2015 Teacher Summit and LEADERSHIP FORUM

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2015 Teacher Summit and Leadership Forum

They all involve engineering!!

Providing water

Gadgets galore

Fashion & beauty

CO₂

Solving problems

Creating cars

Sports

Food

Health & medicine

Built environment

- "Scientists investigate that which already is; engineers create that which has never been."
  — Albert Einstein
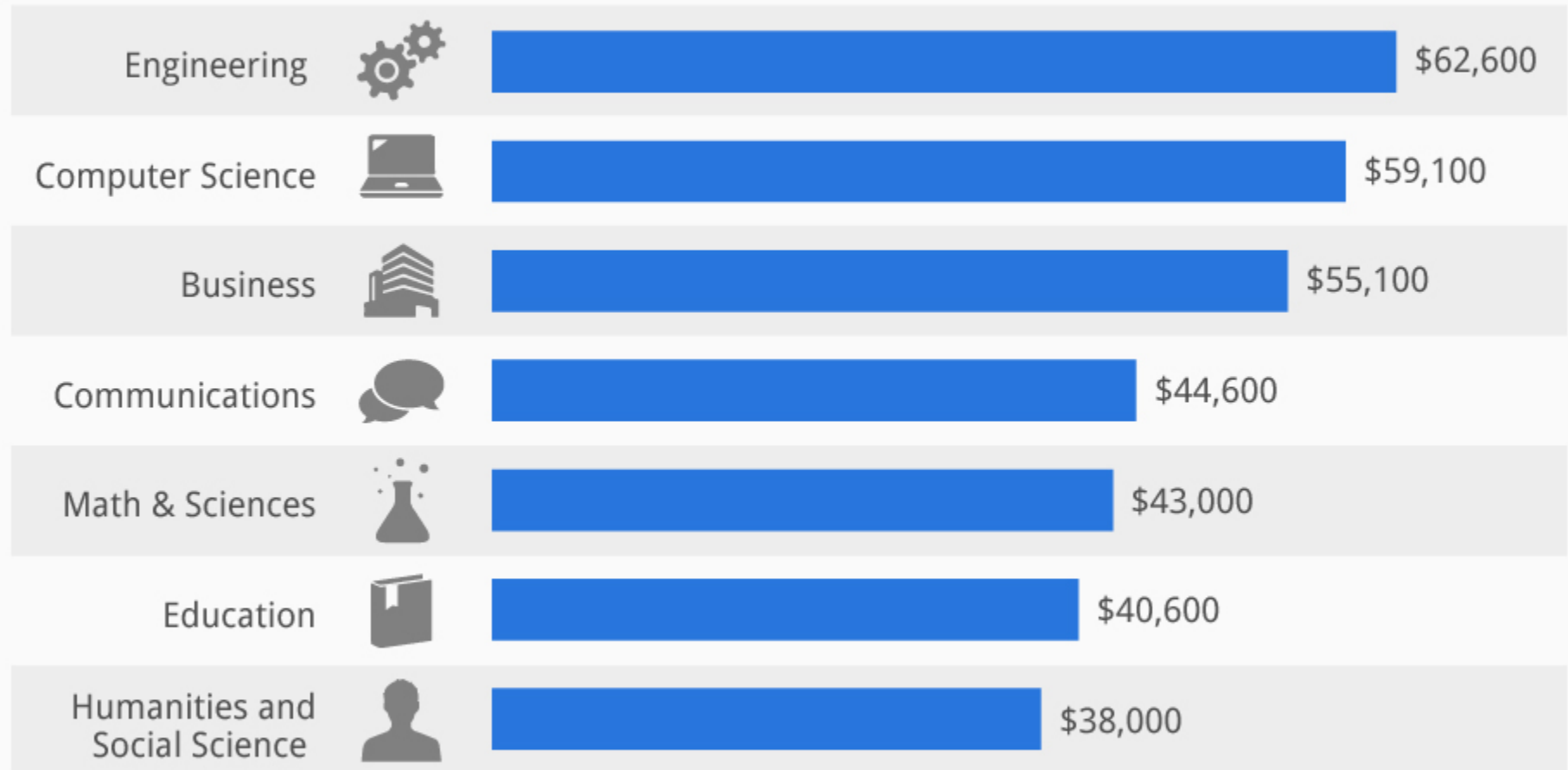
The performance of problem solving and design

(a)   Under constraints

(b)   Fulfilling criteria

(c)   Using data/models for predictive analysis and to evaluate how well criteria and constraints are met

This act is performed by a diverse set of people, with a variety of backgrounds working collaboratively in diverse contexts in an ethical manner.

