# 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

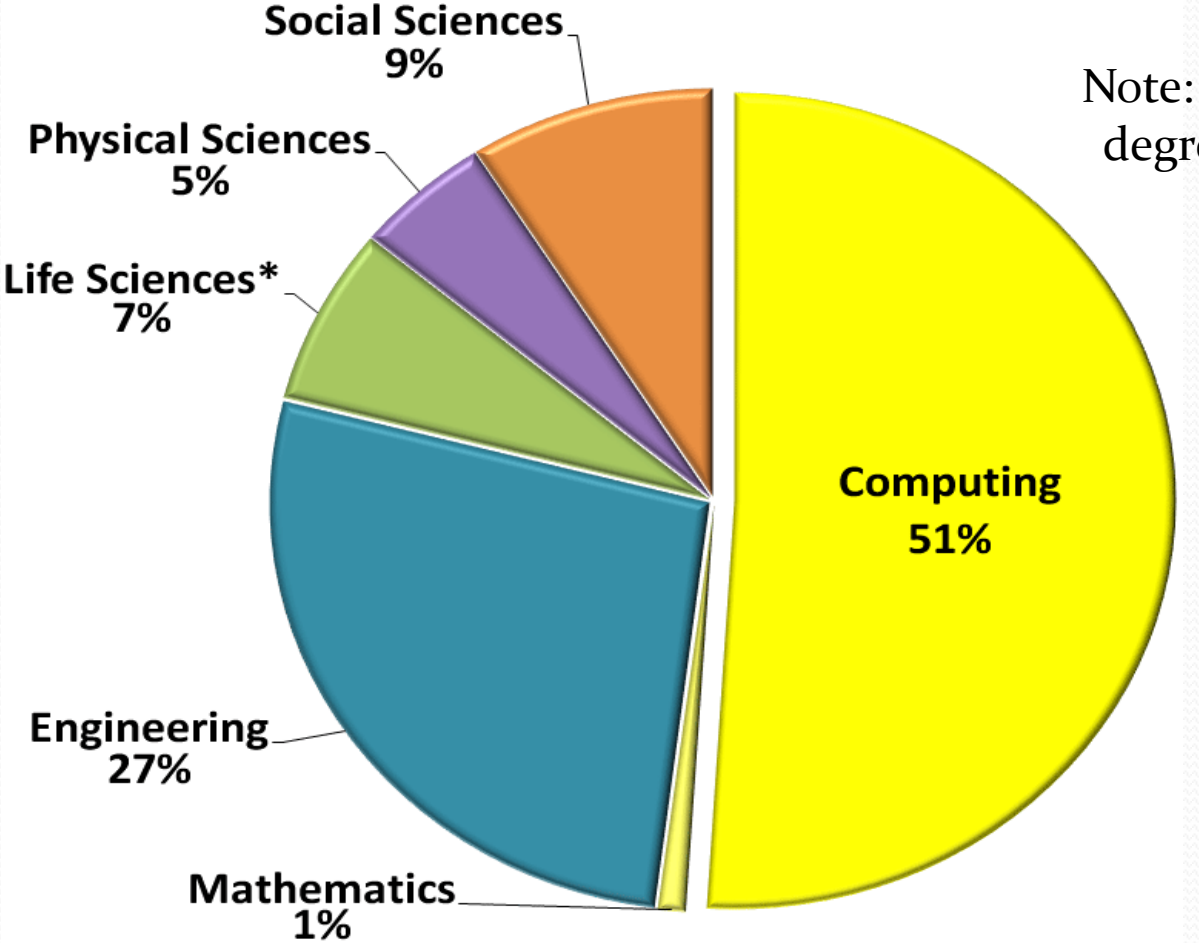

Overall, unemployed people outnumbered job postings by **3.6 to one**


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

CHANGE THE EQUATION

# Where the STEM Jobs Will Be

## Projected Annual Growth