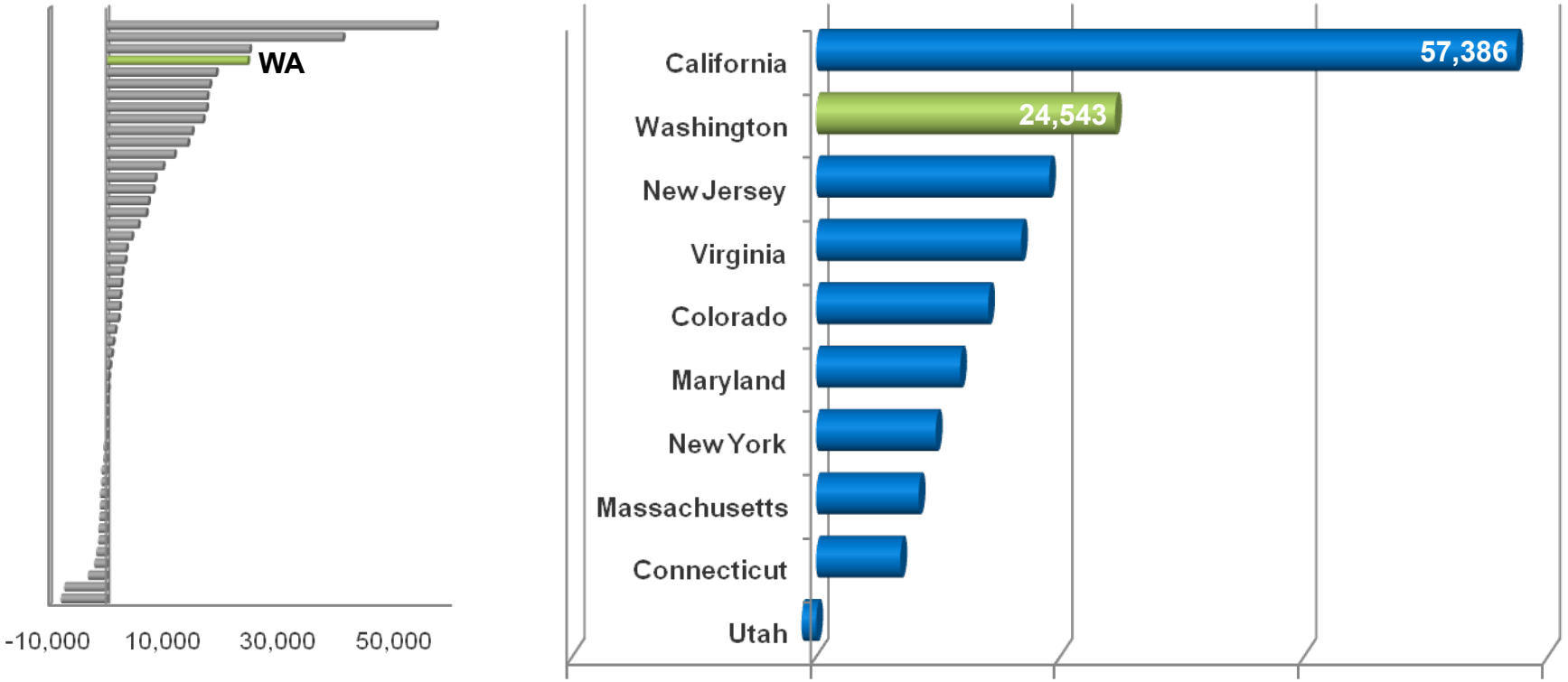


Sources: National Science Foundation: *Science & Engineering Indicators*, 2010; Milken Institute: *State Technology and Science Index: Enduring Lessons for the Intangible Economy*, 2011

It turns out that they are not
our own children!

Washington is the 2nd largest importer of degrees among tech states (and 1st, by far, as a proportion of population).

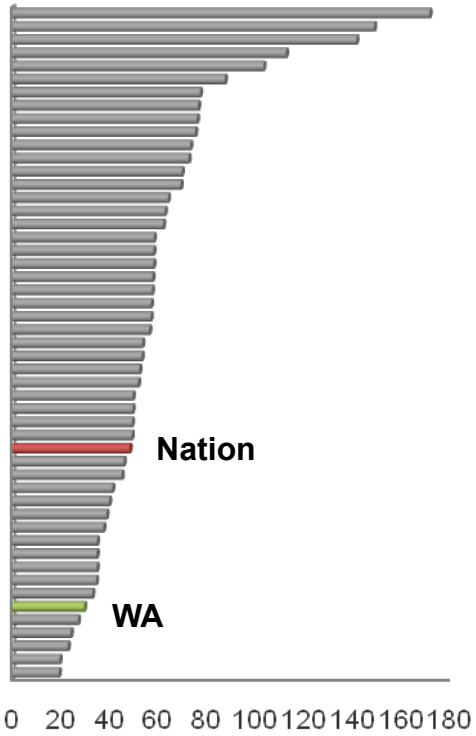
Net Migration: 22-39 Year Olds, Bachelor's Degree or Higher (2007)

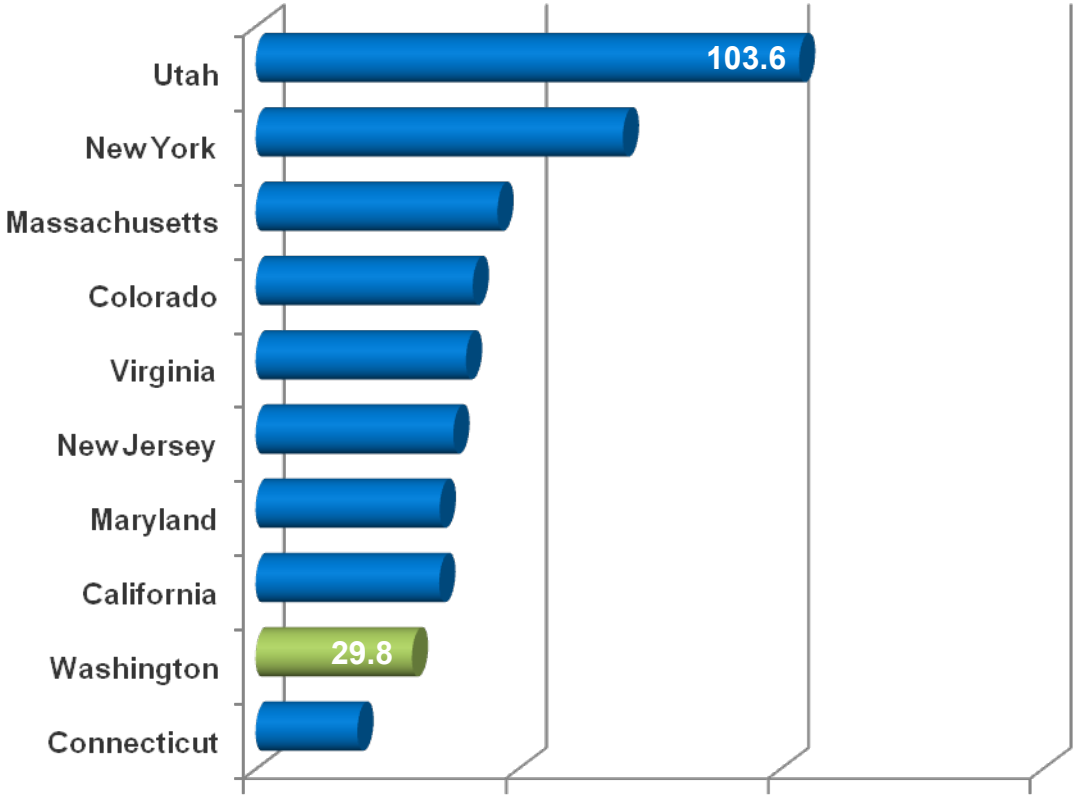


Source: National Center for Higher Education Management Systems/U.S. Census Bureau

We rank very low in engineering degree production relative to engineering occupations.

In-state Engineering Degree Production Per 1,000 Engineering Occupations (2005)

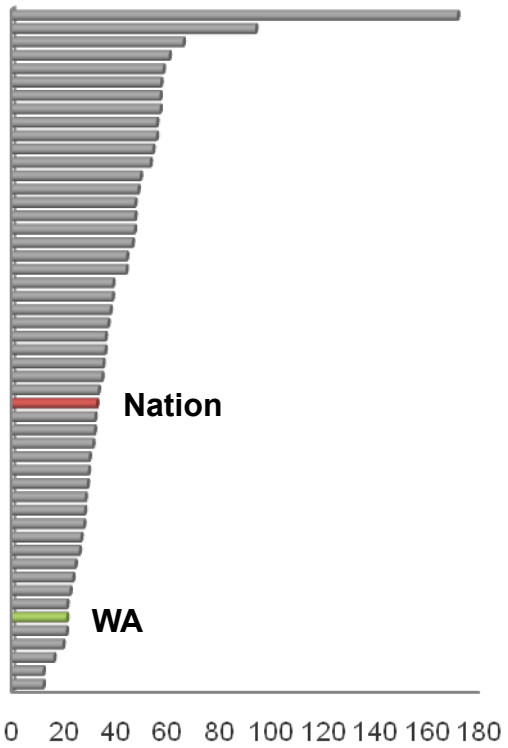


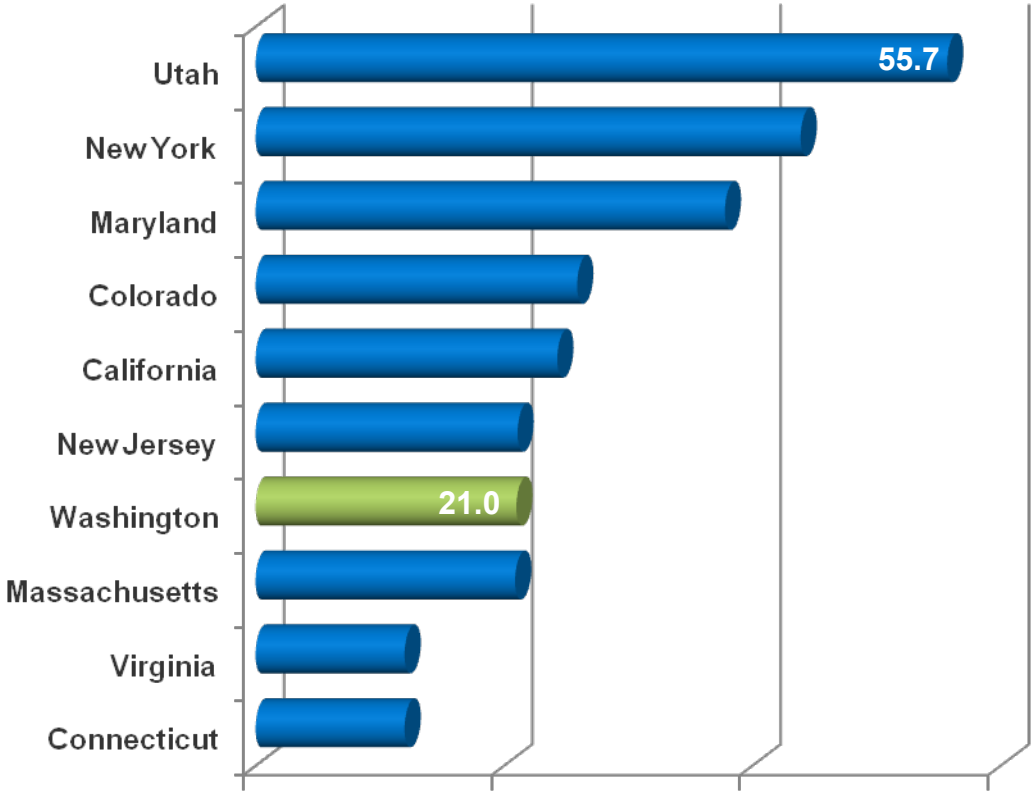


Source: NCHEMS/U.S. Census Bureau

It's the same story in computer science.