Engineering is America's Highest-Earning Major

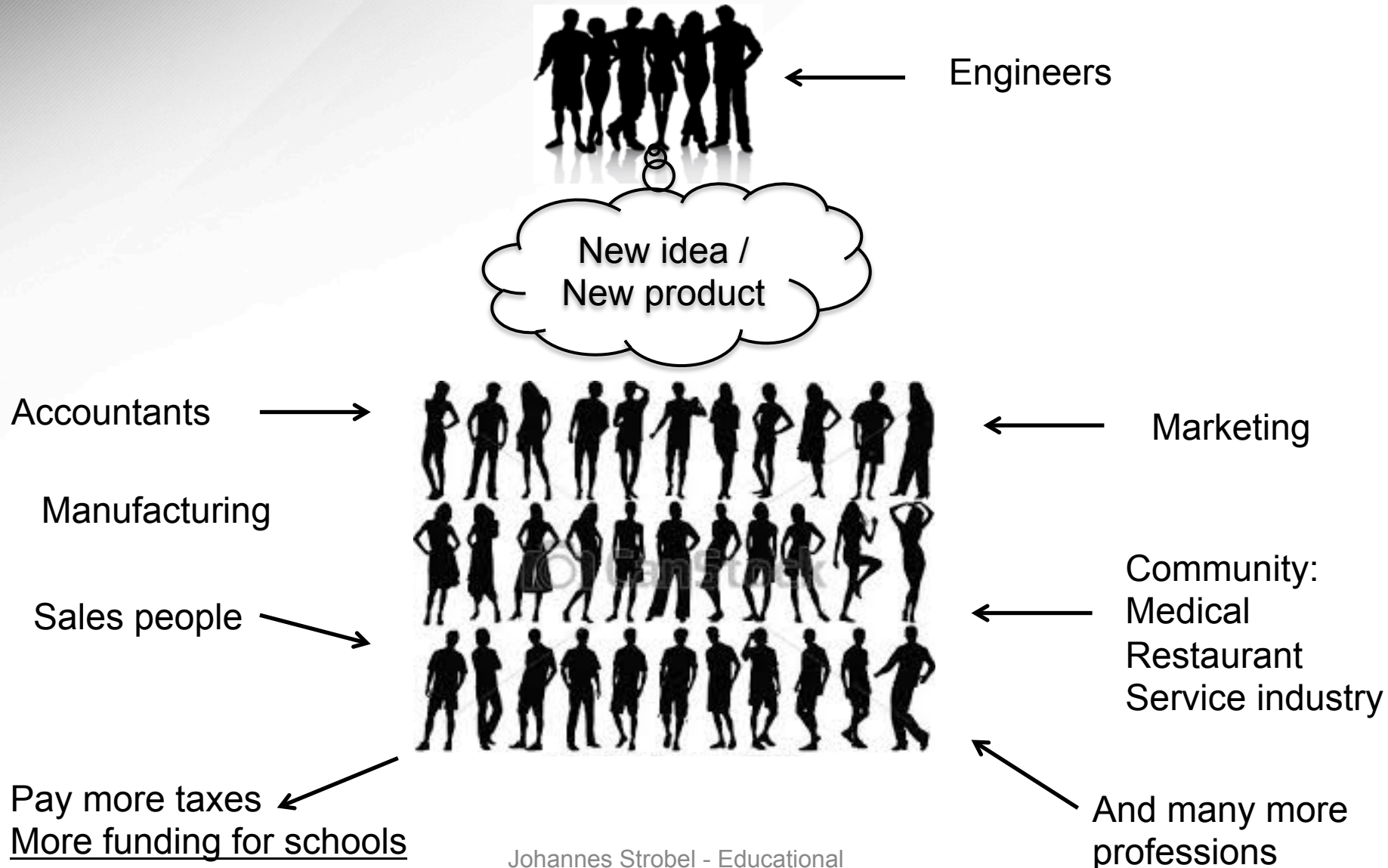The college degrees with the highest starting salaries in the United States in 2013

Major	Starting Salary
Engineering	$62,600
Computer Science	$59,100
Business	$55,100
Communications	$44,600
Math & Sciences	$43,000
Education	$40,600
Humanities and Social Science	$38,000

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Engineers create jobs!