of Total STEM Job Openings 2010-2020



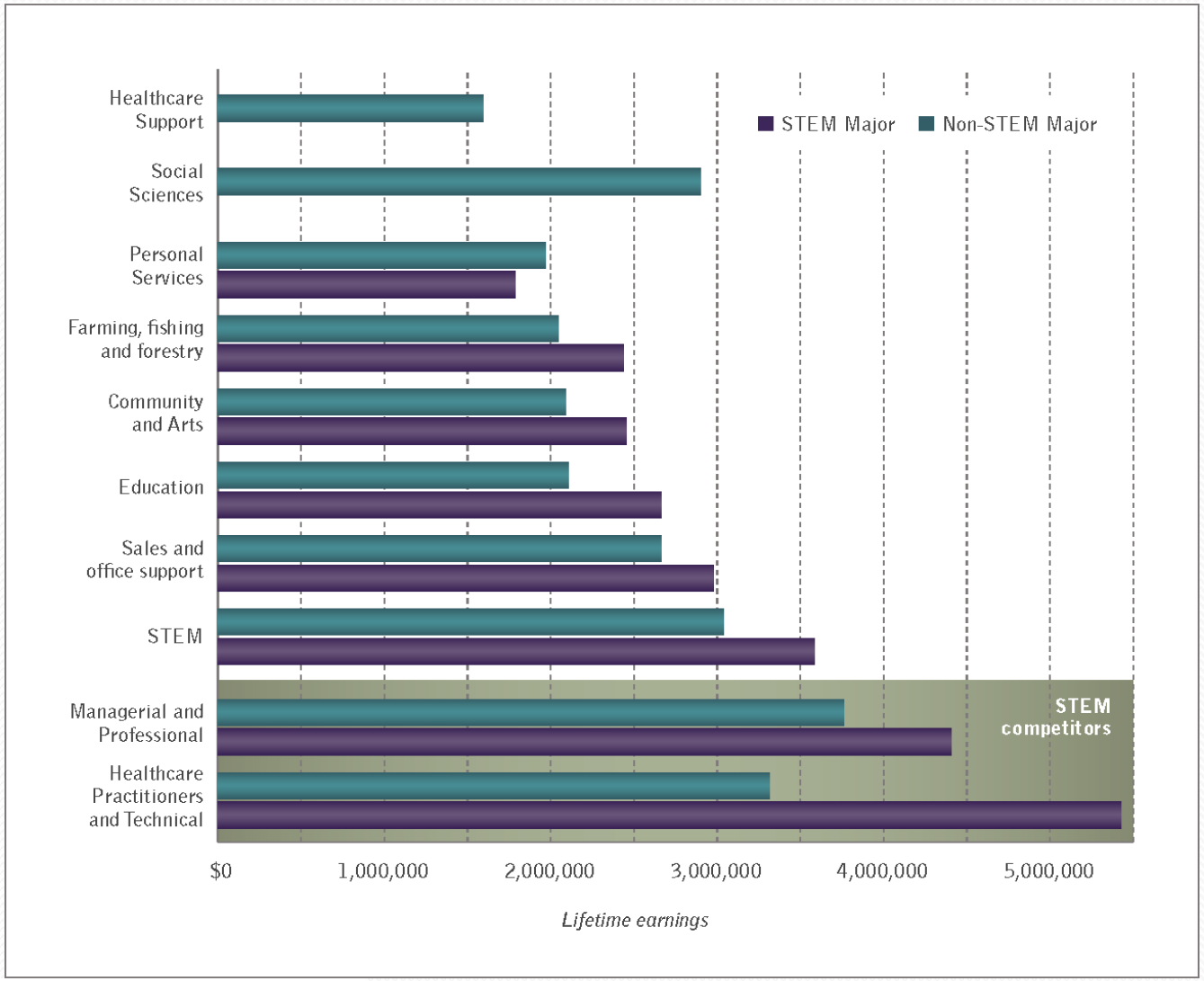

Note: 30% of all STEM degrees go to women

* 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/.

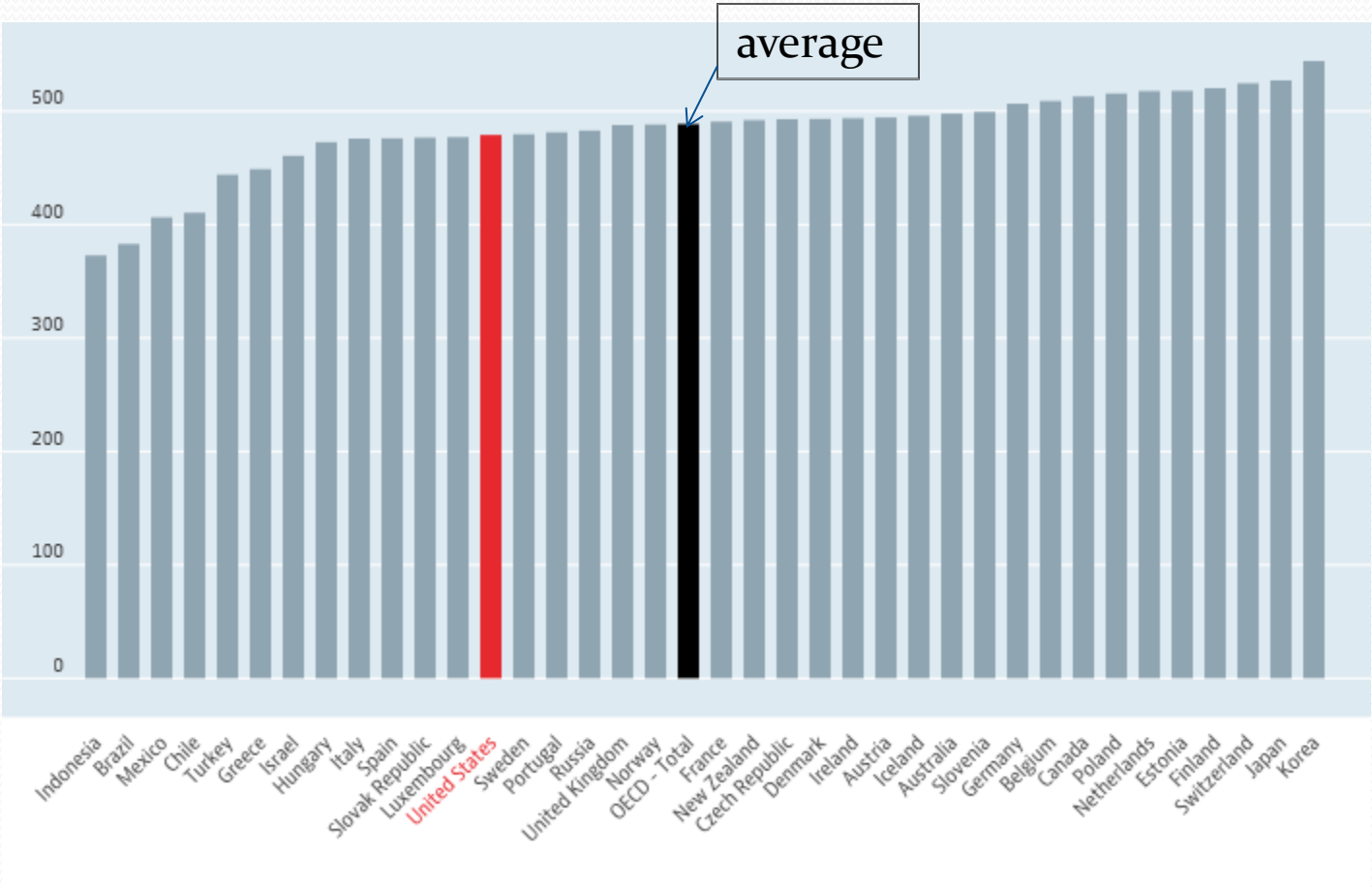
Association for Computing Machinery
Advancing Computing as a Science & Profession

