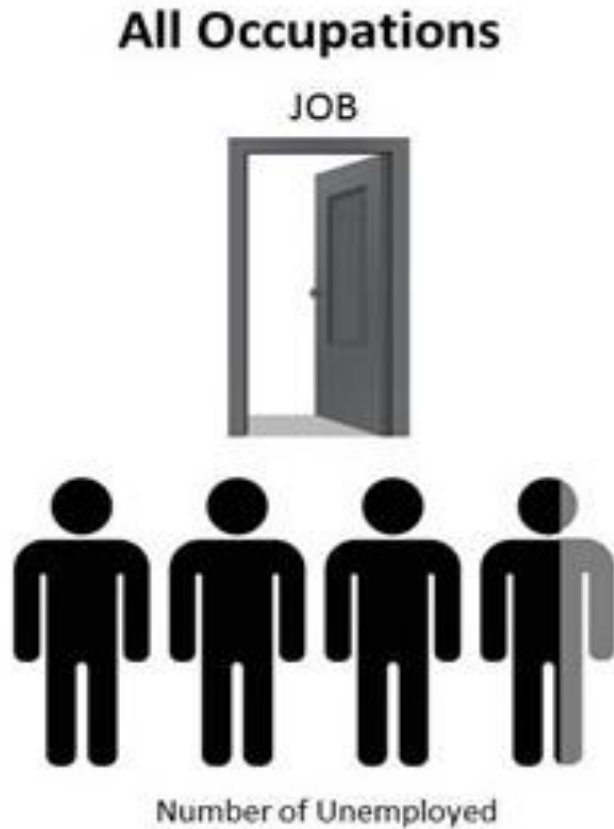


IEEE
Institute of Electrical and Electronics
Engineering,
An International Organization

IEEE, Berkshire Section
presenting

Perspectives on STEM
Education
(Science, Technology, Engineering and Math)

STEM Help Wanted



Overall, unemployed people outnumbered job postings by **3.6 to one**

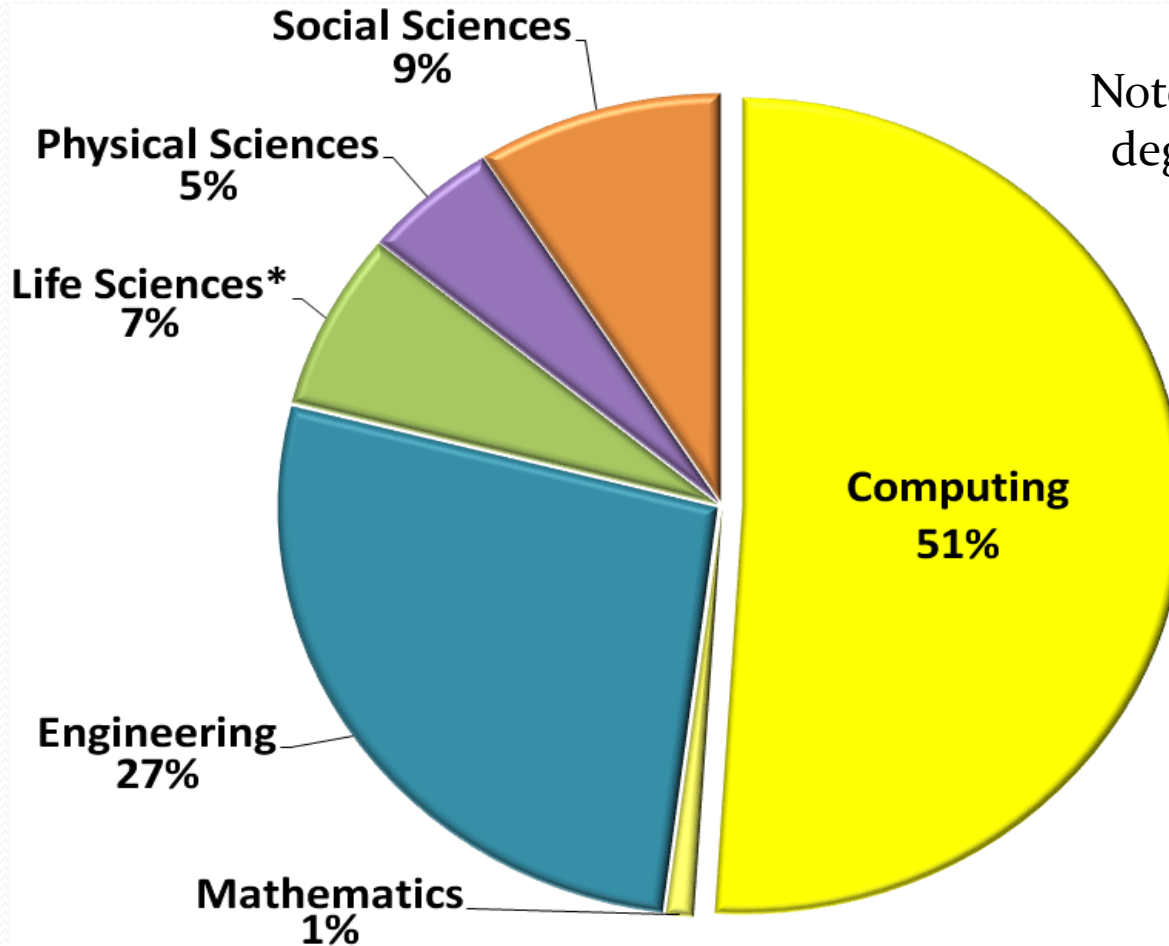
STEM Occupations



In the STEM occupations, job postings outnumbered unemployed people by **1.9 to one**