Engineers

New idea /
New product

Accountants

Marketing

Manufacturing

Community:
Medical
Restaurant
Service industry

Sales people

Pay more taxes
More funding for schools

And many more
professions

Vision

- Provide leaders/administrators a **forum to share best practices** in developing and running STEM

- Discuss **new developments in STEM education** in Texas

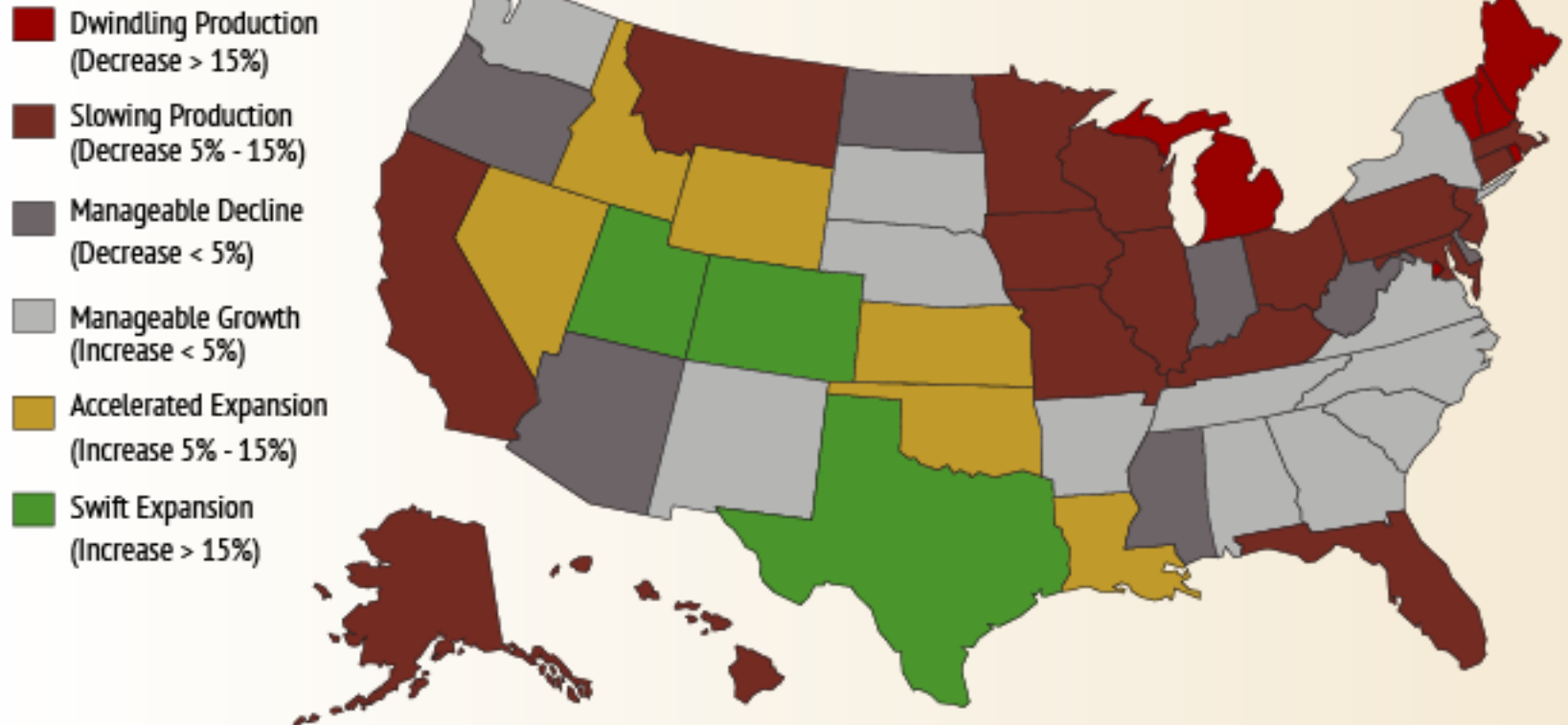- Making the silent "e" in **engineering less silent**

What do **you want to get out** (today) and what should the forum focus (in the future)?

9:40 – 10:40: Overview – "Finding the needle in the haystack: Tools for picking a high-quality STEM curriculum"

10:50 – 11:50: Workshop session (Teacher Professional Development) (**choose one**)

Ballroom 1: Engineering Your Math Class! (Dr. Kristi Shryock)

Ballroom 2: Engineering Your Own Toy AND Your Own Lesson (Dr. Barbara diSioudi)

12:00 – 1:00: Lunch (all)

1:00 – 1:45:   Faculty and Student Panel (all)

1:55 – 2:55:   Leadership forum (leaders/administrators)

"Feedback: NAE K-12 Engineering website"

3:05 – 4:05:   Leadership forum (leaders/administrators)

"Sharing best practices in STEM leadership"