# STEM majors earn more, in any field they choose

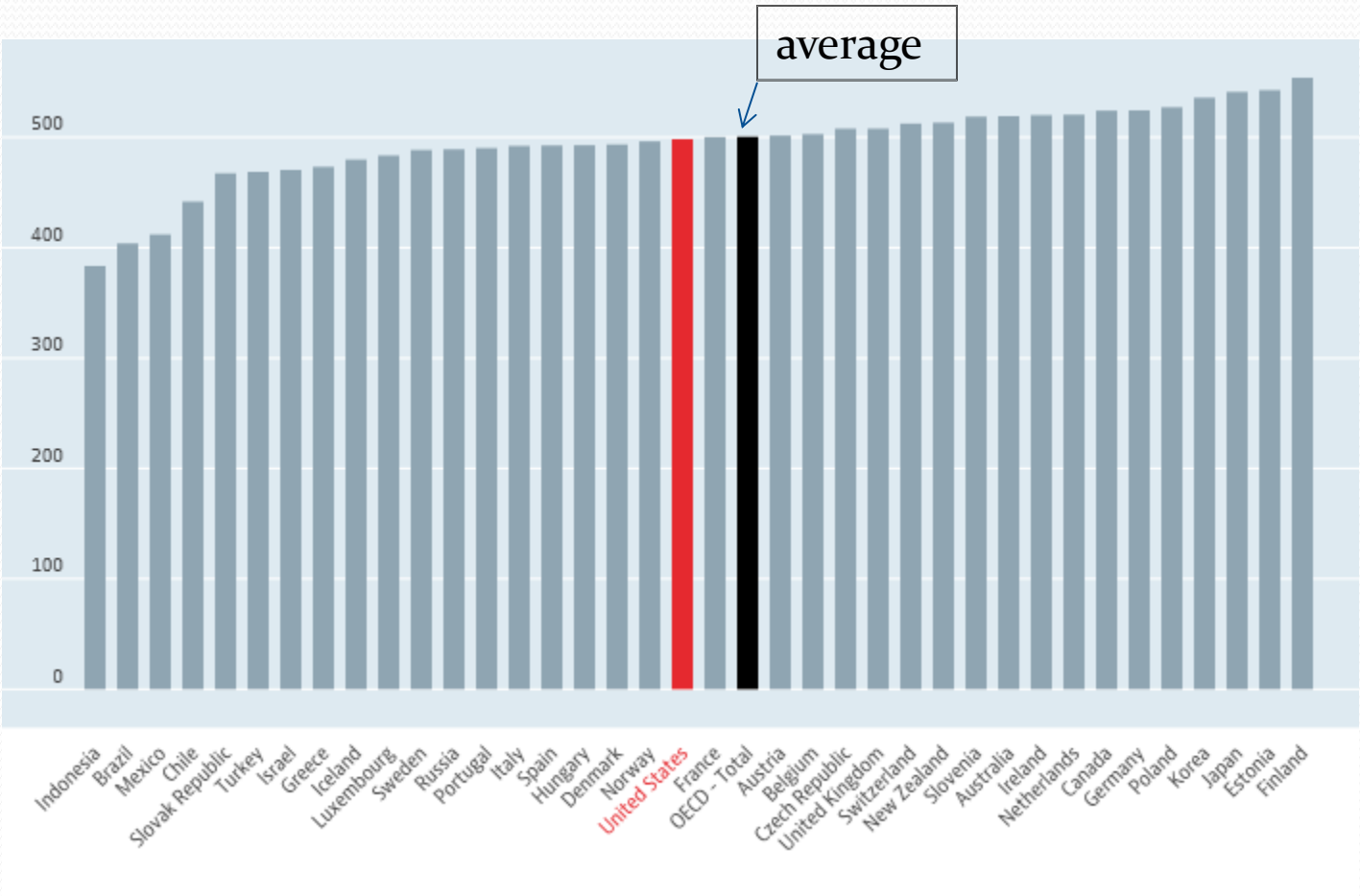



GEORGETOWN UNIVERSITY
Center on Education and the Workforce

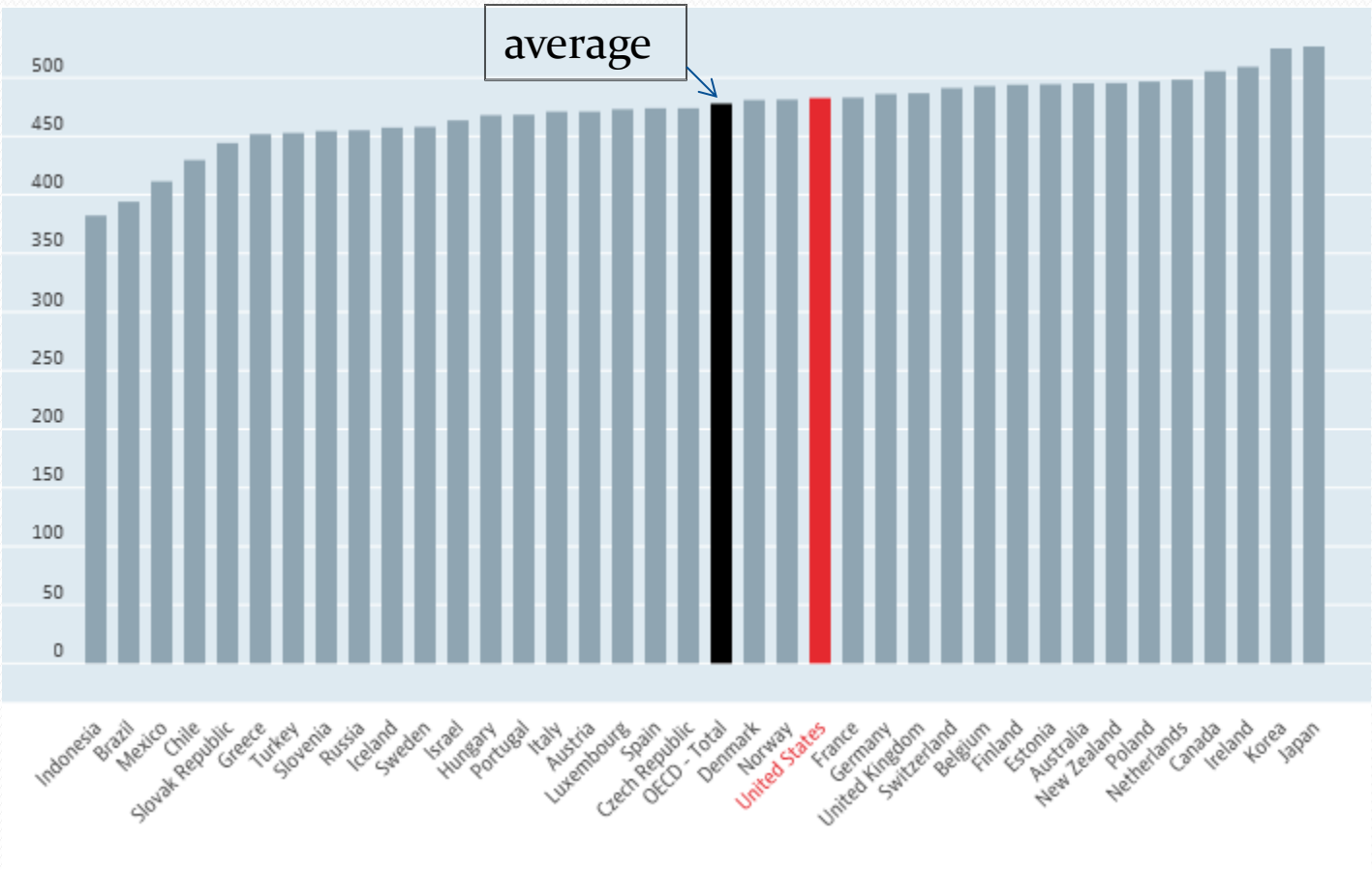
# International **Math** Performance-2012
## Students @ 15yrs 3mo to 16 yrs 2mo
## US =25th



# 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: jpeterson@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 DIGITS[1], 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.

- [1]Conducted by researchers at VERTEX, HQ in Boston. A Bio-Sciences firm.