Where the STEM Jobs Will Be

Projected Annual Growth of Total STEM Job Openings 2010-2020

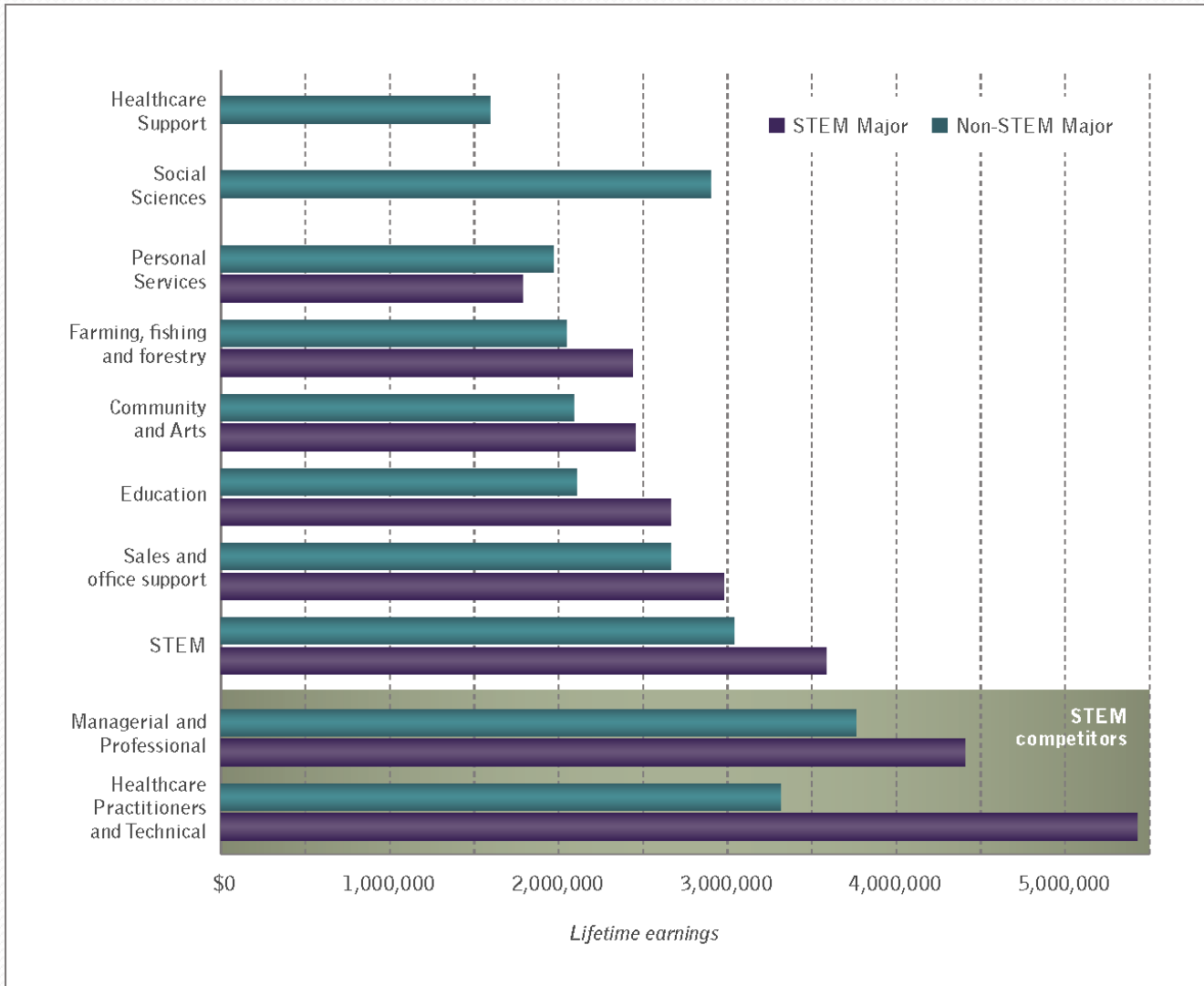


Note: 30% of all STEM degrees go to women

* STEM is defined here to include non-medical occupations.

Source: Jobs data are calculated from the Bureau of Labor Statistics (BLS), Employment Projections 2010-2020, available at <http://www.bls.gov/emp/>.

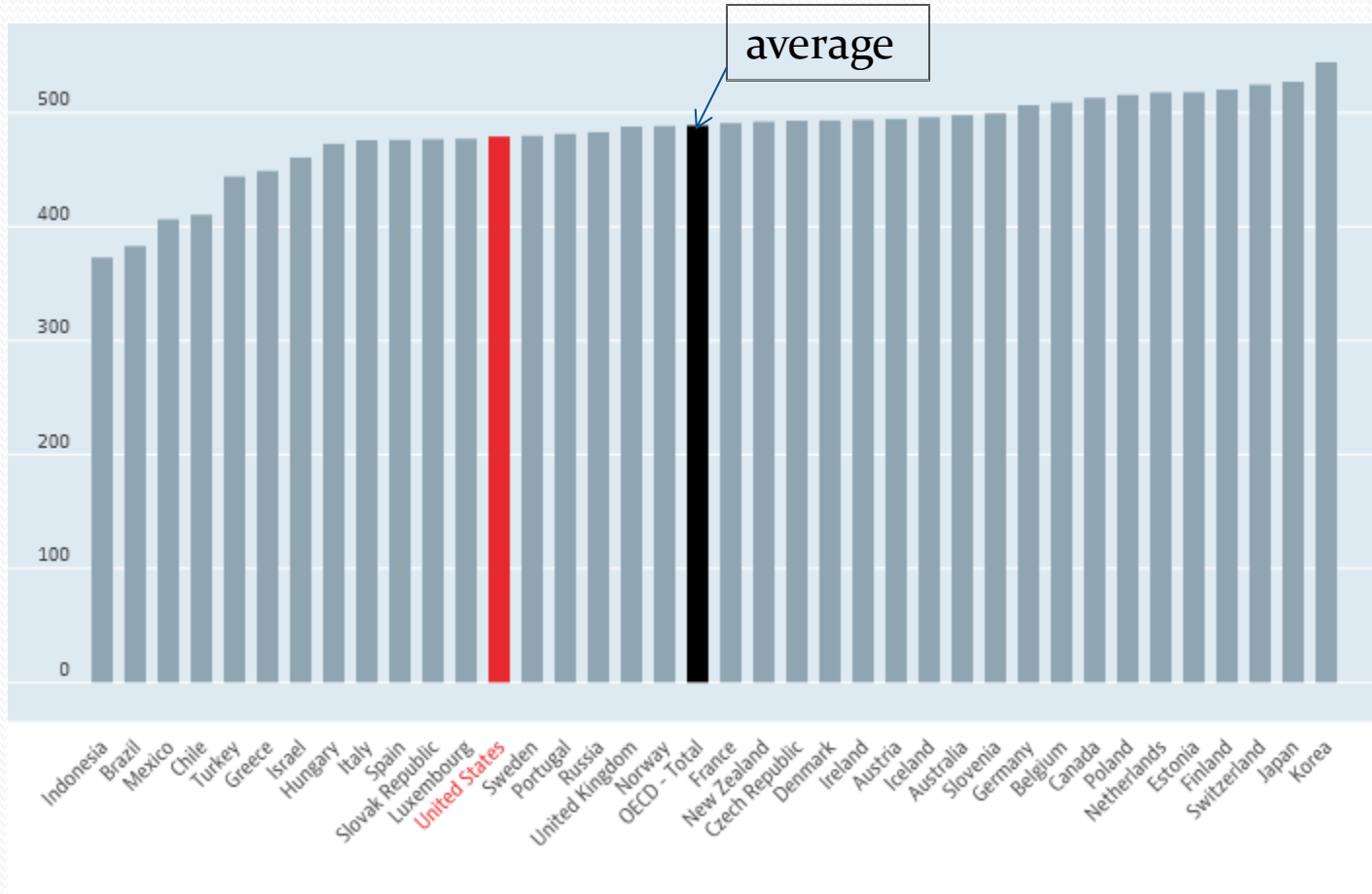
STEM majors earn more, in any field they choose