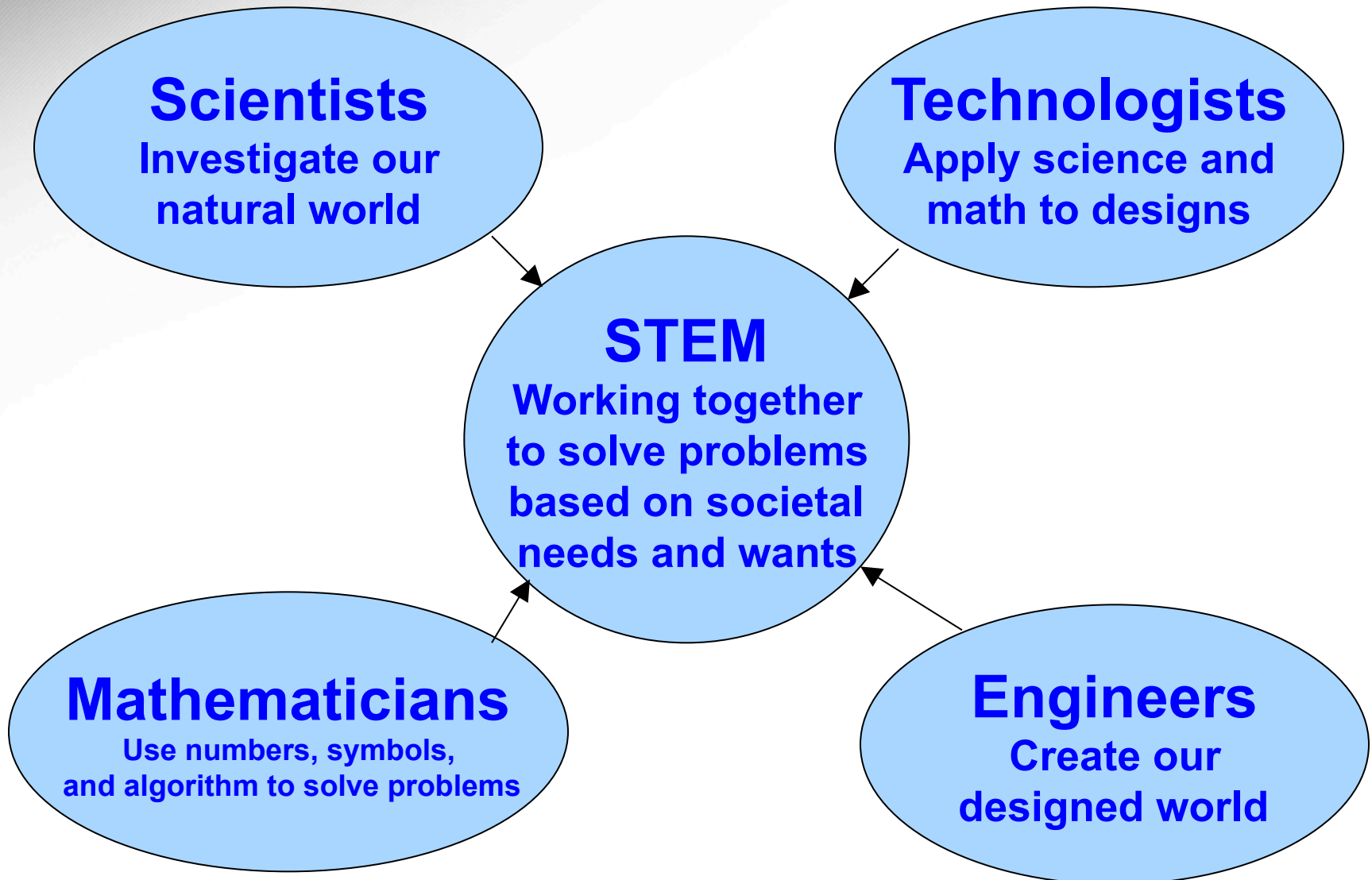4:05 – 4:30:   Closing remarks, snack door prices (all)

High School Demographics and Projections

Projected Percent Change in Public and Nonpublic High School Graduates, by State, 2008-09 to 2019-20