In-state Computer Science Degree Production per 1,000 Computer Science Occupations (2005)

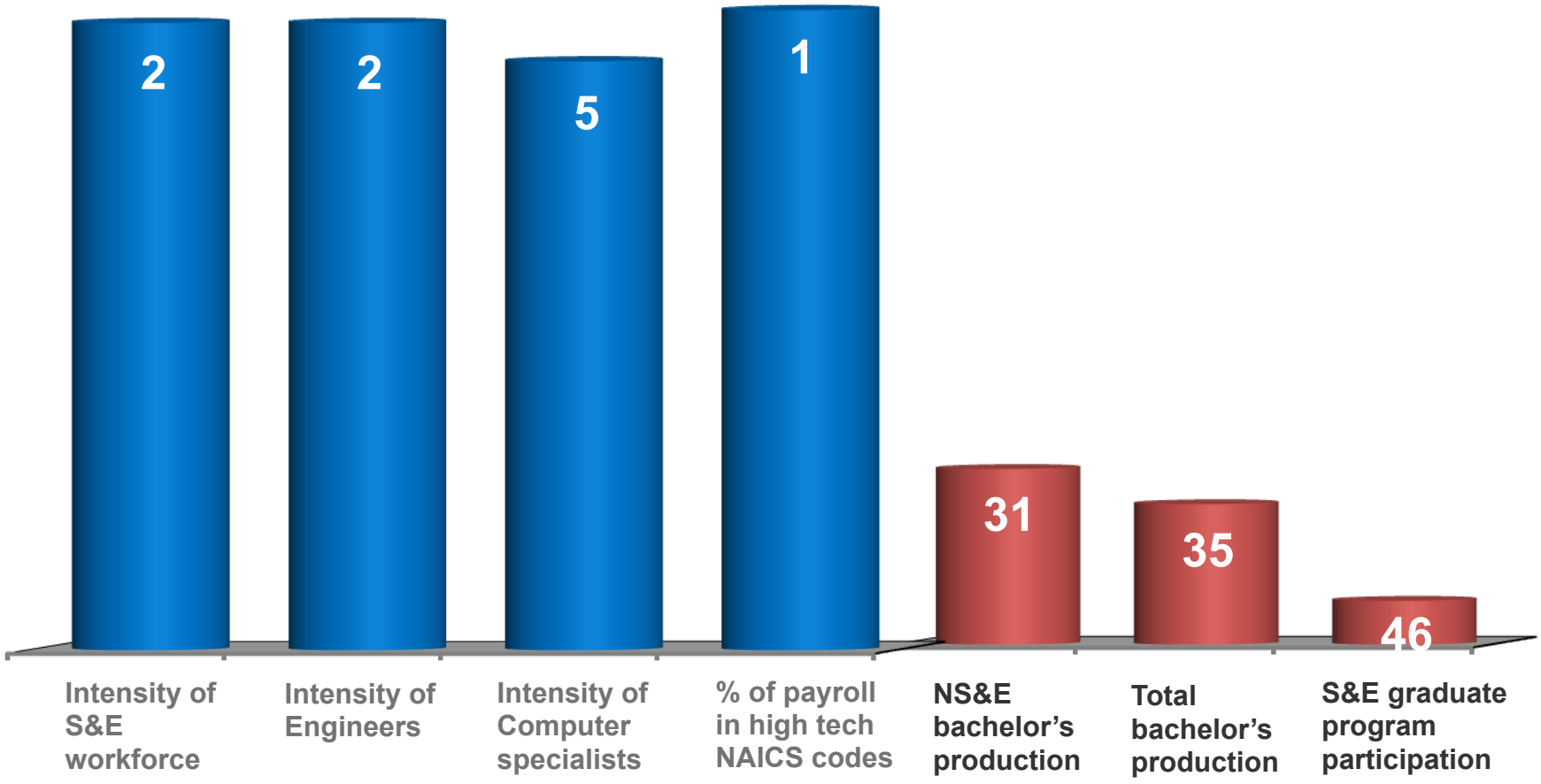




Source: NCHEMS/U.S. Census Bureau


Is this inevitable, given the vibrancy of our technology sector?
Or do we have pipeline and/or capacity issues?

A mismatch between economic opportunity and our educational output.

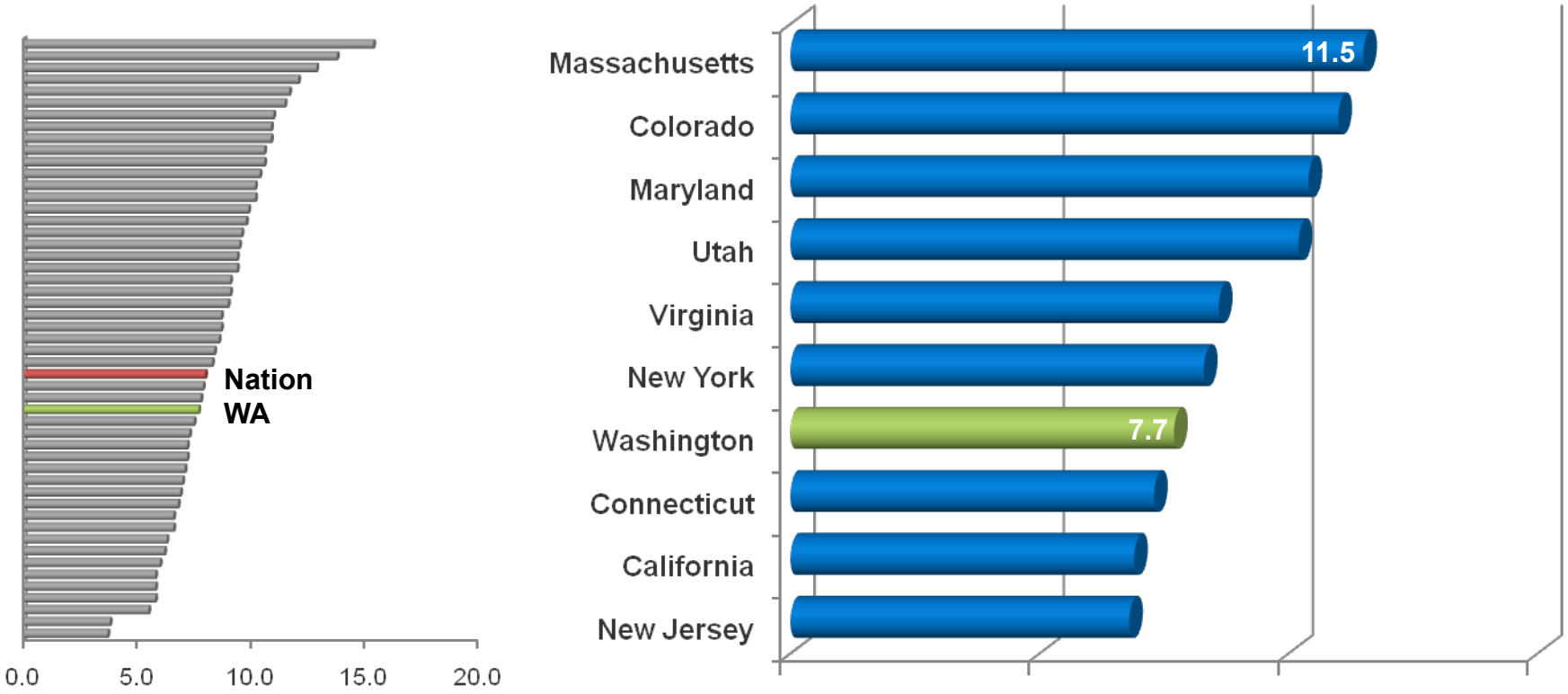


(all indexed to age-range population)

Sources: ITIF/Kauffman Foundation: *The 2010 State New Economy Index*; National Science Foundation: *Science & Engineering Indicators 2010*; NCHEMS/Postsecondary Opportunity

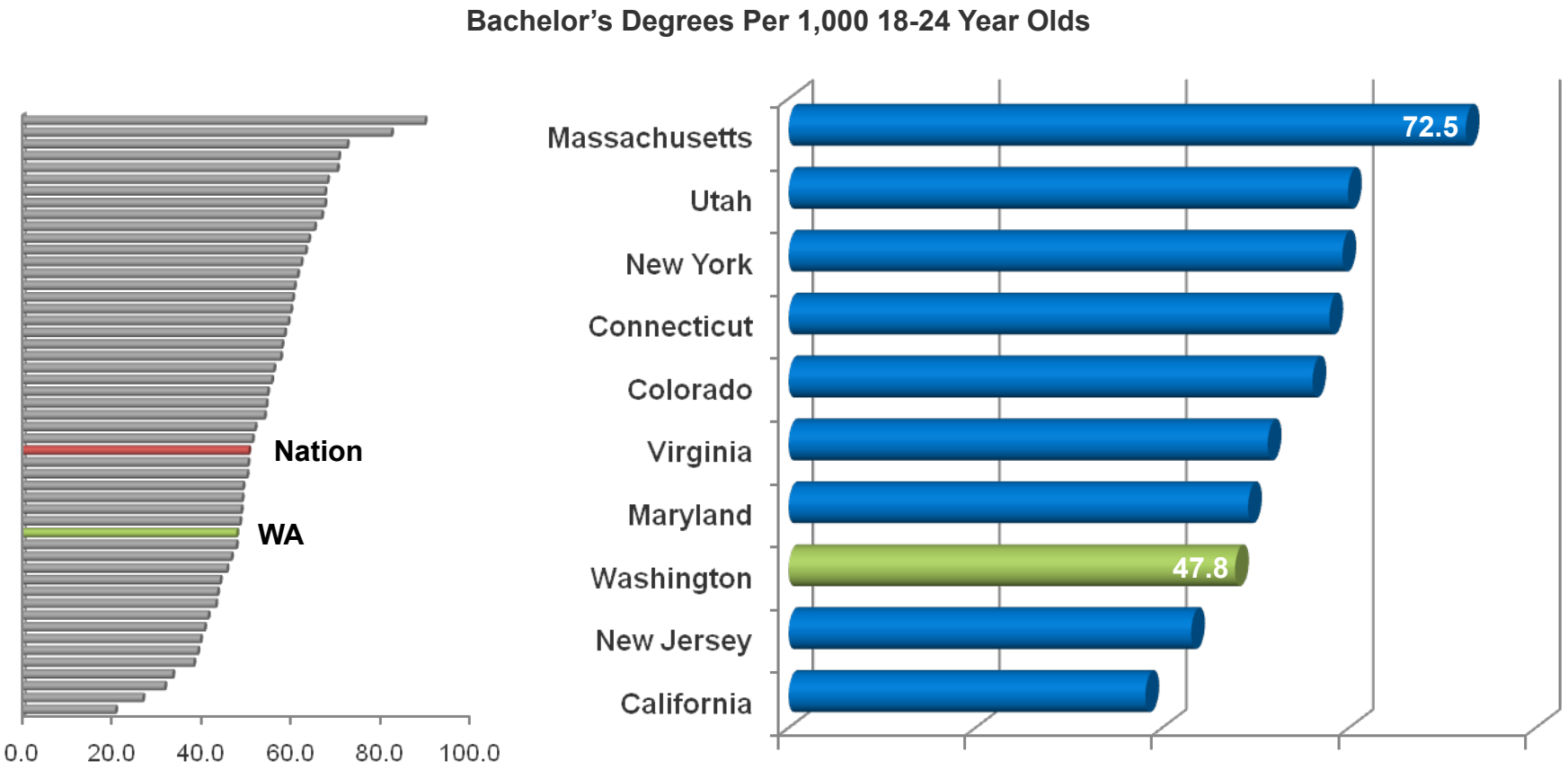
We lag in S&E degree production not only as a function of workforce, but also as a function of population.