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

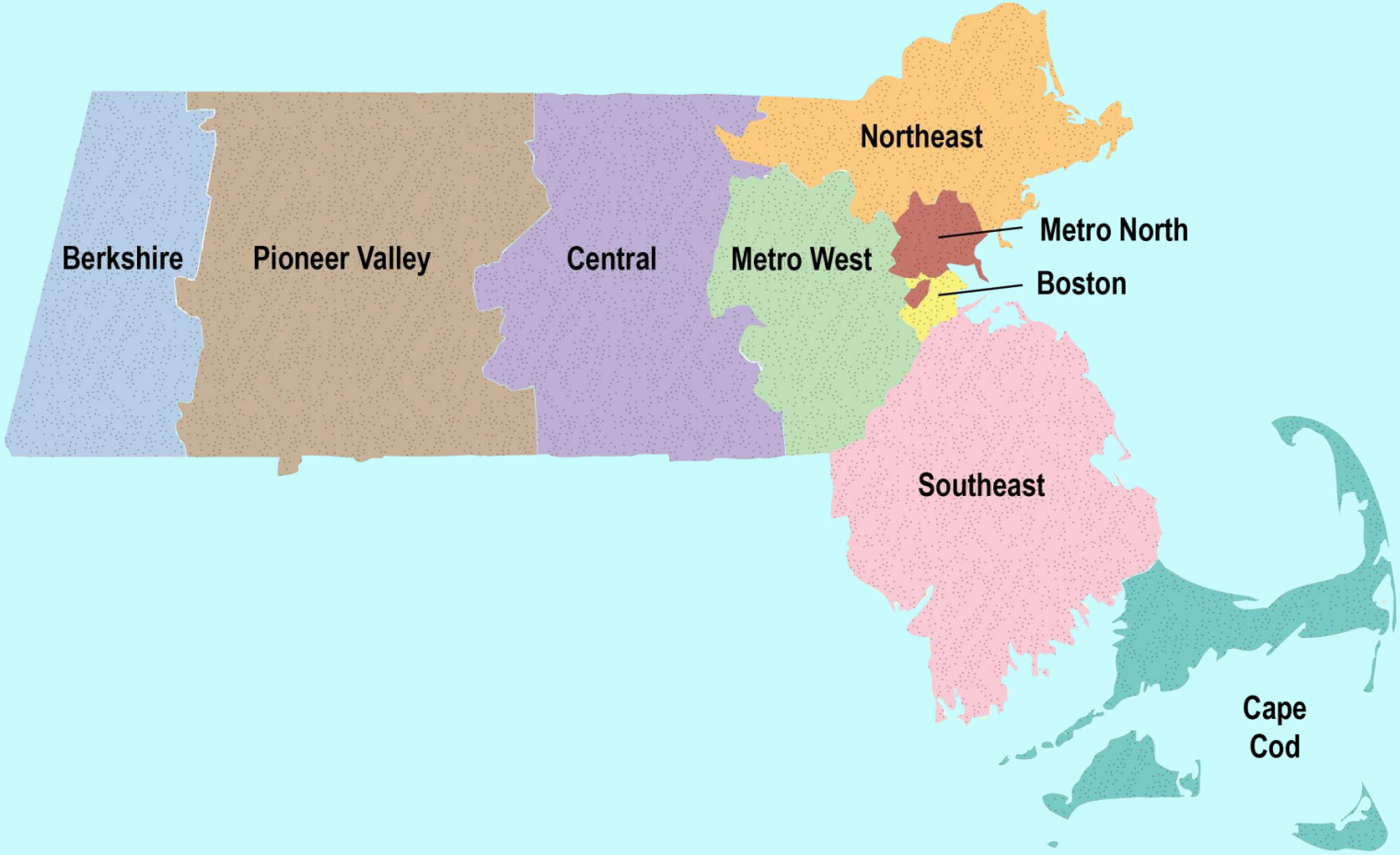
Several of the Courses offered

- 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.

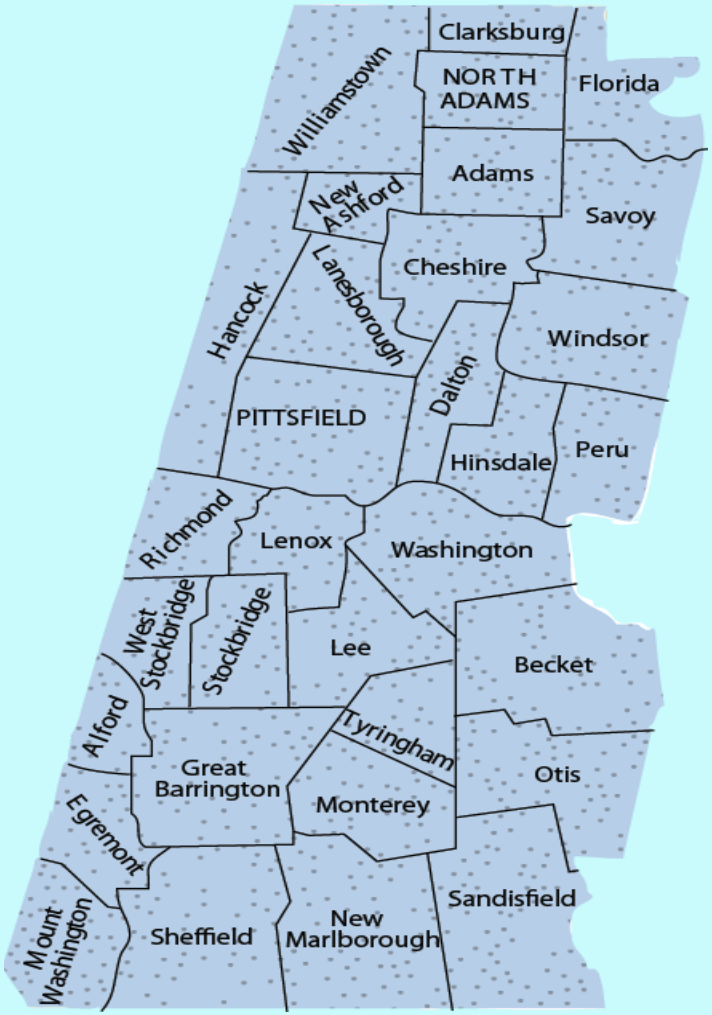
- What is Massachusetts doing?