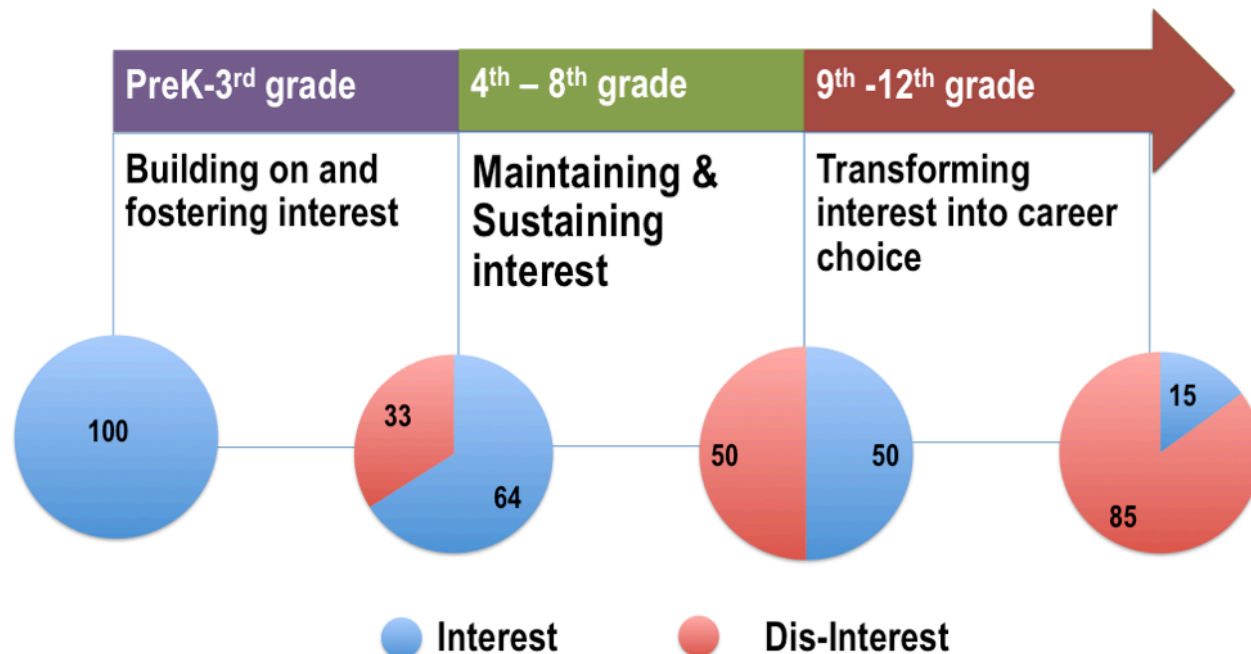Source: Western Interstate Commission for Higher Education

http://www.wiche.edu/knocking-8th

Scientists
Investigate our natural world

Technologists
Apply science and math to designs

STEM
Working together to solve problems based on societal needs and wants

Mathematicians
Use numbers, symbols, and algorithm to solve problems

Engineers
Create our designed world

STEM Picky-Eating-Syndrome

|	Passive	Active
Dis-Interest	I don't know much about STEM (engineering), but I am certain I don't like it.	I engaged in STEM (engineering) and it is not for me.
Interest	Sounds interesting. Where I can find out more?	That was exciting. I want more of STEM (engineering)

PreK-3rd grade	4th – 8th grade	9th -12th grade
Building on and fostering interest	**Maintaining & Sustaining interest**	**Transforming interest into career choice**

100

33
64

50   50

15
85

● Interest   ● Dis-Interest

- ## STREAHMM: **S**cience, **T**echnology, **R**eading/Writing, **A**rithmetic/ **A**griculture/**A**rts, **H**ealth, **M**athematics, **M**edicine

Or simply put: SCHOOL

"STEM? Hmm.
This year we adopted a new science curriculum, in two years we might have time to discuss STEM adoption"

STEM = SteM = Stem = steM = ST_eM or the silent 'e'
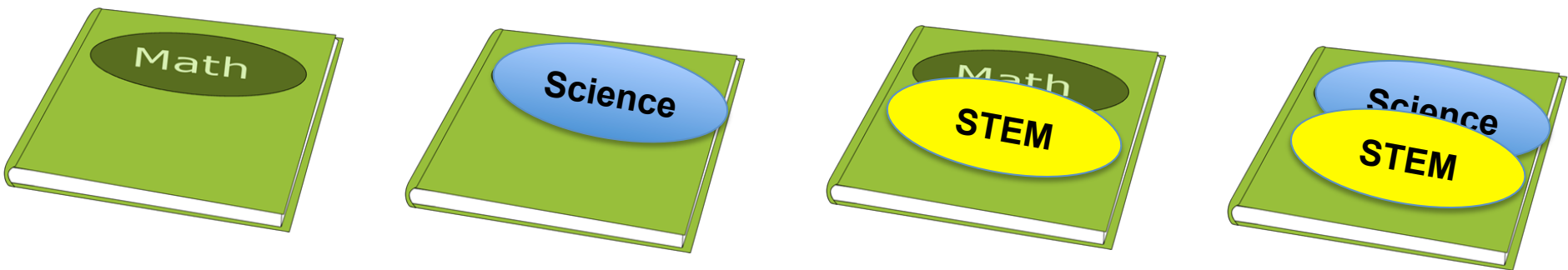
2012