International **Math** Performance-2012

Students @ 15yrs 3mo to 16 yrs 2mo

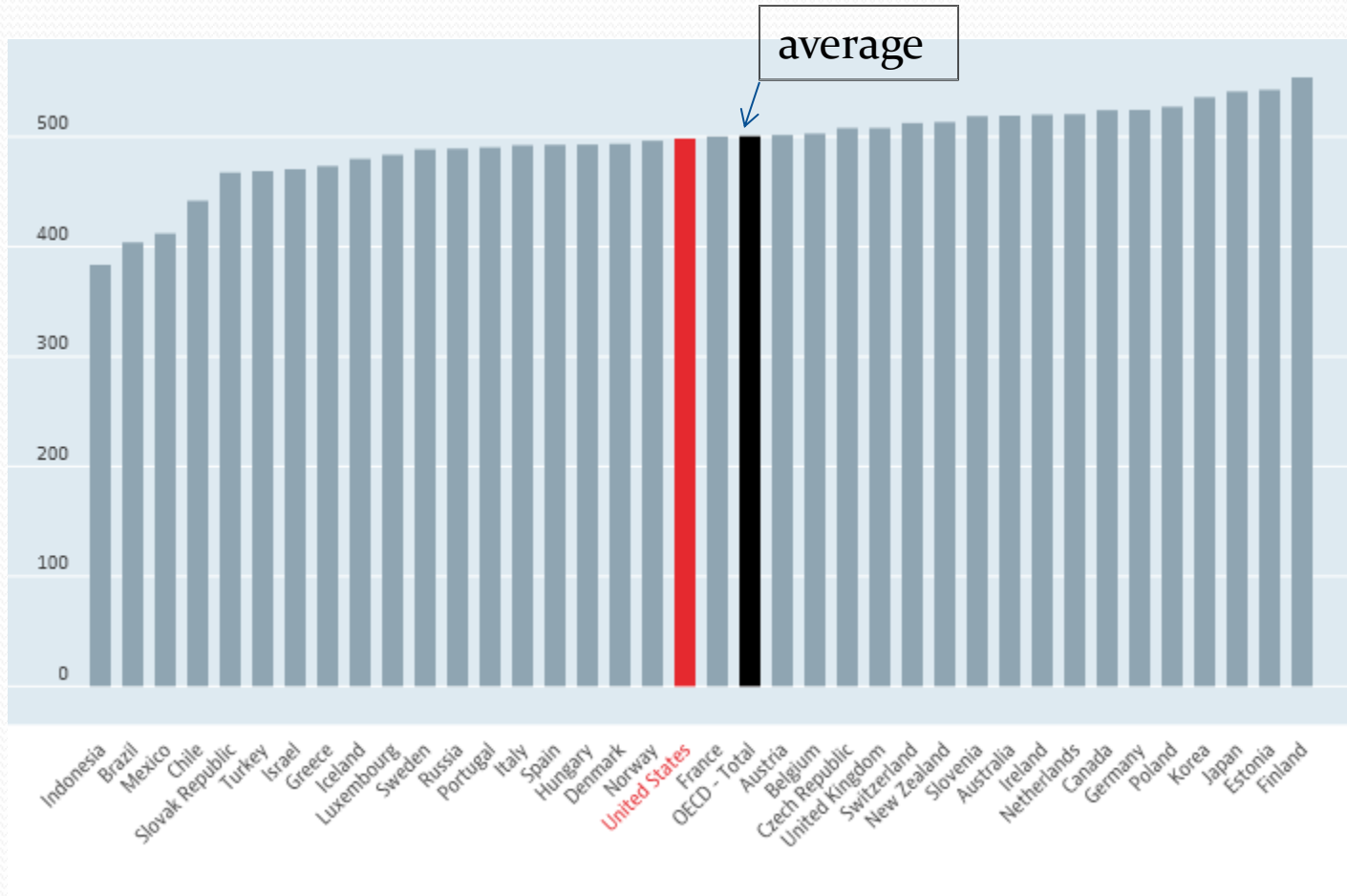
US = 25th



International Science Performance-2012

Students @ 15yrs 3mo to 16 yrs 2mo

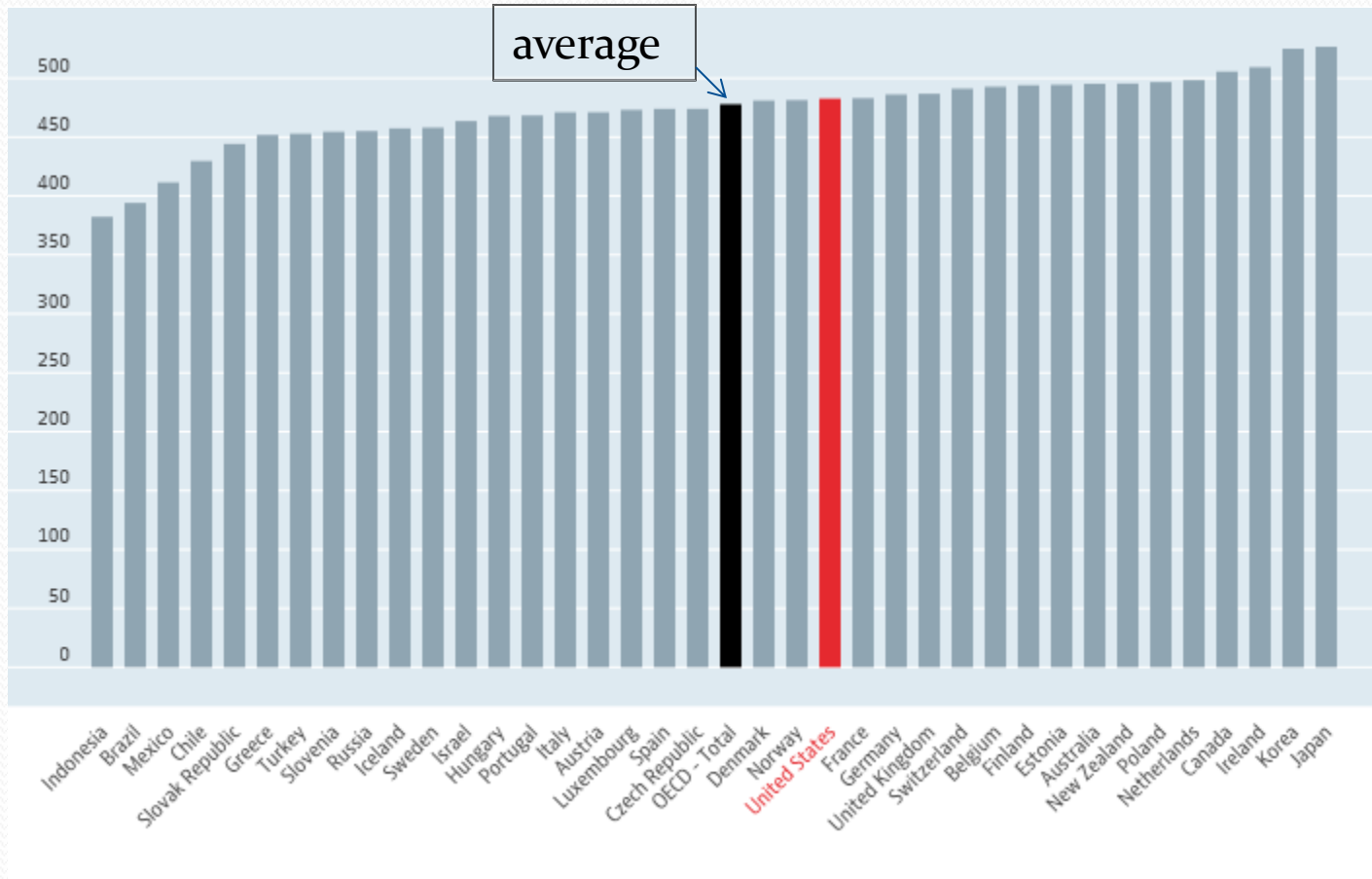
US = 19th



International Reading Performance-2012

Students @ 15yrs 3mo to 16 yrs 2mo

US = 16th



ACT College Readiness Test – “First look at STEM” 2013

How does committing to STEM impact College readiness ?

Subject	STEM ¹ (11.6%)	Non-STEM (88.4%)
English	70% (+11%)	59%
Reading	57% (+13%)	44%
Mathematics	57% (+24%)	33%
Science	41% (+20%)	21%

Footnote:

1. Expressed interest in STEM career!

Perspectives on STEM Education, cont.

1st , Recent Events

- Free Community College
- No Child Left Behind reauthorization bill
- Obama Budget proposal 2016

Free Community College

- President's Plan
 - 1. Maintain a 2.5 GPA.
 - 2. Good quality Degree Program.
 - 3. Successful Grad rates & placement to 4 yr colleges or jobs.
 - 4. Course credits must be transferable.

However, No apparent STEM focus

Show of hands: How many think it will pass congress?

Health, Education, Labor, and Pensions - HELP

- No Child Left Behind – NCLB; Senator Lamar Alexander(R-TN), Chair, to revise it. (Co-Chair Patty Murray(D-WA))
- Original goal was 100% proficiency in Math & Science by 2014!!!
- The NSTA, Nat. Sci. Teachers Assn. are encouraging people to push congress for STEM attention. (I did.)