# Regional MA STEM Networks

(mass.edu/STEM)



# STEM Network - Berkshire County

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**Website**

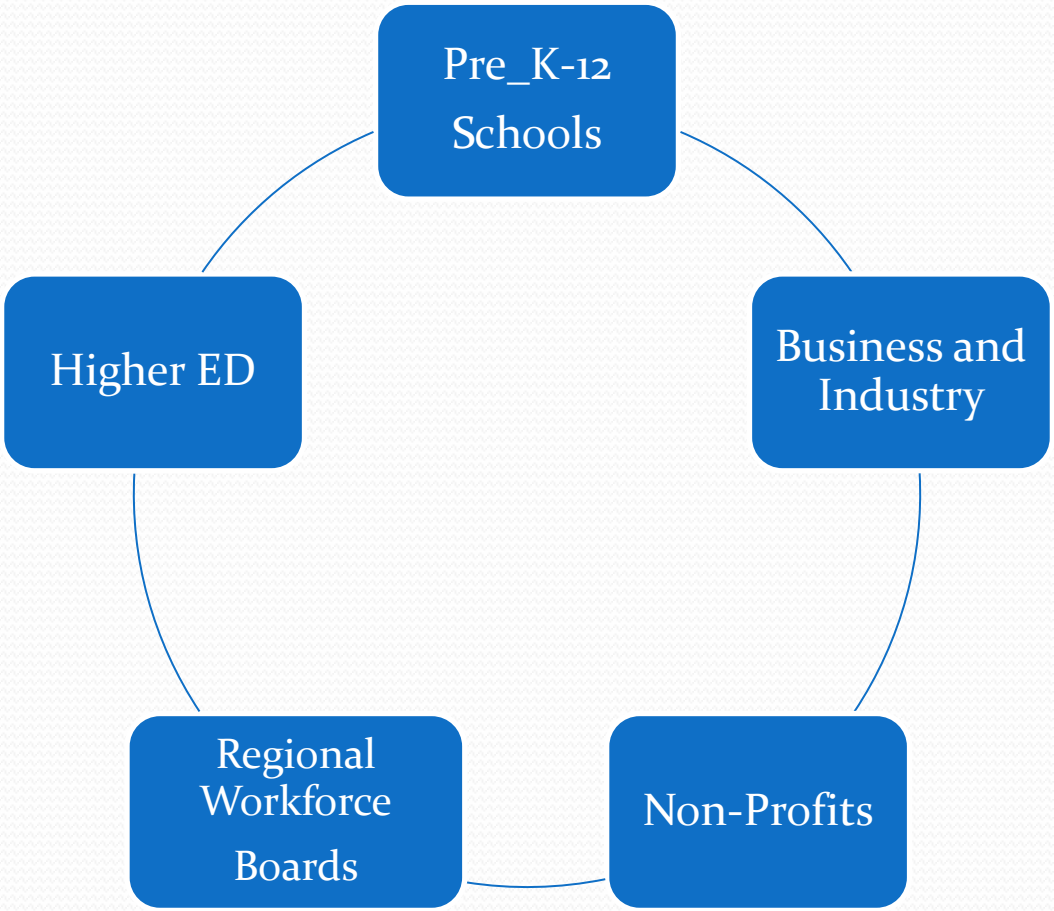
http://www.mcla.edu/pipeline

# Massachusetts[1] 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

[1]Resembles the federal plan.

# Regional STEM Networks, for STEM Education and Workforce Collaboration



# “Teacher Quality” in STEM

- Science always changing
- STEM professionals make **$$$** while STEM teachers, **$**
- How do you incentivize STEM Teaching excellence?
- Need STEM Master Teachers Corps to teach the teachers


# STEM Pipeline Fund[1]

- 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

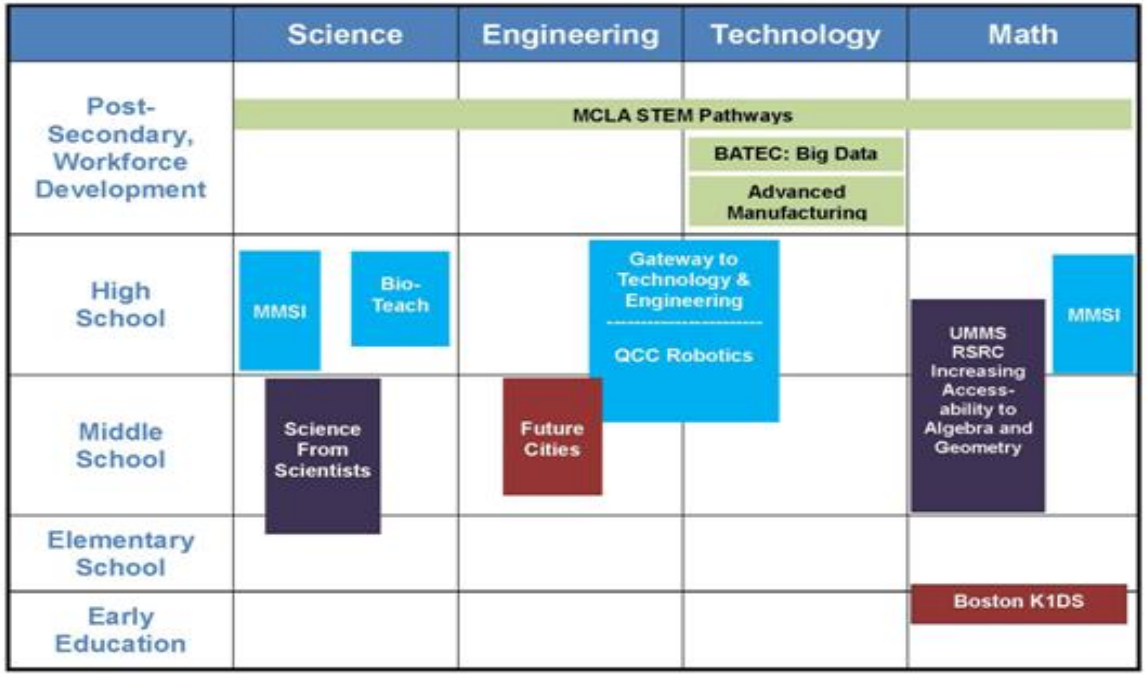
[1]The STEM Pipeline Fund is dependent on an annual appropriation from the state legislature.