2014

Texas House Bill 5 STEM Endorsement

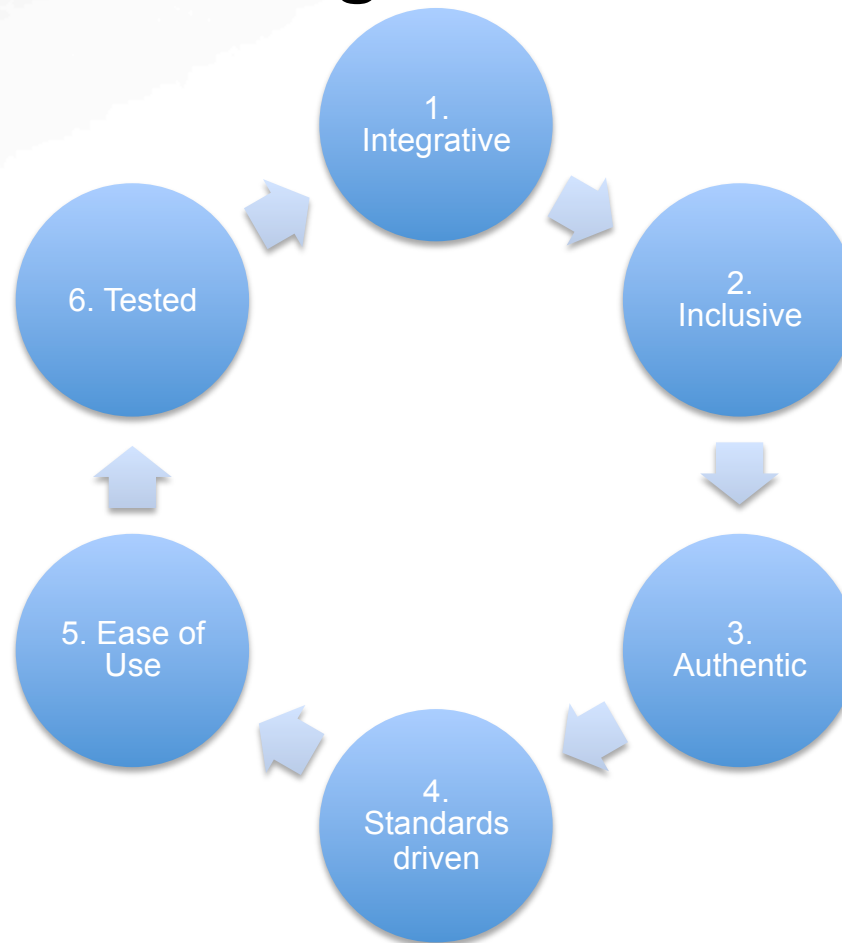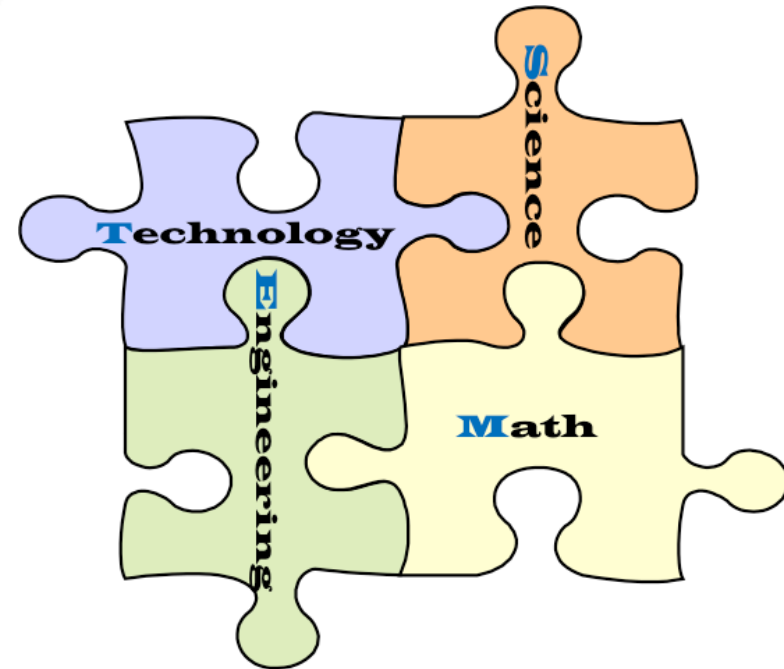|				
Name of Endorsement	STEM			
Pathway	Math	CTE	Computer Science	Science
General Requirements	Four math Four science Two elective	Four math Four science Two elective	Four math Four science Two elective	Four math Four science Two elective
Specific Requirements	Five (5) courses math (Algebra I, II, Geometry + 2)	Four courses (2 in cluster)	Four (4) courses from a wide variety of CS courses	Biology, Chemistry, Physics + 2 more credits

Six dimensions to evaluate STEM curricula/ learning modules

1. Integrative
2. Inclusive
3. Authentic
4. Standards driven
5. Ease of Use
6. Tested

1. Integrative

Science | Technology | Engineering | Mathematics

- True STEM (all four letters)
- Not another silo
- iSTEM: Integrative and Systematic Teamwork to Engage in Multi-Modal Representations (mathematical, technological, engineering (design), scientific)