- Originally: “The Elementary and Secondary School Act of 1965”

President's 2016 budget released recently

- \$3+ billion for STEM Ed programs
- To include:
 - Math and Science Partnership pgm
 - Next Generation High Schools
 - Nat. Sci. Foundation - Largest Amount: \$963 million
 - STEM + Computer Science Partnerships

Point person: jpeterston@nsta.org STEM ED Coalition

...more Ed budget items ...another \$3.8 billion

- **High School Redesign.**
- **Perkins Career & Tech Ed pgm.**
- **College Pathways & Accelerated Learning**
- **GEAR UP & TRIO pgms (\$1.1 b – most)**
- **School Turnaround Grants**
- **Promise Neighborhoods**
- **Investing in Innovation**
- **Dual Enrollment pgms (HS/Coll) (\$42 m – least)**

Example: STEM Resources

MIT summer program for K-12 M & S Educators

- SEPT - Sci & Eng Pgm for Teachers (in 2014)
 - Daily lectures from MIT Scientists on new frontiers
 - Hands on computer simulation experiences
 - Built-in curricula for after school implementation
 - Wet lab experiments led by MIT Scientists
 - Other MIT created K – 12 initiatives for students & Teachers

Example: STEM Resources
Welcome to DIGITS¹, an @Scale project

www.DIGITS.us.com

- For sixth graders...
- Volunteers mingle and engage Sixth Graders in STEM activities.
- Online Teacher Resource Packages(OTRP), with multi-media content for teachers to supplement classroom instruction.
- ¹Conducted by researchers at VERTEX, HQ in Boston. A Bio-Sciences firm.