# @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



# Some, morePersonal, Perspectives

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

# A Tale of Two Worlds

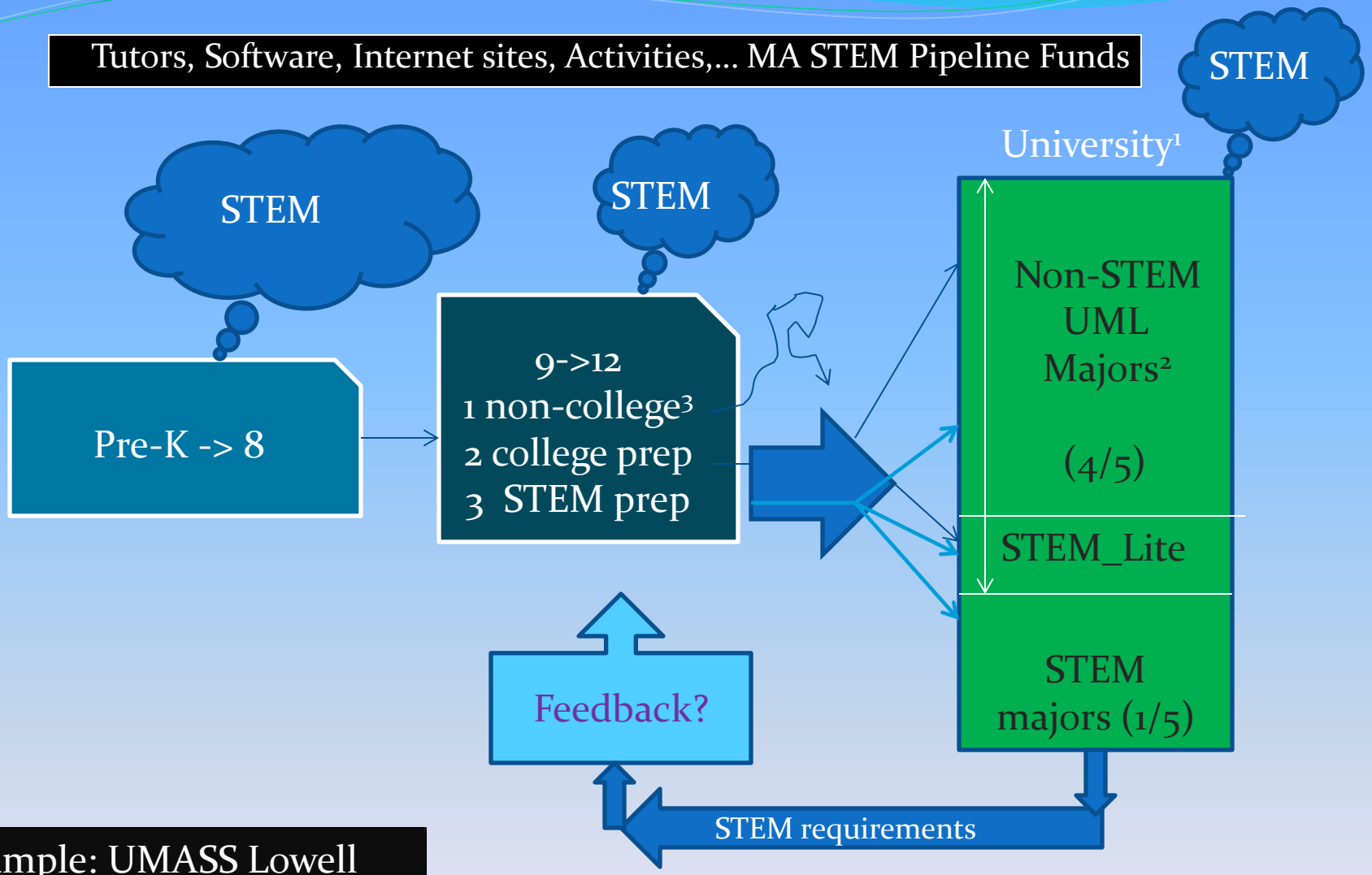
A. There are contractors, consultants, all manner of "academic experts", publishers, officials at the Federal and State levels, etc…