Natural Science & Engineering Bachelor's Degrees Per 1,000 18-24 Year Olds



Source: NSF, *Science & Engineering Indicators 2010*
Note: NS&E degrees include physical, computer, agricultural, biological, earth, atmospheric, and ocean sciences; mathematics; and engineering.

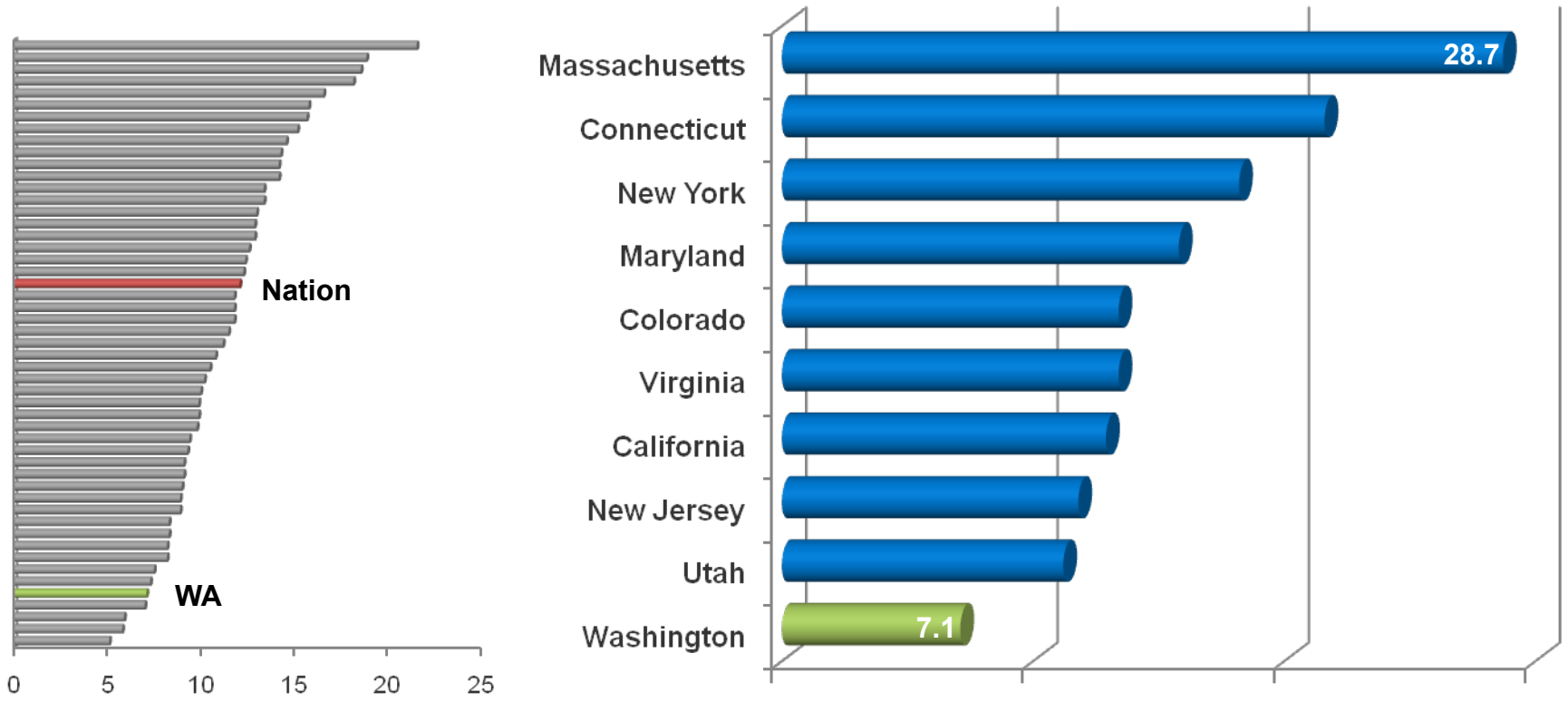
Same for total bachelor's degree production.



Source: NSF, *Science & Engineering Indicators 2010*

We rank last among tech states in S&E graduate program participation.

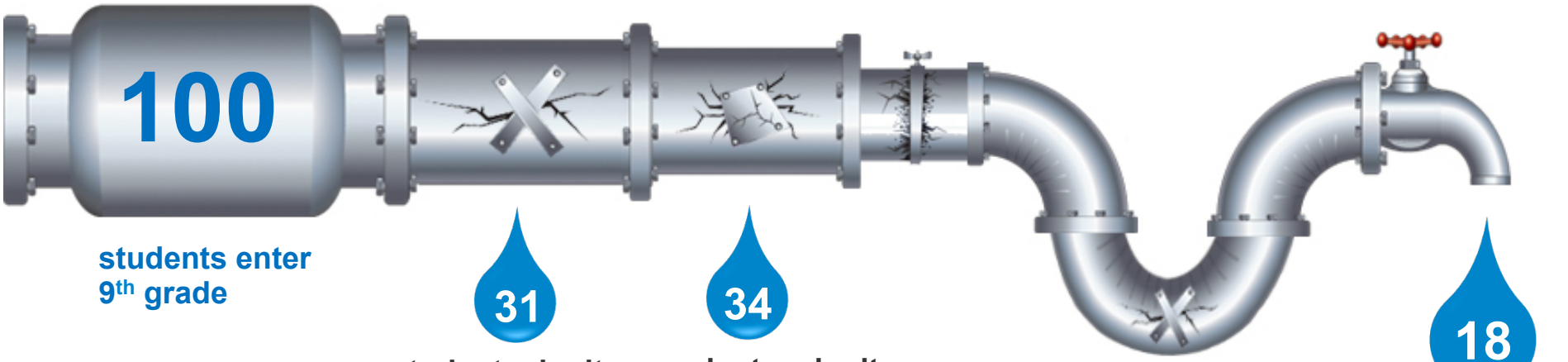
Science & Engineering Graduate Students Per 1,000 Population 25-34 Years of Age (2007)



Source: NSF, *Science & Engineering Indicators 2010*
Note: S&E includes physical, computer, agricultural, biological, earth, atmospheric, ocean, and social sciences; psychology; mathematics; and engineering.


There are pipeline issues from secondary to postsecondary
To deal with the gathering storm, we need to stop the leaks.

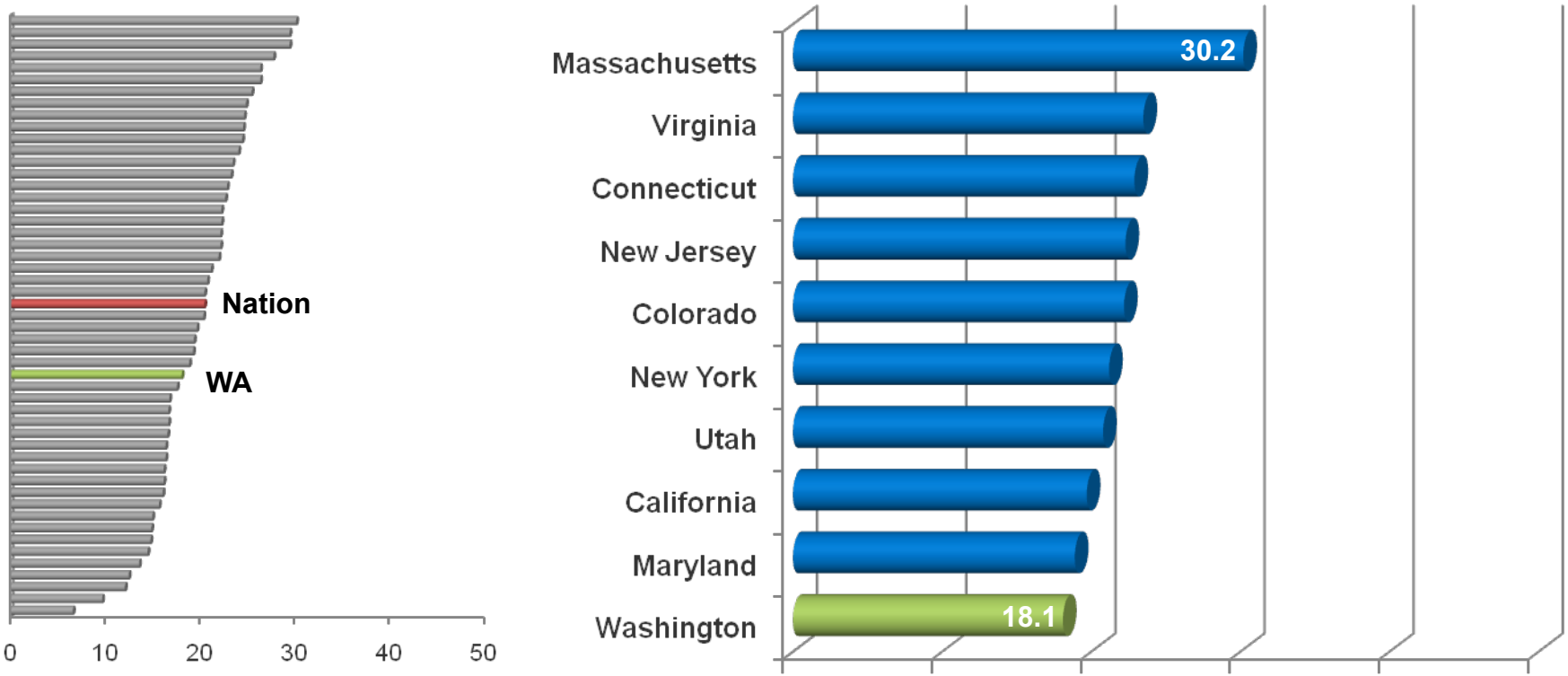
Our kids' futures are leaking!