STEM PhD – e.g. Tufts Dept. of Education

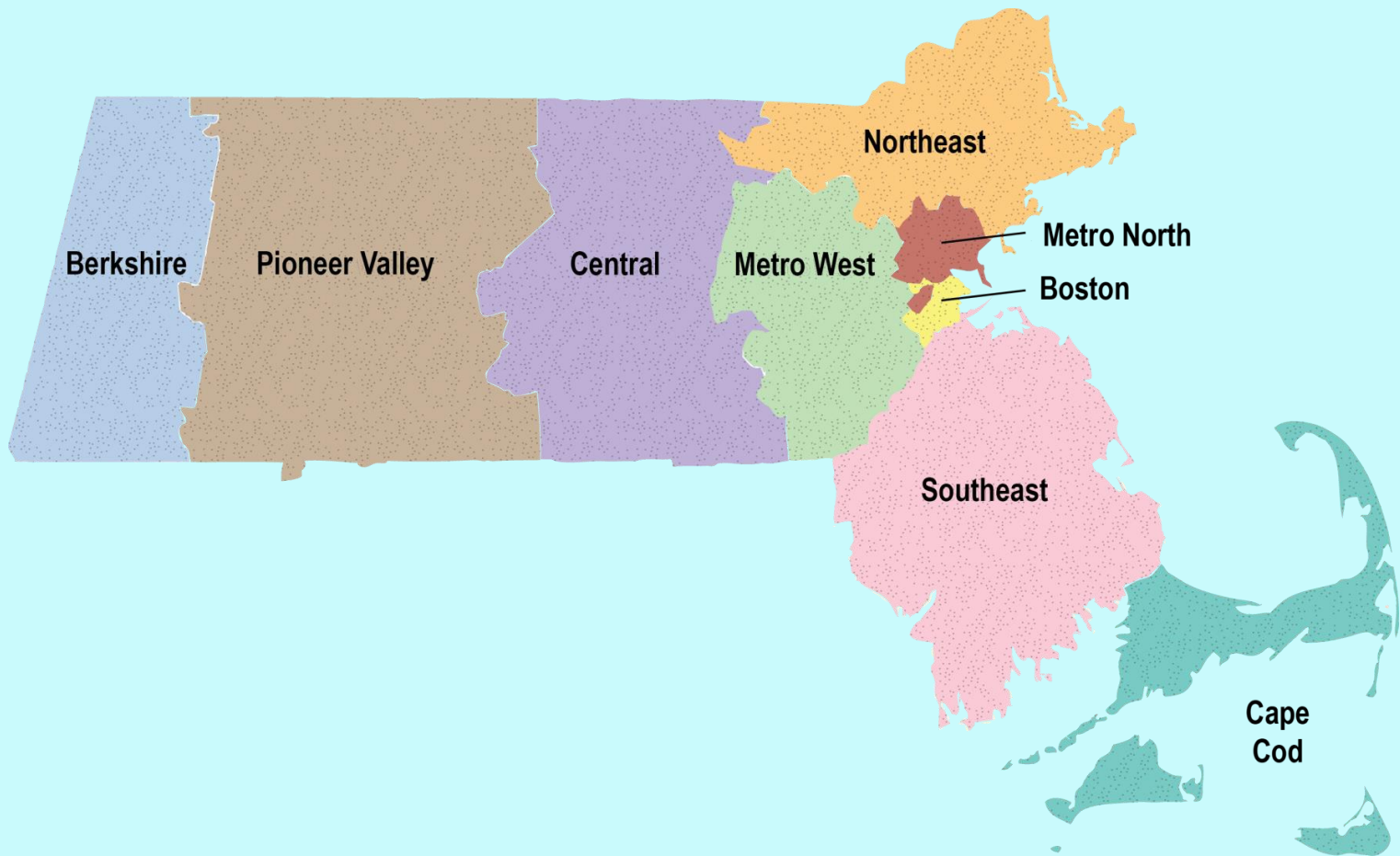
Several of the Courses offered

- ED 111 Development of Knowledge and Reasoning in Science curriculum
- ED 112 Mathematics Learning Environments
- ED 291 Theory and Research in Science, Technology, or Engineering Education
- PS 107,8 Advanced Statistics I,II
- SOC 101,2 Quantitative Research Methods I, II
- CD 240 Directed Research
- **Must take two Grad courses in the Mathematics, Sciences or Engineering Departments.

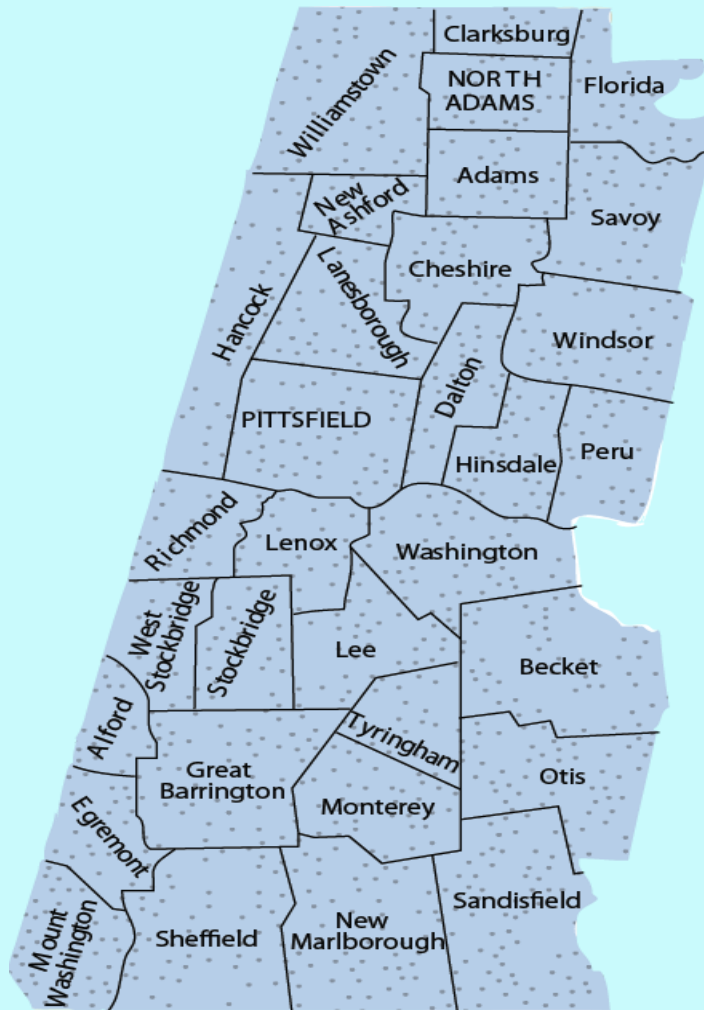
- 
- What is Massachusetts doing?