Defining iSTEM
from "single" over "integrated" to
"integrative"

- **Shorthand S-T-E-M**
- **Foundational**
- **Knowledge Level**
- **Discrete**
- **Content Level**
- **Cross-cutting is missing**
- **Literacy-focused**

- **Mixed S-T-E-M**
- **Focus on relationship between disciplines**
- **Exchange and hand-offs**
- **Problem Level**
- **Guided or Modeled**
- **Competency**

- **Integrative STEM**
- **Synthesis**
- **Project Level**
- **Discovery Based**
- **Innovation/Invention**
- **Critical Evaluation**
- **Integration with language/social studies**
- **Proficiency**

STEM Spectrum

2. Inclusive: Dos and Don'ts when speaking about STEM

What interests students, particularly girls, underrepresented minorities?

- Engineering for the social good -> contributing to well-being

- Mathematics and Science are tools – you don't have to love them (or even like them)

- Challenges and teamwork, not competitions
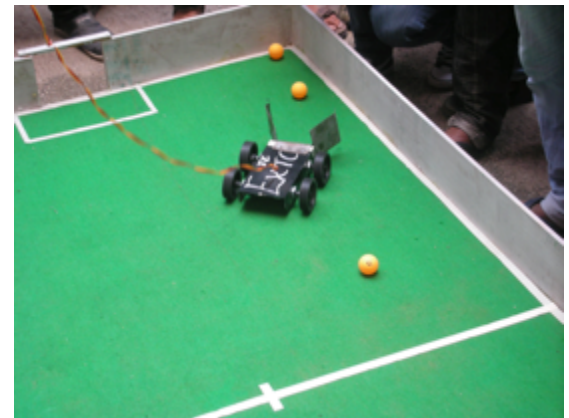
2. Inclusive

- Are images of girls and boys equally being utilized?
- Does the material include images of different races and ethnicities?
- Is team work fostered?
- Is the material fostering access and accommodate for special needs?
- Does the curriculum allow for differentiated learning?
- Are stereotypes about STEM reduced? Some stereotypes:
  - STEM workers work alone and don't talk with people
  - STEM work is **D**irty, **D**angerous, **D**ark and **D**ull
  - STEM is fixing cars and conducting trains
- All children are STEM learners
- Demonstrate that "Everyone Engineers" and Everyone CAN be an Engineer

|	
Context authenticity	***Authentic Activities*** 1. In a mathematics class, the teacher not only introduces theories, principles and equations to students, but also involves students in designing a toy where the principles and equations would be applied. 2. In an engineering class, the teacher provides students with opportunity to work on projects, which have relevance beyond the classroom and resemble work and life environment (clients, criteria, constraints).
Task authenticity	***Authentic Activities*** 1. In a high school engineering learning module, the students are responsible for collecting data from the local factory and using the data to do their projects. 2. In a high school engineering learning module, the students are trained to use AutoCAD which is a popular tool used in the industry where the students may eventually work.
Impact authenticity	***Authentic Activities*** 1. In an environmental engineering learning module, students' design of a waste-collection system is implemented throughout their school and community making impact beyond the walls of their classroom. 2. For a civil engineering learning module, students' analysis of traffic in front of their school is reported to the city planning office and influences the design of pedestrian crossings and other road construction.
Personal/ value authenticity	***Authentic Activities*** 1. Students conduct interviews with individuals in their neighborhoods to design a transportation system. 2. Students collect data on the use of water in their household throughout the year and investigate possible ways to reduce consumption.

"Authentic problems are problems, which primary purpose and source of existence is not to teach or provide a learning situation; The primary purpose and source should be a need, a practice, a task existing in a context outside of schooling and educational purposes."