Source: NCHEMS
Note: Data for high school graduation doesn't account for transfers to private high schools and out-of-state. The calculation for college graduation doesn't account for transfers across institutions.

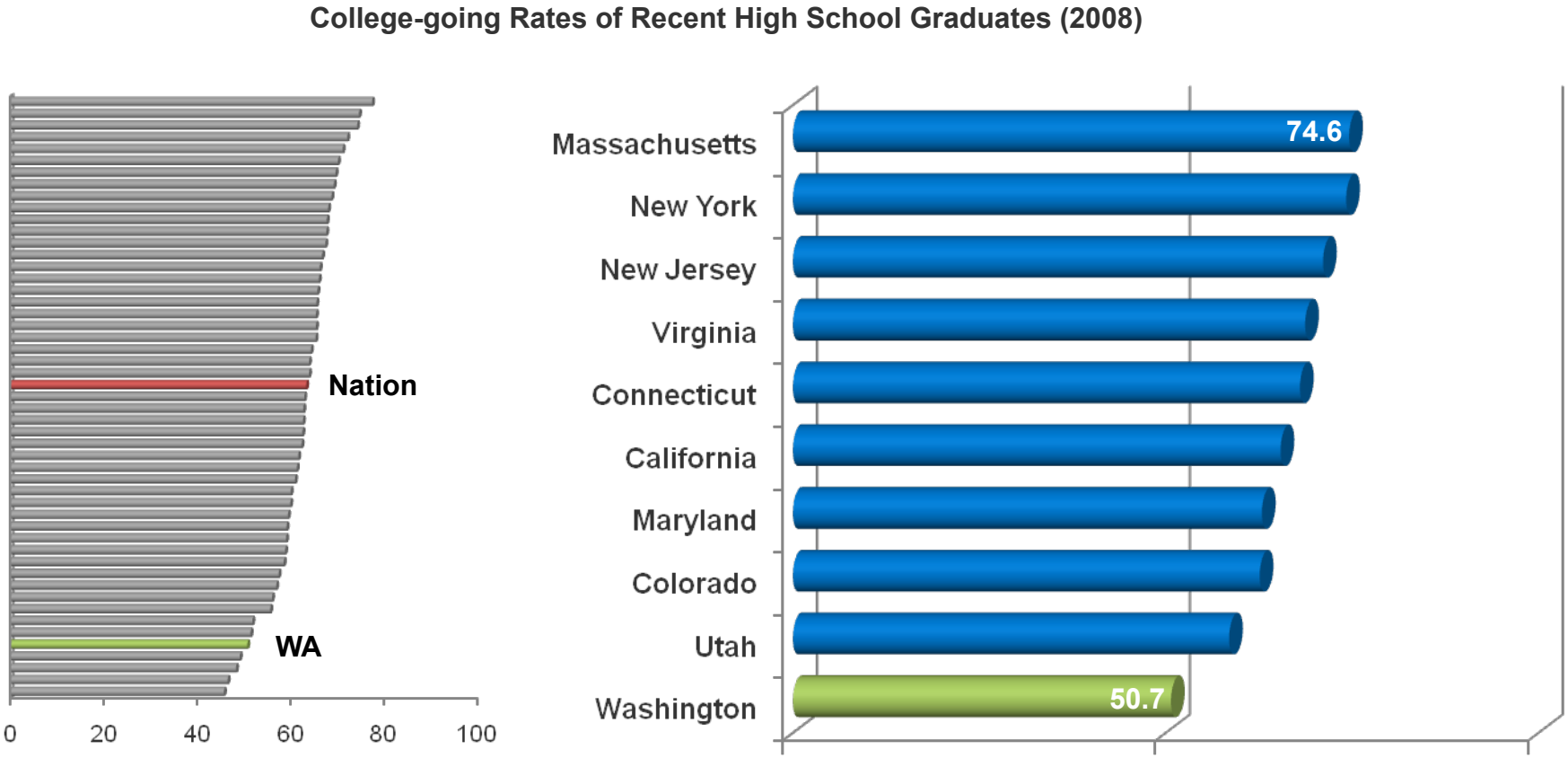
Overall, our pipeline is the leakiest among the tech states.

Student Pipeline: Transition & Completion Rates, 9th Grade to College (2008)



Source: NCHEMS/Tom Mortenson, Postsecondary Opportunity

We are last among tech states in the proportion of high school graduates who move directly to college.

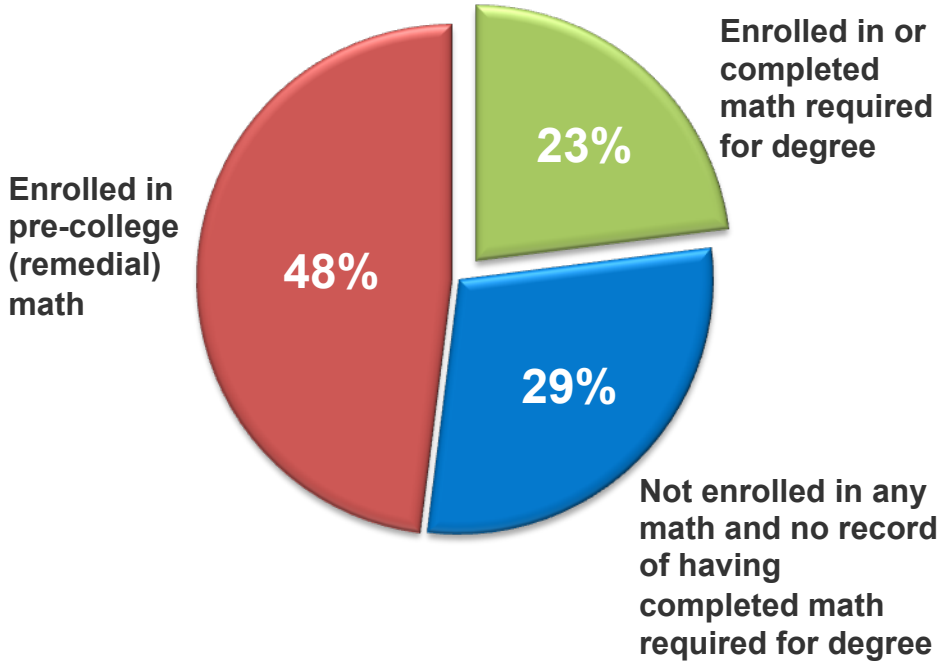


Source: NCHEMS/Tom Mortenson, Postsecondary Opportunity

Of the ones who do move directly to college, too many are unprepared for college-level work.

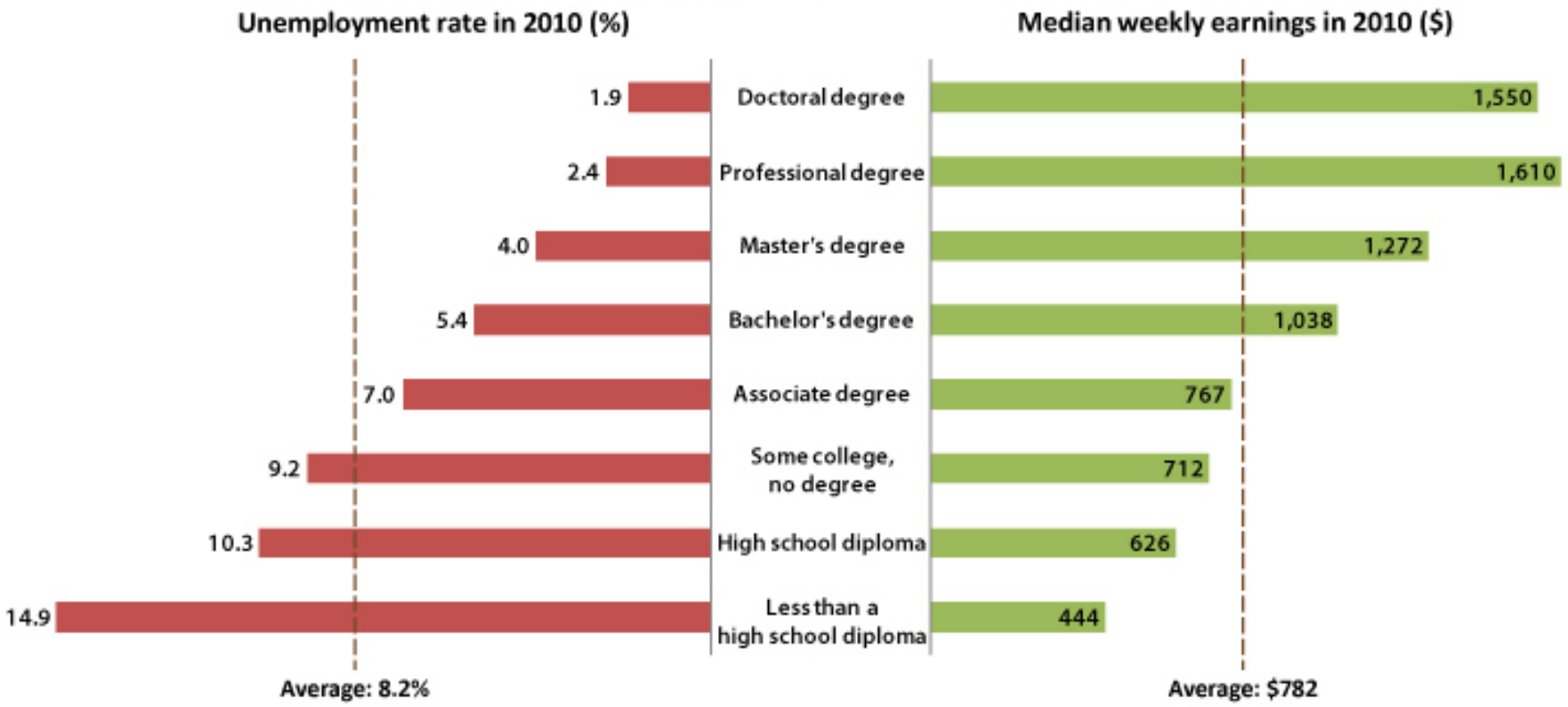
A Math Problem:

Only 23% of 2008 high school graduates entering our 2-year colleges enrolled in college-level math or already had the math required for their degree.