Regional MA STEM Networks

(mass.edu/STEM)



STEM Network - Berkshire County



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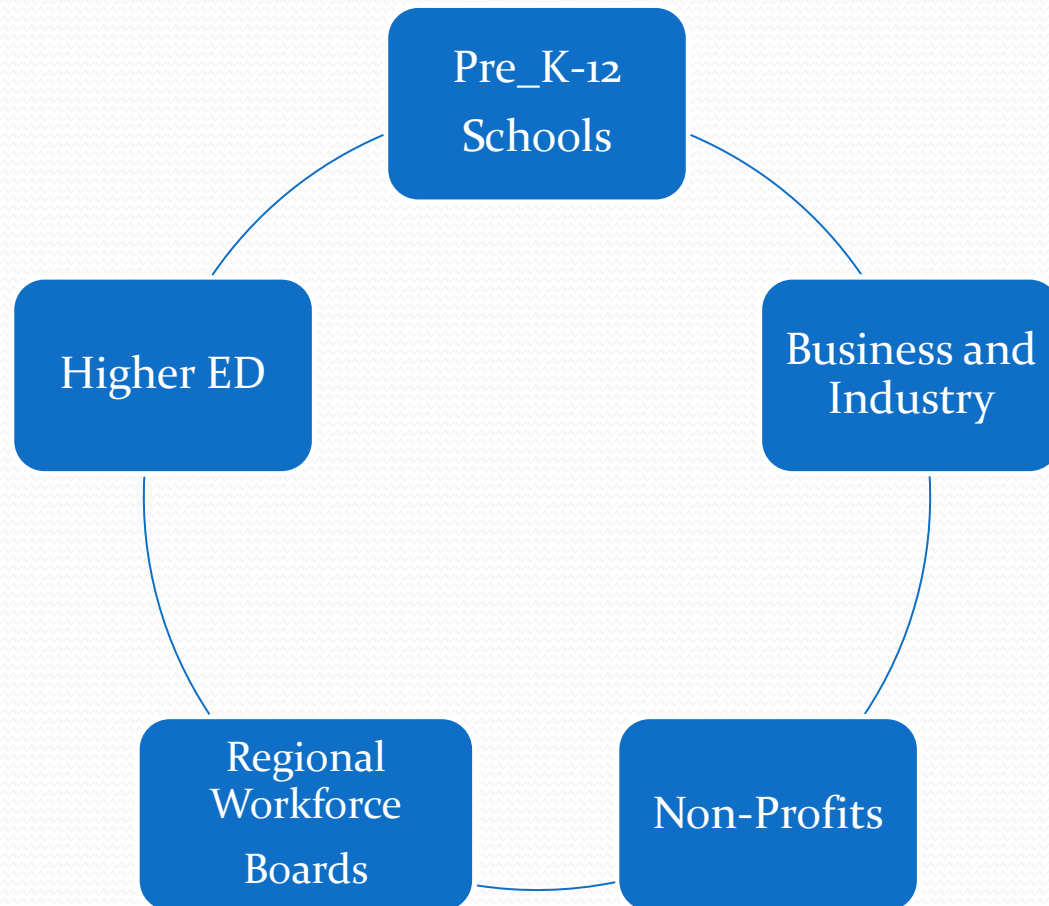
<http://www.mcla.edu/pipeline>

Massachusetts¹ STEM Plan

1. Increase student *interest* in STEM areas;
2. Increase student *achievement* among all Pre_K-12 students;
3. ****Increase** the percentage of *skilled educators* who teach Pre_K->16 STEM classes;
4. Increase the percentage of student *completion of post-secondary degrees or certificates* in STEM subjects;
5. **STEM Ed** *alignment* with the region's workforce opportunities in STEM-related fields

¹Resembles the federal plan.

Regional STEM Networks, for STEM Education and Workforce Collaboration



STEM Pipeline Fund¹

- Goal – achieve MA STEM Plan success
- 2014, the STEM Pipeline Fund has been used to support:
 - 9 *Regional STEM Networks*
 - 17 *@Scale* Projects
 - *Evaluation*
 - *Public Awareness Campaign*
 - *STEM Council* meetings and events
 - Subcommittees

¹The STEM Pipeline Fund is dependent on an annual appropriation from the state legislature.

@Scale Grant Program

What are the Characteristics of @Scale Projects?

- Effective
- Successful
- Best Practice
- Ready to be scaled up
- Sustainable without State funds

MA @Scale projects

	Science	Engineering	Technology	Math
Post-Secondary, Workforce Development	MCLA STEM Pathways			
				BATEC: Big Data
				Advanced Manufacturing
High School	MMSI Bio-Teach		Gateway to Technology & Engineering QCC Robotics	UMMS RSRC Increasing Accessibility to Algebra and Geometry MMSI
Middle School	Science From Scientists	Future Cities		
Elementary School				
Early Education				Boston K1DS

Some, more Personal, Perspectives

*When there is Money...
“...fools rush in where
angels fear to tread.”
Alexander Pope*

A Tale of Two Worlds

A. There are contractors, consultants, all manner of “academic experts”, publishers, officials at the Federal and State levels, etc...