Vs

B. Principals and teachers

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

# STEM Activity in Schools (Overview)

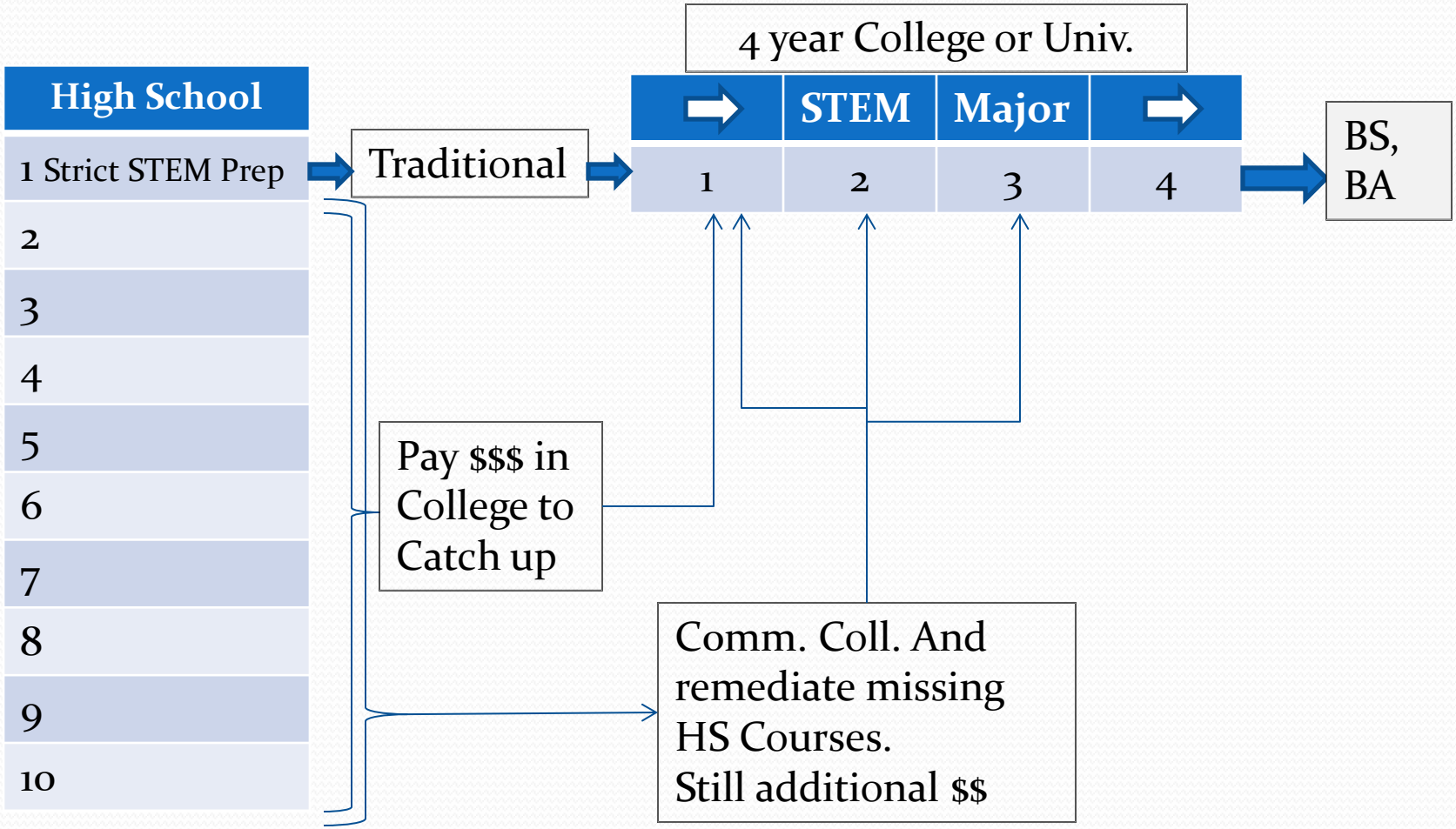



[1]Example: UMASS Lowell

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

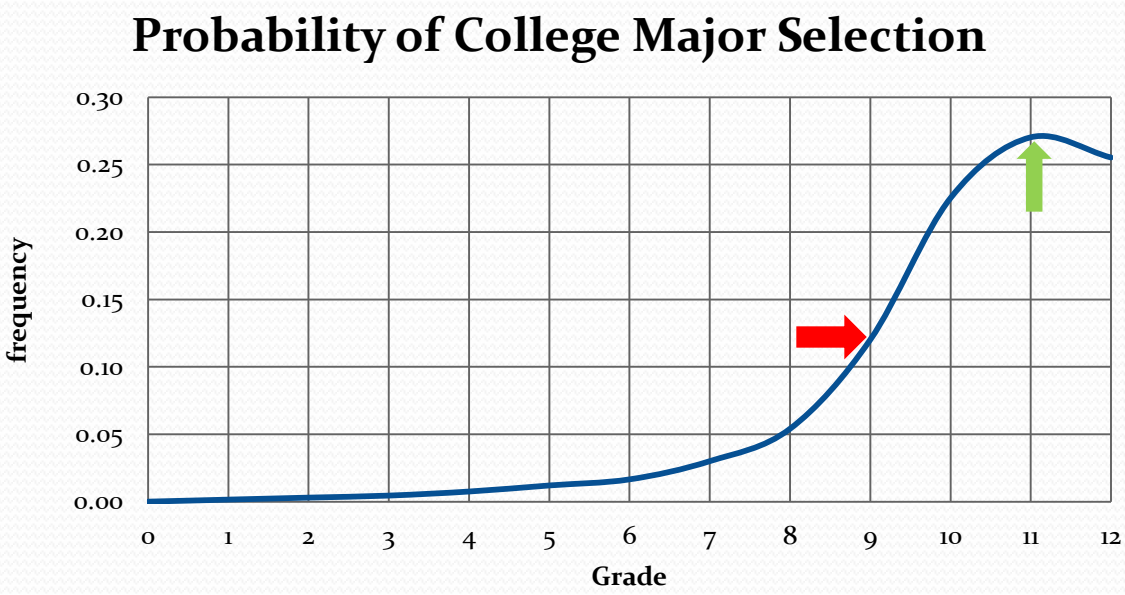
[3] Open Admissions Community Colleges

# 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?



# The Critical, "When is it too late to go STEM?"

Tipping Point: 9th Grade Algebra I

*Tipping Point* because

- *B*y 12TH Grade, should have taken "Pre-calculus" and need Unbroken Math through 12Th grade

- ALSO, Like HS STEM College Prep, it is a <u>sufficient</u> 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**