Source: Washington State Board for Community & Technical Colleges: *Role of Pre-College (Developmental and Remedial) Education for Recent High School Graduates Attending Washington Community and Technical Colleges*, 2009

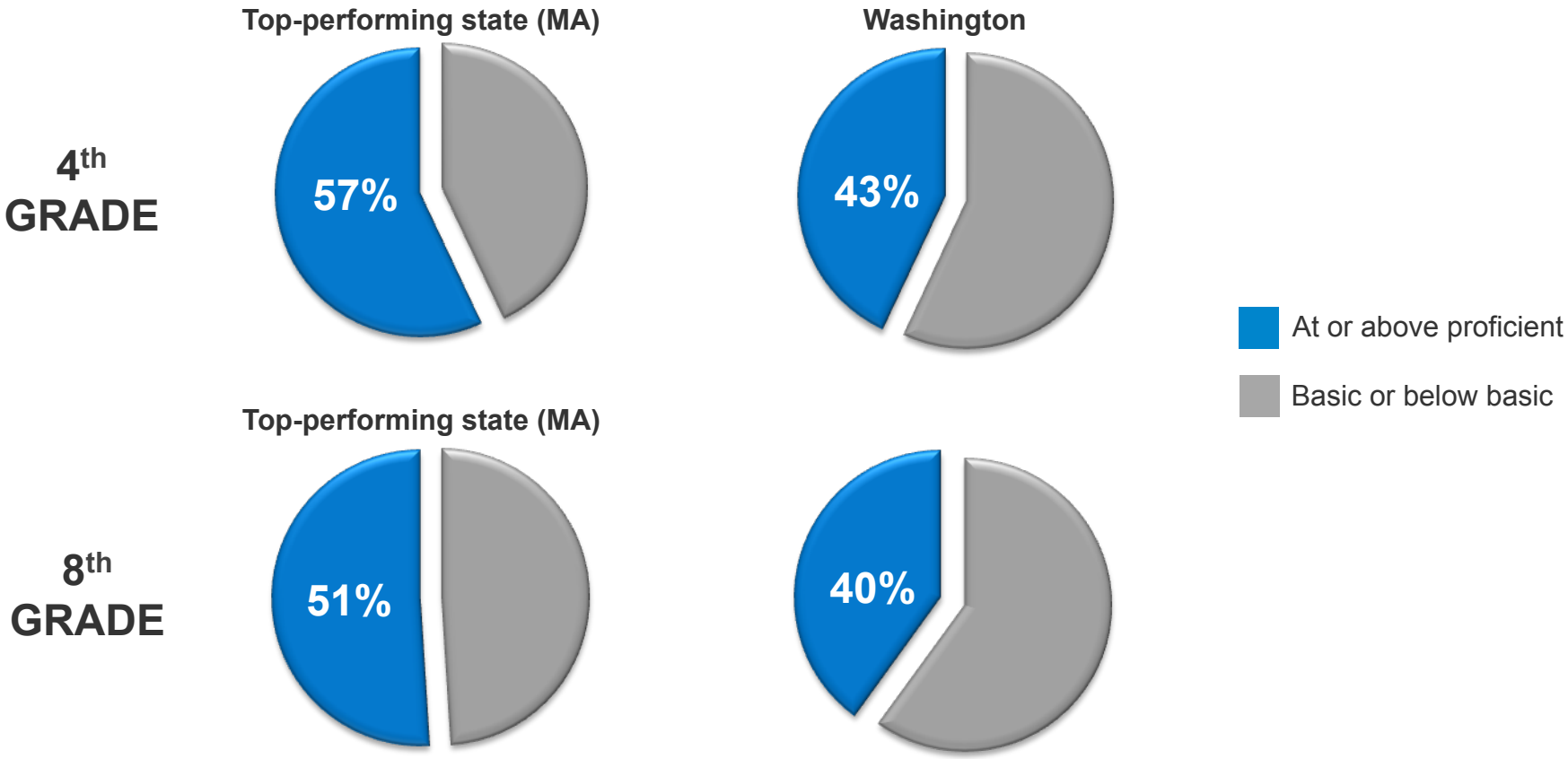
Reducing the leaks in the pipeline is critical for our citizens, our economy, and our society.



Source: Bureau of Labor Statistics, Current Population Survey

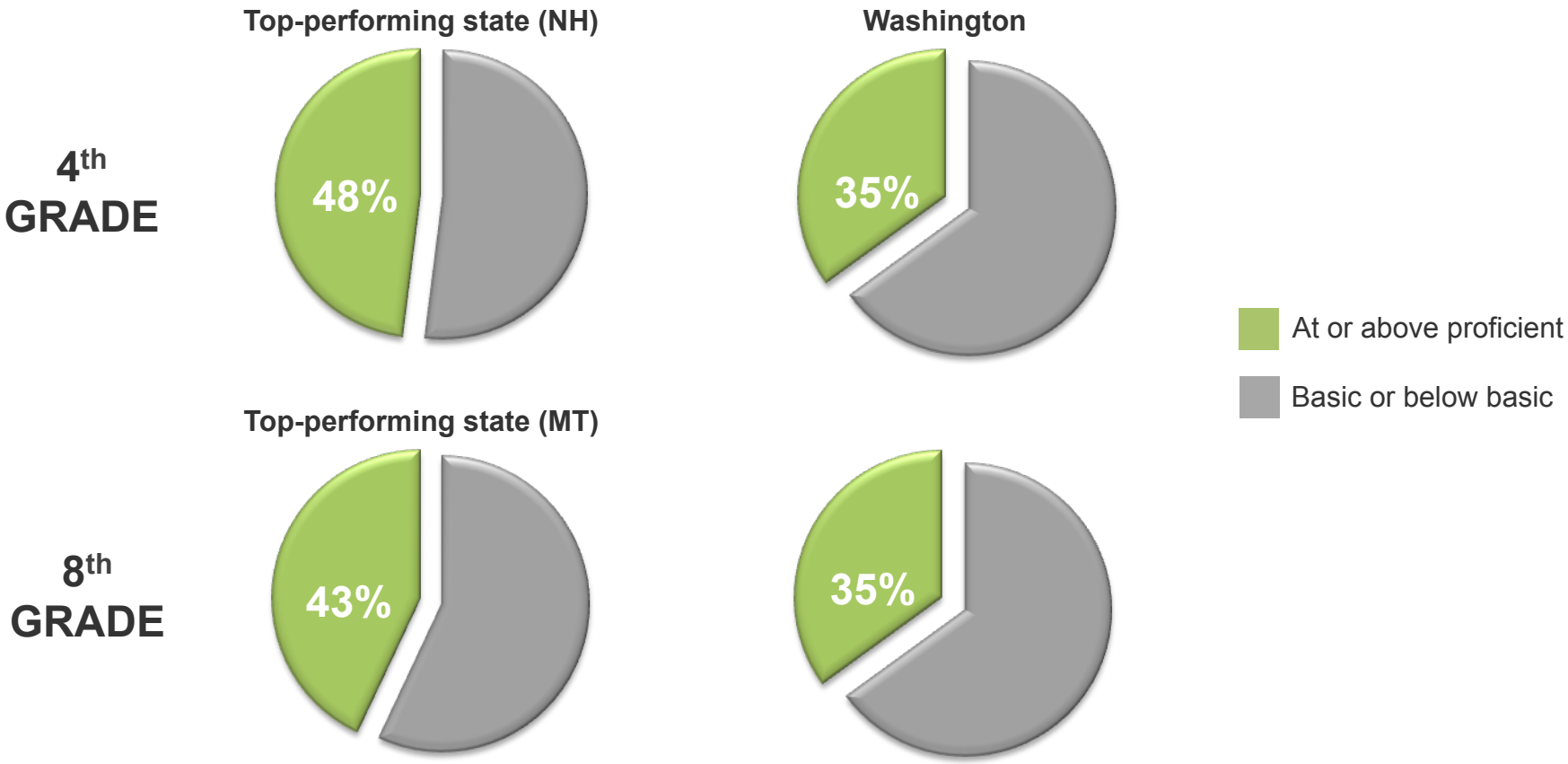

But it begins much earlier…
And it is a national issue.

As a nation, we are not adequately preparing our K-8 students for high school math…



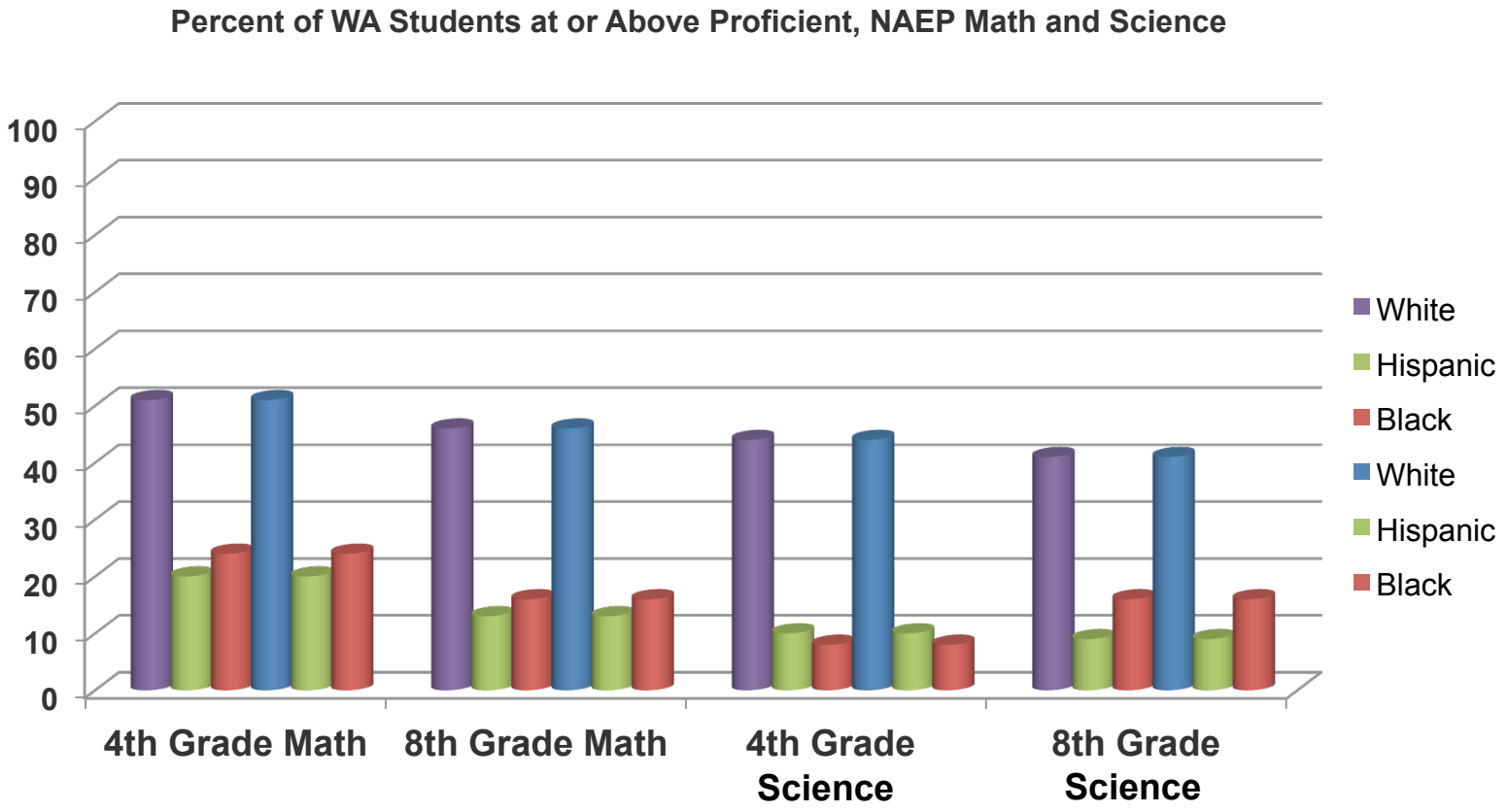
Source: National Assessment of Educational Progress (NAEP), 2009

And we must make science more of a priority nationally and here at home!