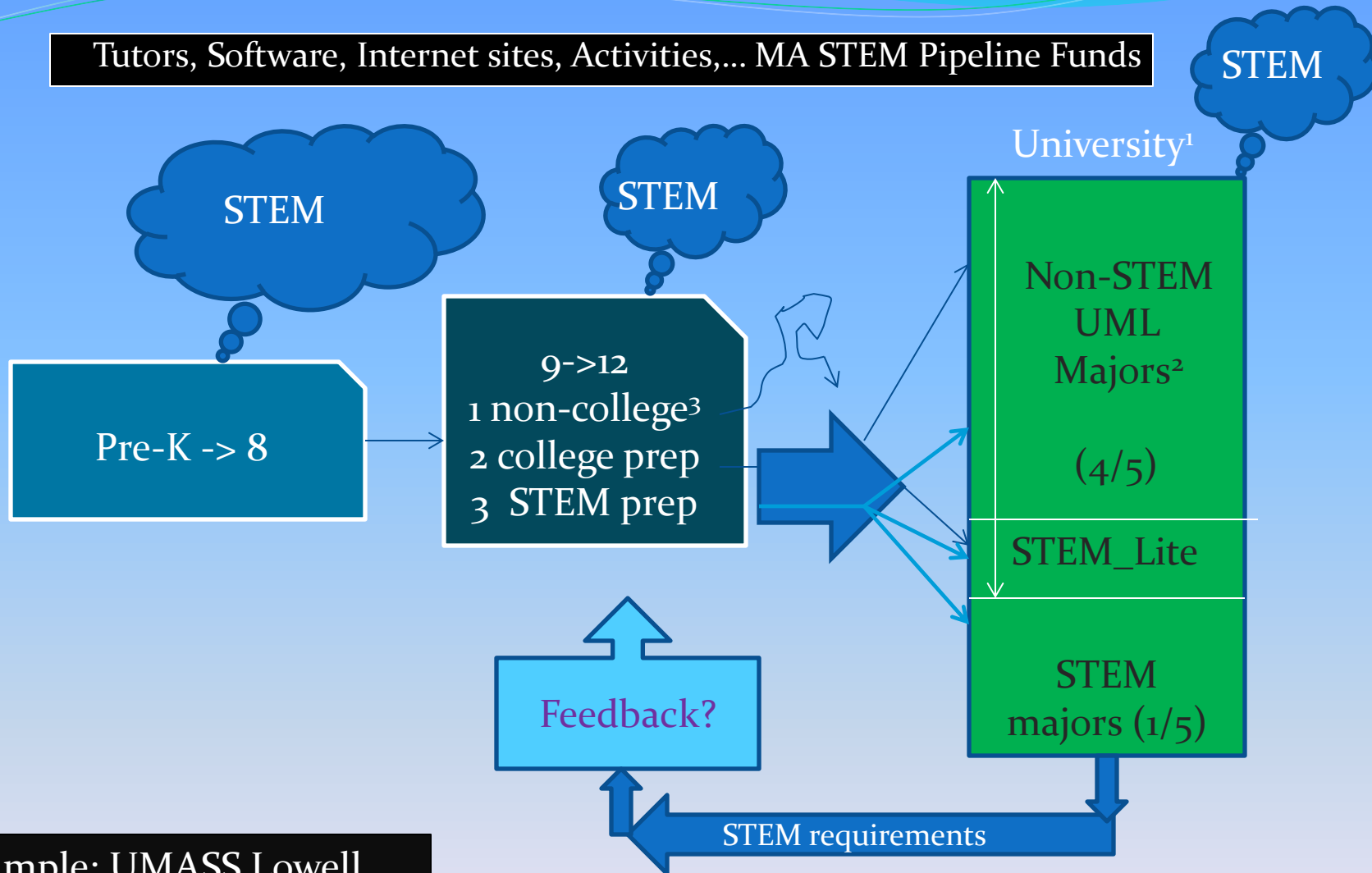
Vs

B. Principals and teachers

...and the footprints of the former are way too big.

STEM Activity in Schools (Overview)