Strobel, J., Wang, J., Weber, N., & Dyehouse, M. (2014). Conceptualizing authenticity in engineering education: A systematic literature review. *Computers and Education*. Invited paper for the special issue honoring David Jonassen
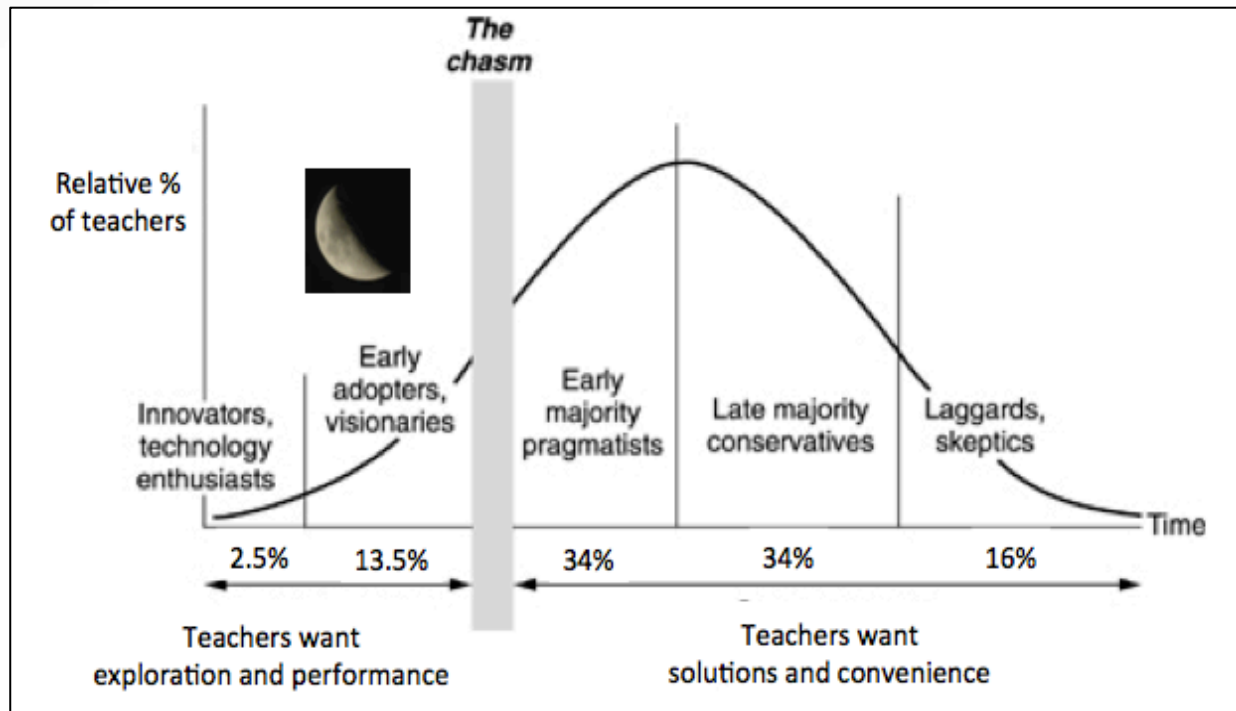
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- State Standards (TEKS)

Standards
Inform design/
development

STEM

STEM
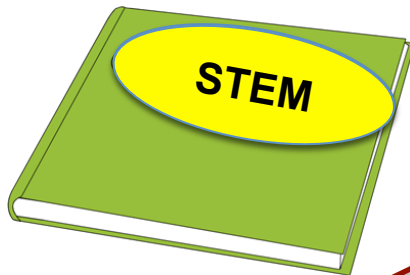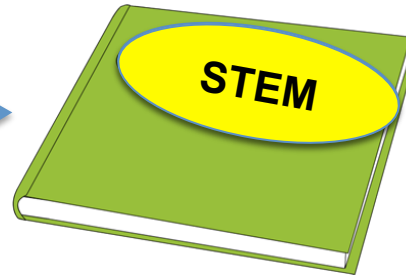
Curricula/Learning Modules are mapped to standards

- How much TPD do I need?
- How much prep time do I need?
- How ready is the material?

The chasm

Relative % of teachers

Innovators, technology enthusiasts

Early adopters, visionaries

Early majority pragmatists

Late majority conservatives

Laggards, skeptics

Time

2.5% 13.5% 34% 34% 16%

Teachers want exploration and performance

Teachers want solutions and convenience

- Is the curriculum design informed by research?
  - Are best practices being used?
  - Was testing part of the development?
- Is this curriculum based on research?
  - Is research published?
  - Is research done by experts?
  - Is the research done rigorously?
  - Is research done to address your need type (low SES, high diverse, special education, ELL/ESL)

Schedule

Feedback – NAE K-12 Engineering Implementation

- National Academy of Engineering together with American Society for Engineering Education (ASEE), National Science Teacher Association (NSTA), International Technology and Engineering Educators Association (ITEEA), Council of State Science Supervisors and Achieve, Inc. (sponsored by Chevron) builds:

"Builds a web site to provide **resources for effective engineering education** in K-12 education"

- Alpha 2 site on or about March 1

Feedback

1. What resources and community support do you think should be included on the website to advance K12EE in K-12 classrooms?

2. What resources or community support do you think should be included on the website to advance the education of pre-service teachers?

3. What resources or community support do you think should be included on the website to advance the professional development of in-service K12EE educators?

Schedule

Sharing best practices in STEM leadership

- What is **your school / district** doing that is **working well to support STEM** education?

  Share and record in small team

- What do you want to see being **offered in the next Leadership Forum**?

  Share and record in small team

Schedule

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