Source: NAEP, 2009

Data on specific student groups in our state paints an even more troubling picture.

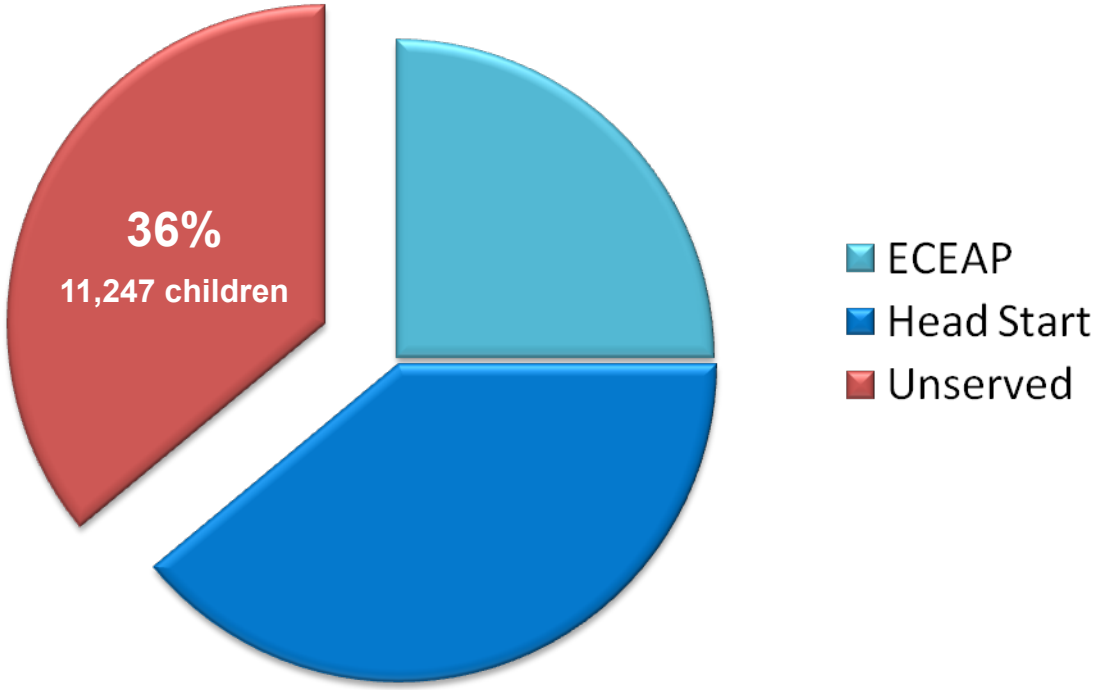


Source: Change the Equation/NAEP, 2009

Quality early learning:

A pre-requisite for student success, but...

More than 1/3 of eligible low-income kids in Washington are not served by early learning programs.

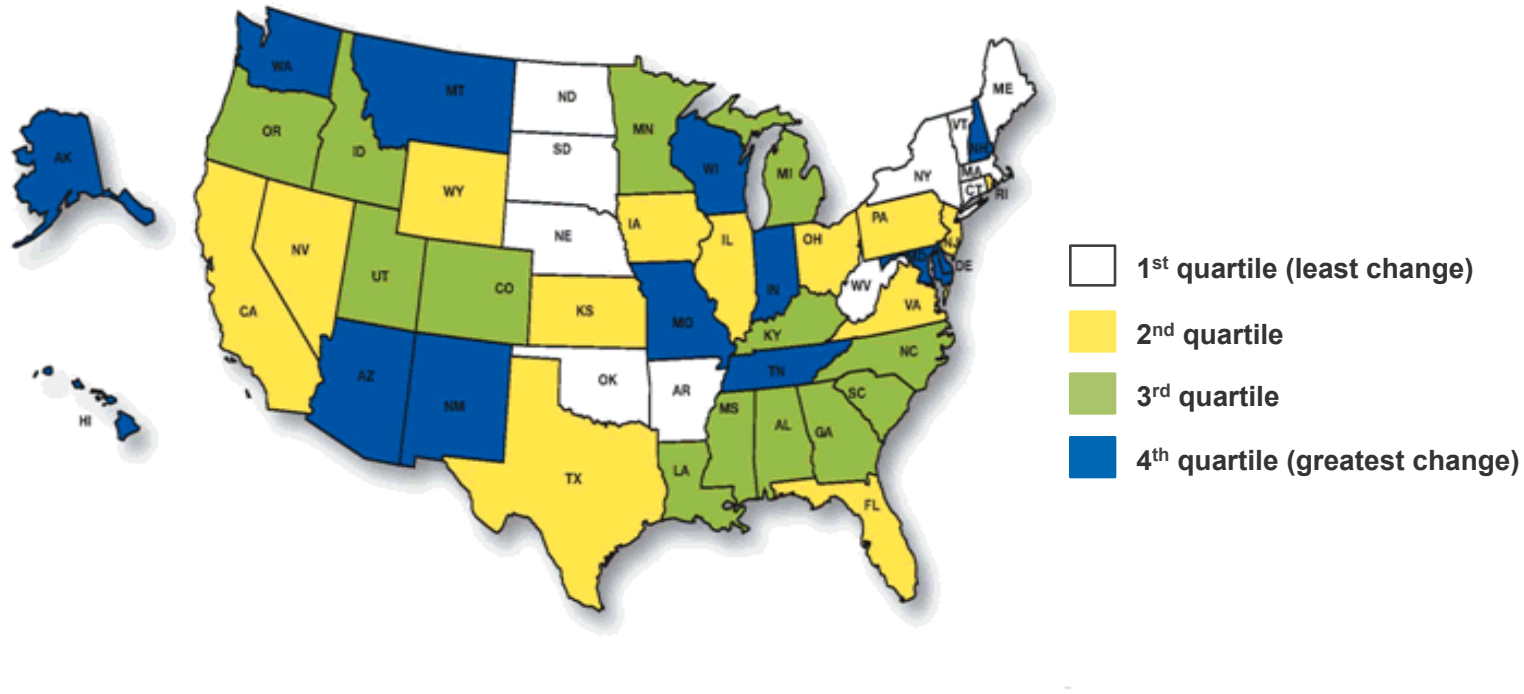


Source: League of Education Voters/Washington Department of Early Learning, 2010


Behind the numbers…
A human tragedy is unfolding in our state.

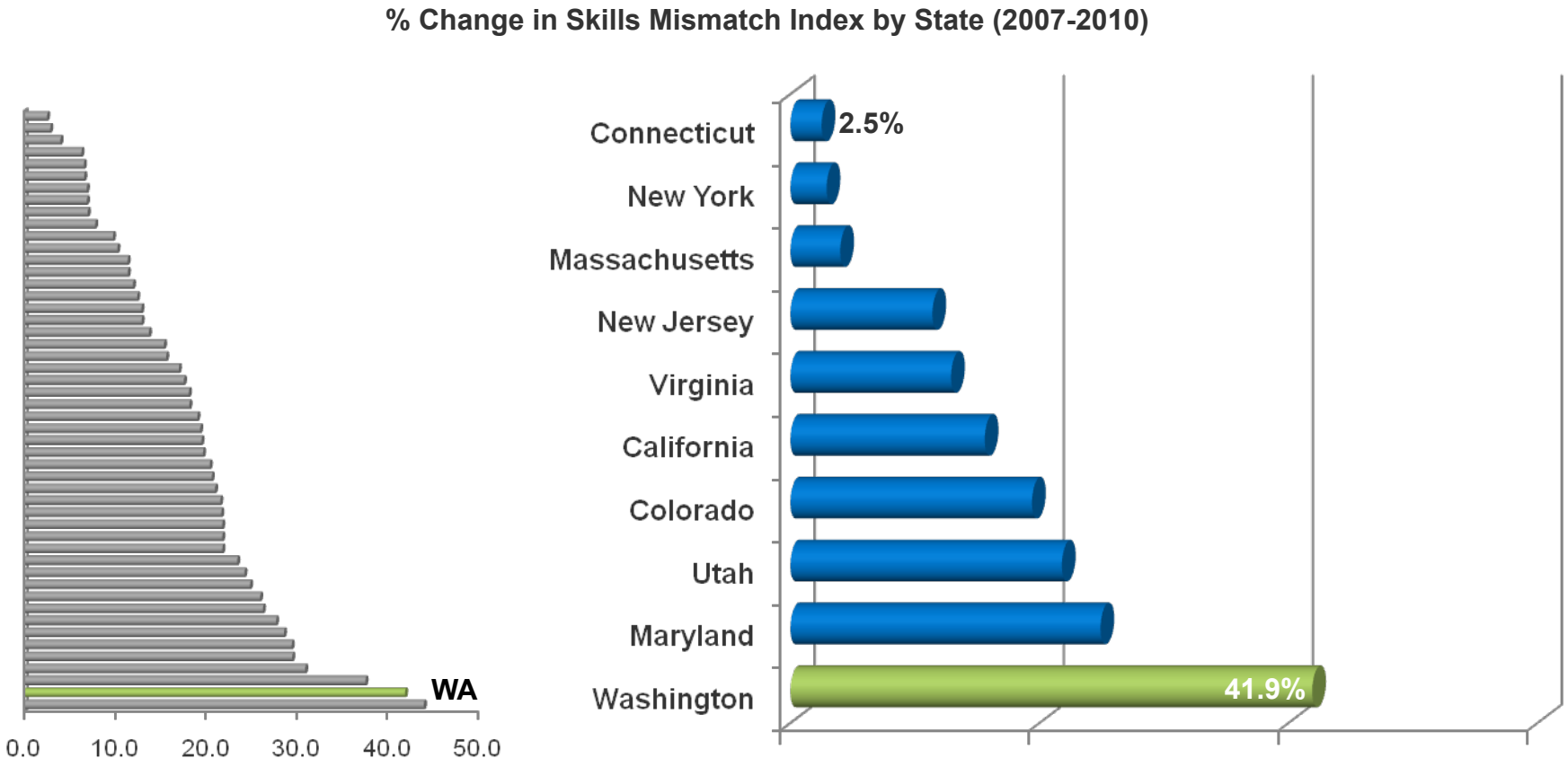
The mismatch between the skills required for available jobs and the skills people have is growing.

% Change in Skills Mismatch Index by State (2007-2010)



Source: Estavao, Marcello and Evridiki Tsounta, “Has the Great Recession Raised U.S. Structural Unemployment?” International Monetary Fund, 2011/Haver Analytics, U.S. Bureau of Labor Statistics, U.S. Census Bureau, author’s calculations

In the last 3 years, Washington's skills mismatch grew more than that of all but one other state.