Tutors, Software, Internet sites, Activities,... MA STEM Pipeline Funds

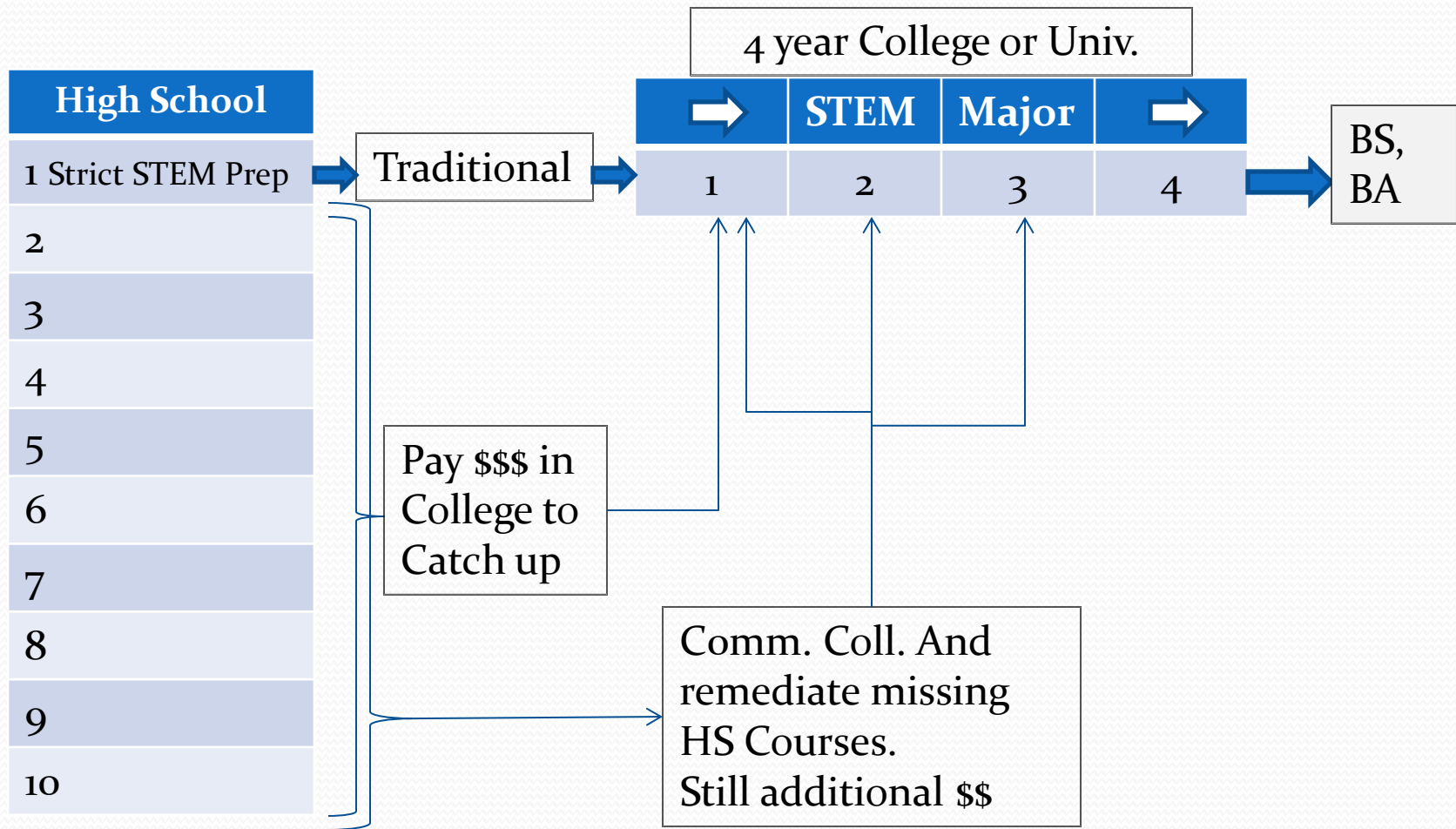


¹Example: UMASS Lowell

²STEM, STEM_Lite, & non-STEM = f (quantity and quality of Math & Sci core)

³ Open Admissions Community Colleges

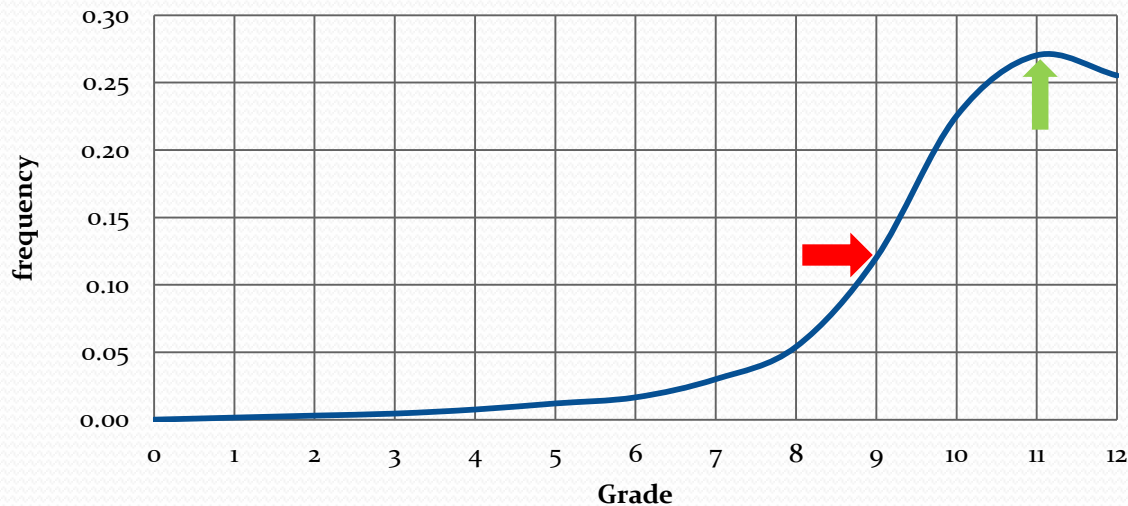
The Path(s) to STEM



Think Point:

When is the typical student likely to decide what major to take in College? 2nd Grade? 6th? 11th?

Probability of College Major Selection



The Critical, “When is it too late to go STEM?”

→ Tipping Point: 9th Grade Algebra I →

Tipping Point because

- By 12TH Grade, should have taken “Pre-calculus” and need Unbroken Math through 12Th grade
- ALSO, Like HS STEM College Prep, it is a sufficient Upstream Goal (for Elementary Schools)

Why are the number of STEM capable decreasing?

EDUCATION is a *TRICKLE DOWN* Process

All the Non-STEM Programs in
College



Reduce need for strict STEM
Math & Science for College
Bound in High School



And Elementary Schools follow
suit.

Parting Thoughts

- In COLLEGE
 - ENG 101 , practically unchanged over decades.
 - Yet, MATH 101 , and SCI 101 are dumbed down for many non-STEM degrees (aka, “Math & Science for Poets”)
- “Is College Worth It?” (2013) Bill Bennett. (Ron Reagan’s Educ. Secretary)
 - Are BS, BA a Golden Ticket? ...
 - Most likely ticket for “...debt, unemployment, and politically charged pseudo-learning...”

HOW TO Increment # of STEM capable. NEW GOAL

- DEFINE A PUBLIC HIGH SCHOOL MINIMAL
STEM COLLEGE PREP option.
- Parents! HS SCP readies the student for ANY College major.
 - Must overcome the “get all A’s” syndrome.
 - Provides shorter path to readiness for re-entry into STEM industry, later in life, regardless of college degree.
- Opportunities for STEM professionals is only going to increase in the near future.
- ***A quality STEM professional is a national resource!***

MA Lead the Way Today (MLTW)

- **A Minimal HS STEM College Prep Base (9->12)**
- **(***)*Math*** –(4 years **Minimum**)
1 year Algebra I&II+1 year Geometry+ 1 year Algebra II+1 yr Trig &Functions
- **(***)*Science*** – 3 yrs (2 yrs **Minimum**) with Labs
1 year Biology+1 year Chemistry+1 year Physics (concurrent with Trig)
 - Required: P&C, or P&B, recommend P&C&B
- **(**)*Computer Literacy*** – Learn to use the tools and understand how computers work) Spreadsheet, Database, PowerPoint, familiarity.
- (Additional, but not necessary) ½ year Statistics, Environmental Science, AP Science and, or AP Math.
- Additional liberal Arts courses

If not HS SCP, Listen to the sound of doors closing!

Final, W.O.W. to parents and students

- A debt the size of a Home Mortgage deserves a healthy Return On Investment.
- It's the last degree you get that is most important. (Save some for grad school!)
- Engineering is one of the highest affirmative action disciplines for women.
- A STEM background can transition to any discipline, but not vice versa.

The END?

STEAM

ESTEEM:
**Engineering, Science
& Technology
Entrepreneurship
Excellence Masters
Program, UND**