Source: Marcello and Tsounta, courtesy of Drew DeSilver, Seattle Times.

The people who held the jobs we're losing aren't going to get the jobs we're creating.

57% of the job openings among the top 10 occupations are in computing.

Where the jobs are and aren't

Some employers are hiring, but the openings don't overlap much with the jobs most commonly lost to the economic downturn.

TOP 10 JOB OPENINGS IN PUGET SOUND REGION*	OPENINGS, JUNE 2011
Computer software engineers, applications	2,980
Registered nurses	1,340
Computer systems analysts	1,316
Computer and information systems managers	1,132
Marketing managers	740
Customer service representatives	680
Sales managers	644
Computer software engineers, systems software	641
First-line supervisors of retail sales workers	620
First-line supervisors of food preparation and serving workers	556

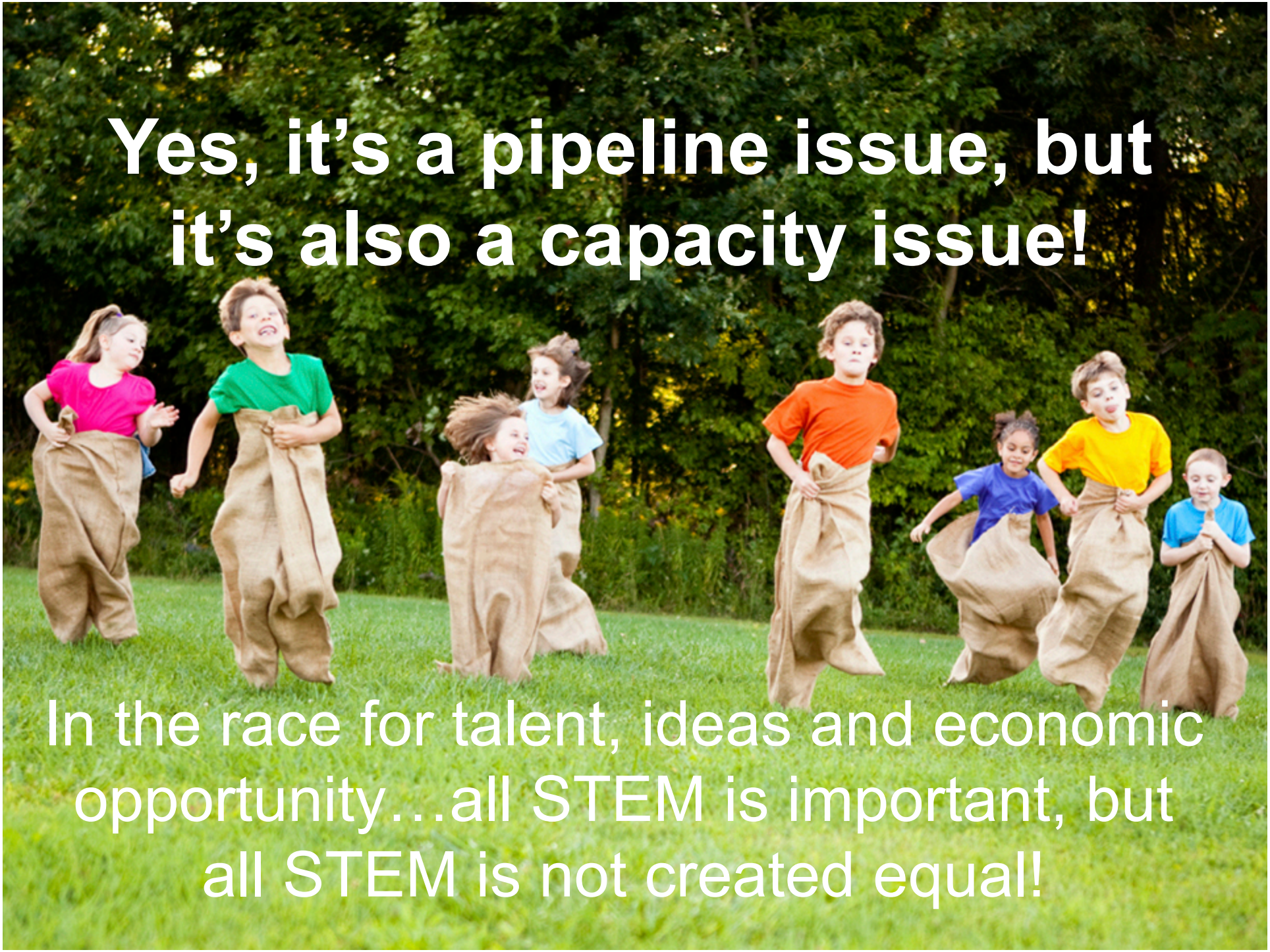
** King, Snohomish, Pierce and Kitsap counties*

TOP 10 JOB CATEGORIES IN WASHINGTON WITH GREATEST LOSSES	JOBS LOST, 2007-2010
Office clerks, general	-14,690
Construction laborers	-12,170
Cashiers	-11,730
Carpenters	-8,940
Laborers and freight, stock, and material movers	-7,920
Combined food preparation and serving workers, including fast food	-7,330
Waiters and waitresses	-6,870
Truck drivers, heavy and tractor-trailer	-5,770
Bookkeeping, accounting and auditing clerks	-5,320
Customer service representatives	-4,780

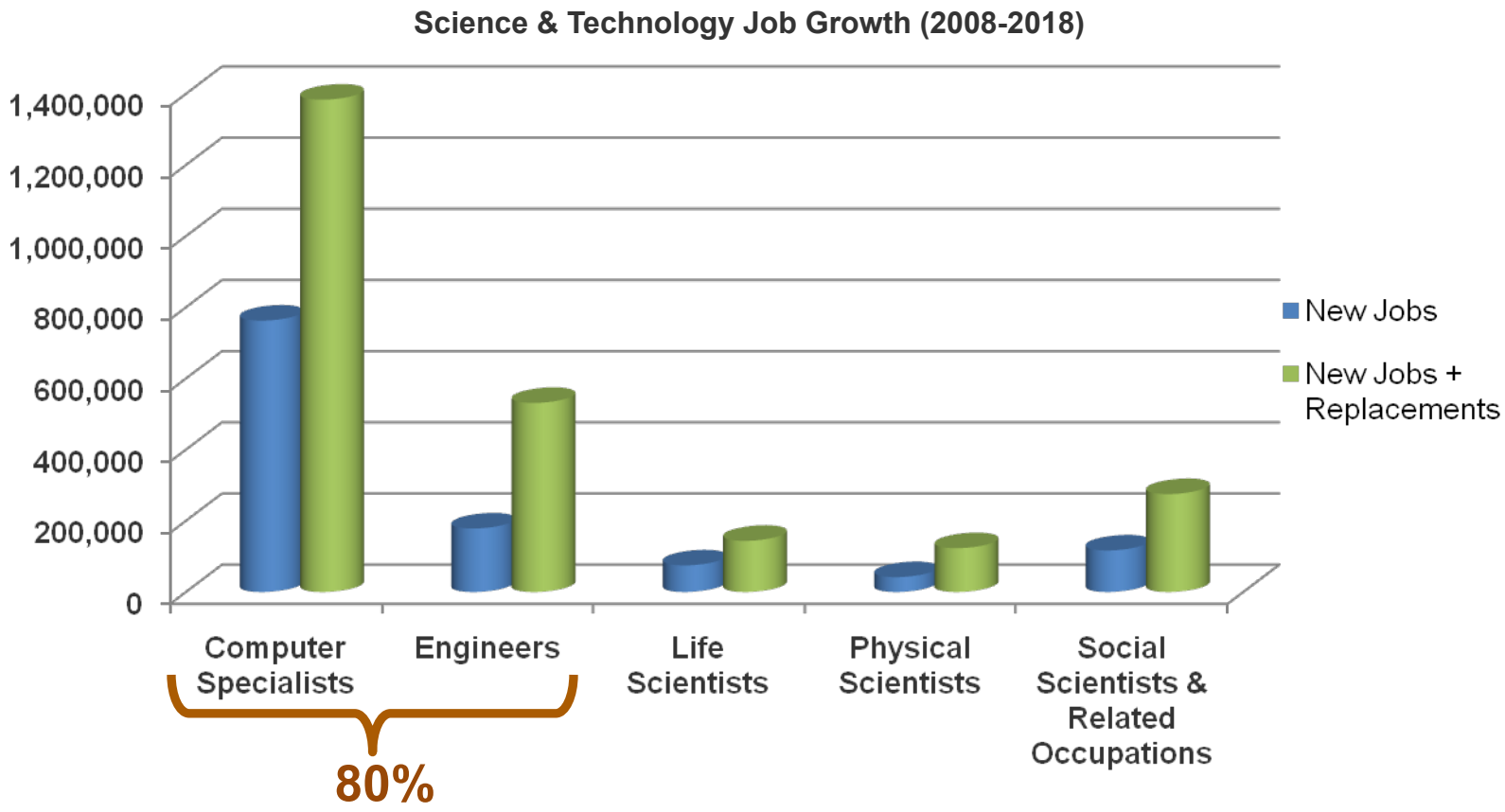
Sources: Seattle Times analysis of WorkSource job postings and Occupational Employment Statistics data

MARK NOWLIN / THE SEATTLE TIMES

Source: Used with permission from the Seattle Times.

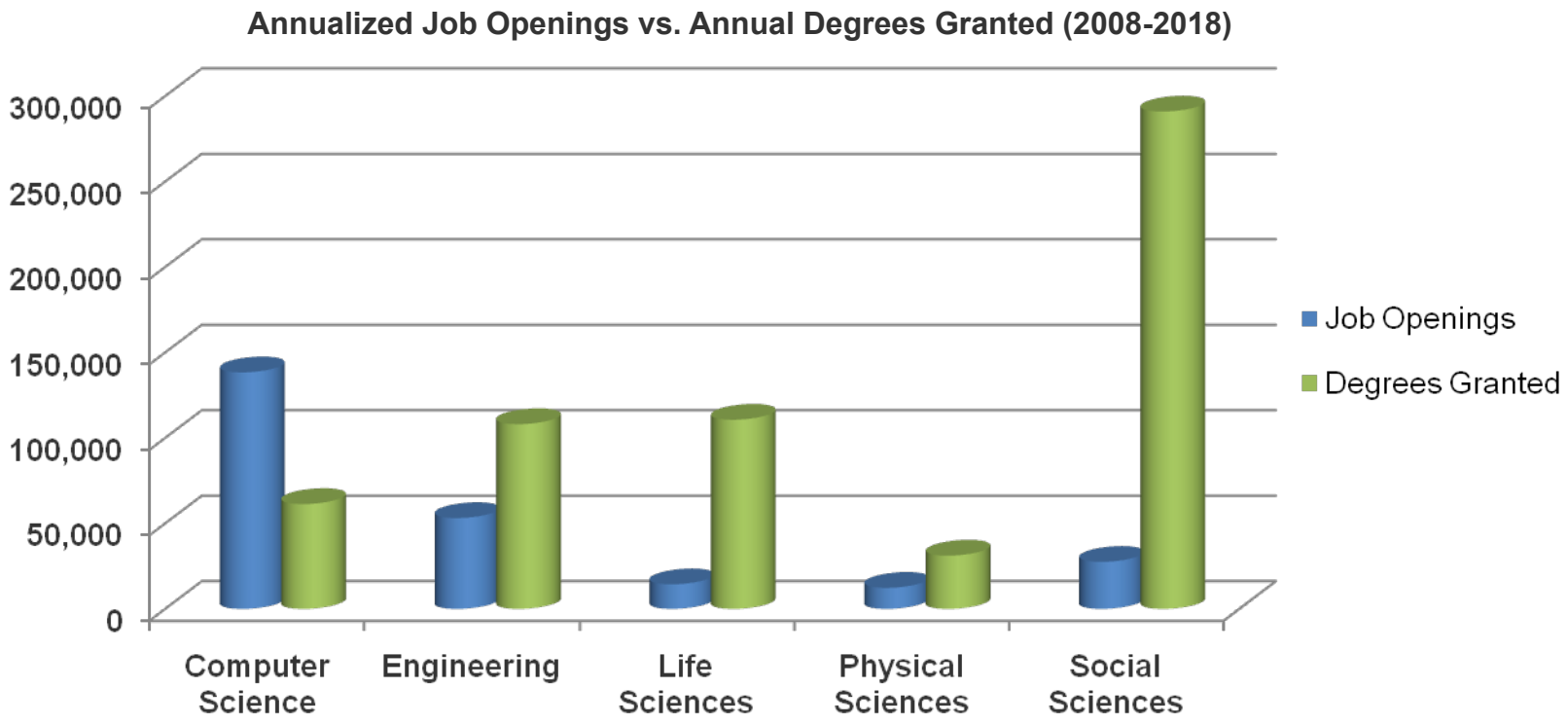

Yes, it's a pipeline issue, but it's also a capacity issue!
In the race for talent, ideas and economic opportunity…all STEM is important, but all STEM is not created equal!

Nationally, 80% of all STEM jobs are projected to be in computer science and other fields of engineering.



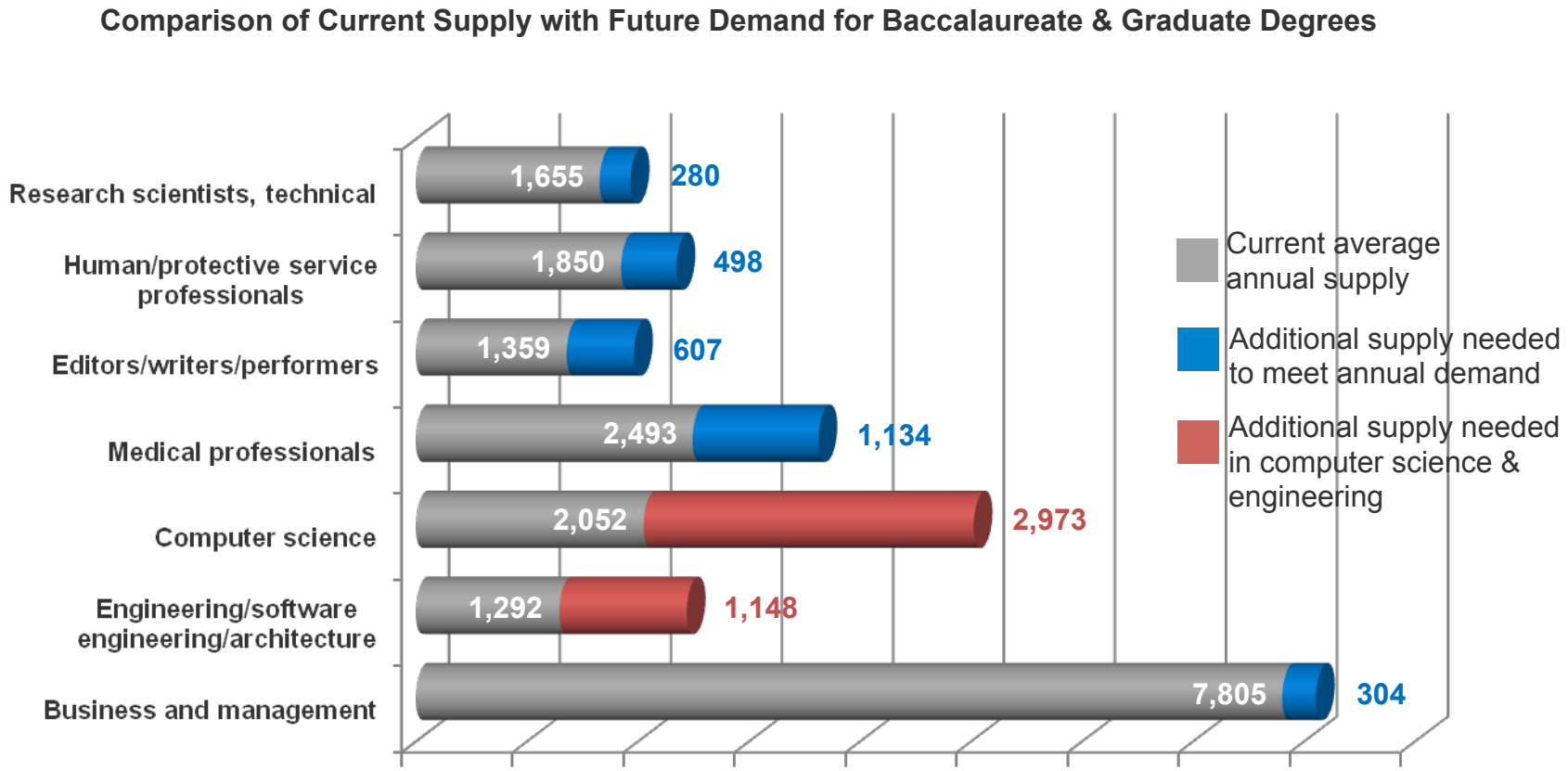
Source: Bureau of Labor Statistics

Nationally, within STEM there is a significant mismatch between jobs and degrees.



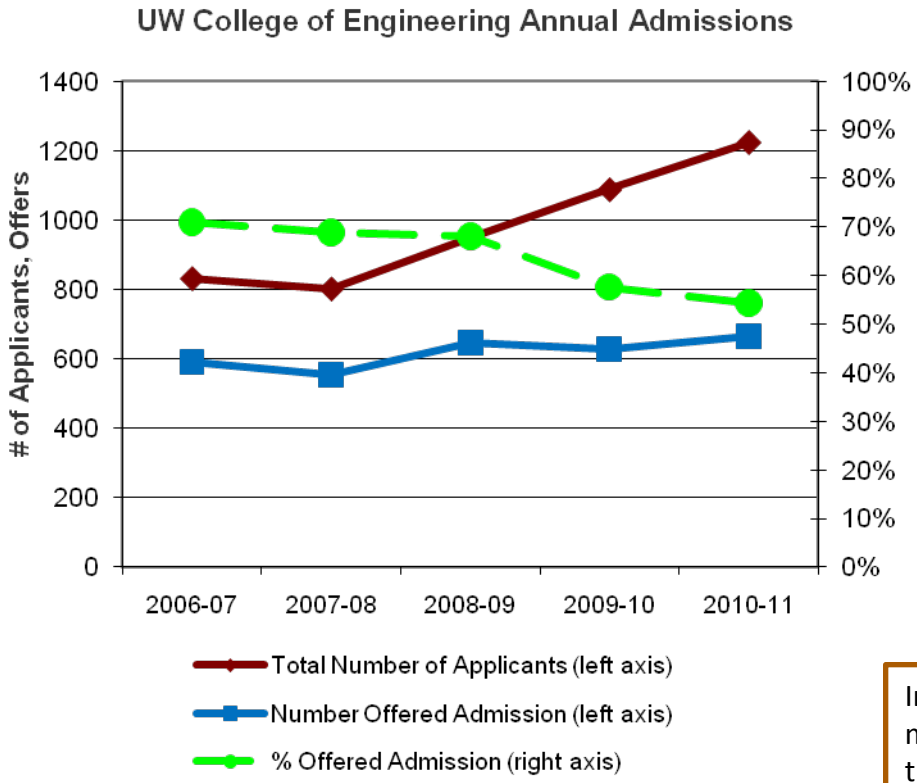
Source: Bureau of Labor Statistics, National Science Foundation

In Washington, computer science and other fields of engineering have the largest gap between supply and demand.

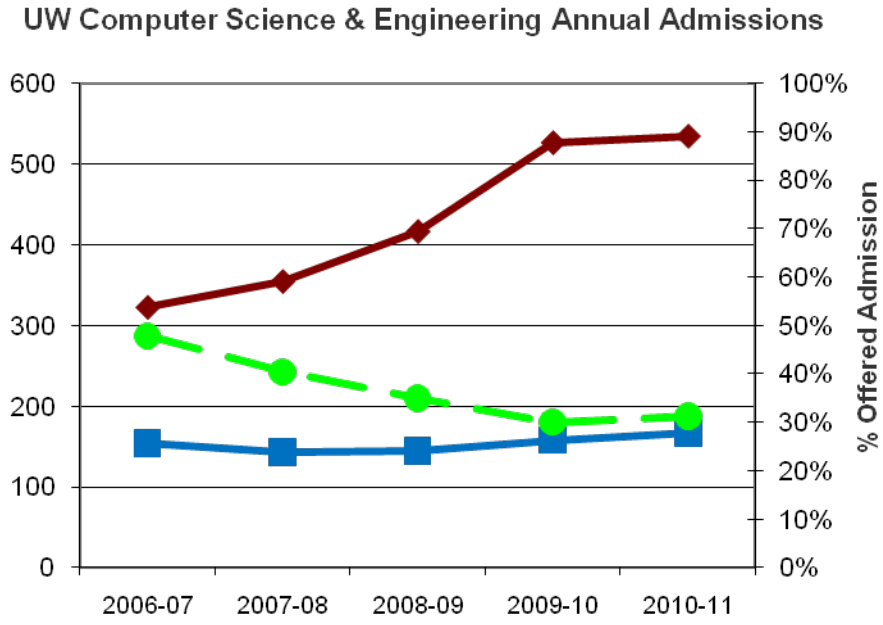


Source: Higher Education Coordinating Board: *Regional Needs Analysis Report*, 2011.
Analysis of Employment Security Department and IPEDS data.

In Washington, the gap is due to lack of program capacity, not lack of student interest.



(Additional students – roughly 30% of the total – are admitted to Engineering majors directly from high school or as high-performing freshmen.)



In the most recent year, more than 500 undergraduates seeking to major in a UW engineering program had to be turned away. More than 40% of the students that the College of Engineering was unable to accommodate, and more than 60% of the students that the Department of Computer Science & Engineering was unable to accommodate, had college grade point averages of 3.25 or above.

Source: University of Washington


Let’s put the vowel
back in STEM!


Questions?
lazowska@cs.washington.edu
http://lazowska.cs.washington.edu/STEM.pdf