A Few Comments...

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100 years ago…

1907 – Joint Committee on Engineering Education *(Cleveland . . . not Columbus)*

- American Society of Civil Engineers
- American Society of Mechanical Engineers
- American Institute of Electrical Engineers
- American Chemical Society
- American Institute of Chemical Engineers
- American Institute of Mining Engineers

1907 – Joint Committee on Engineering Education *(Cleveland . . . not Columbus)*

- American Society of Civil Engineers
- American Society of Mechanical Engineers
- American Institute of Electrical Engineers
- American Chemical Society
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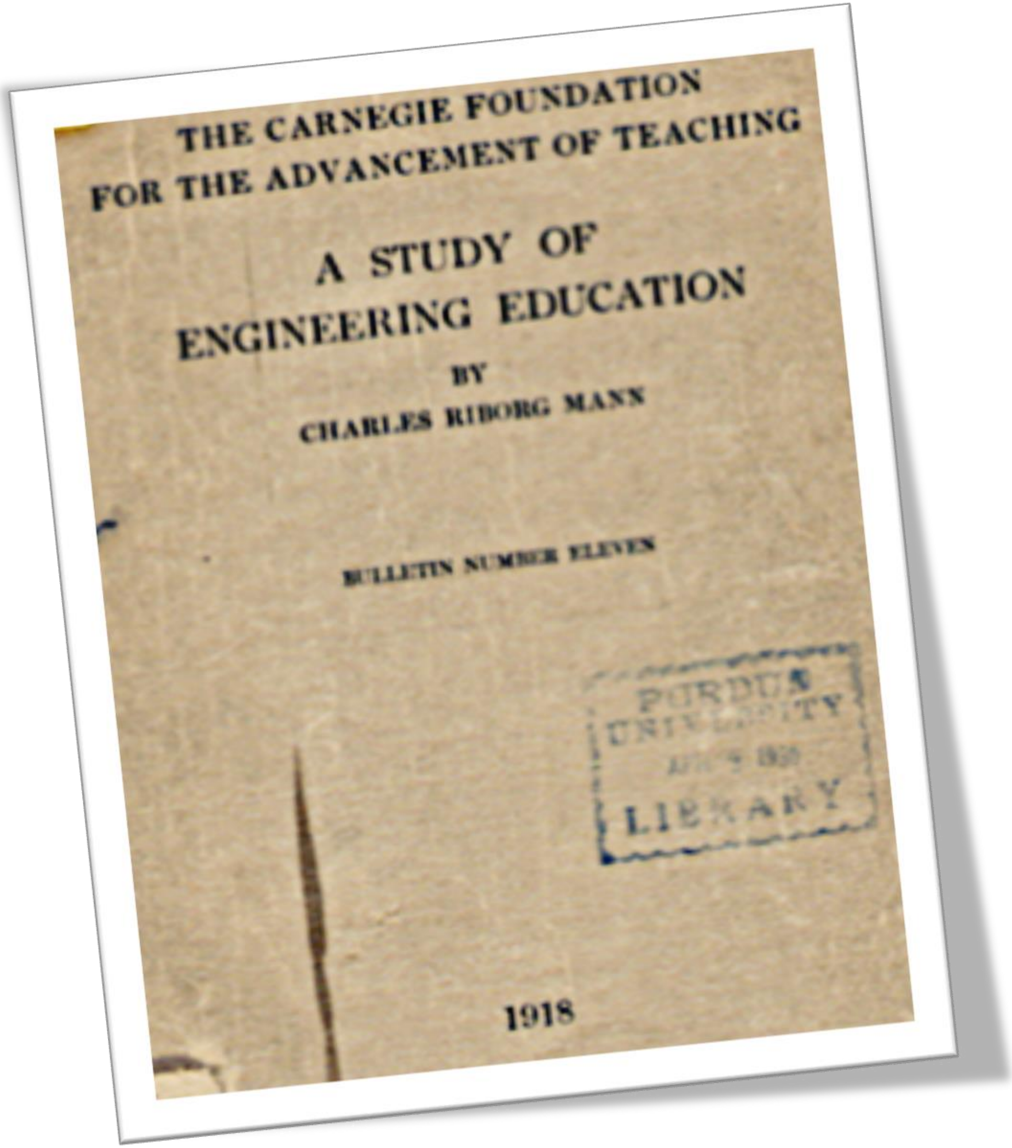
- American Institute of Mining Engineers
- Society for the Promotion of Engineering Education

The Mann Report (1918)



Graduation Rate (1918)

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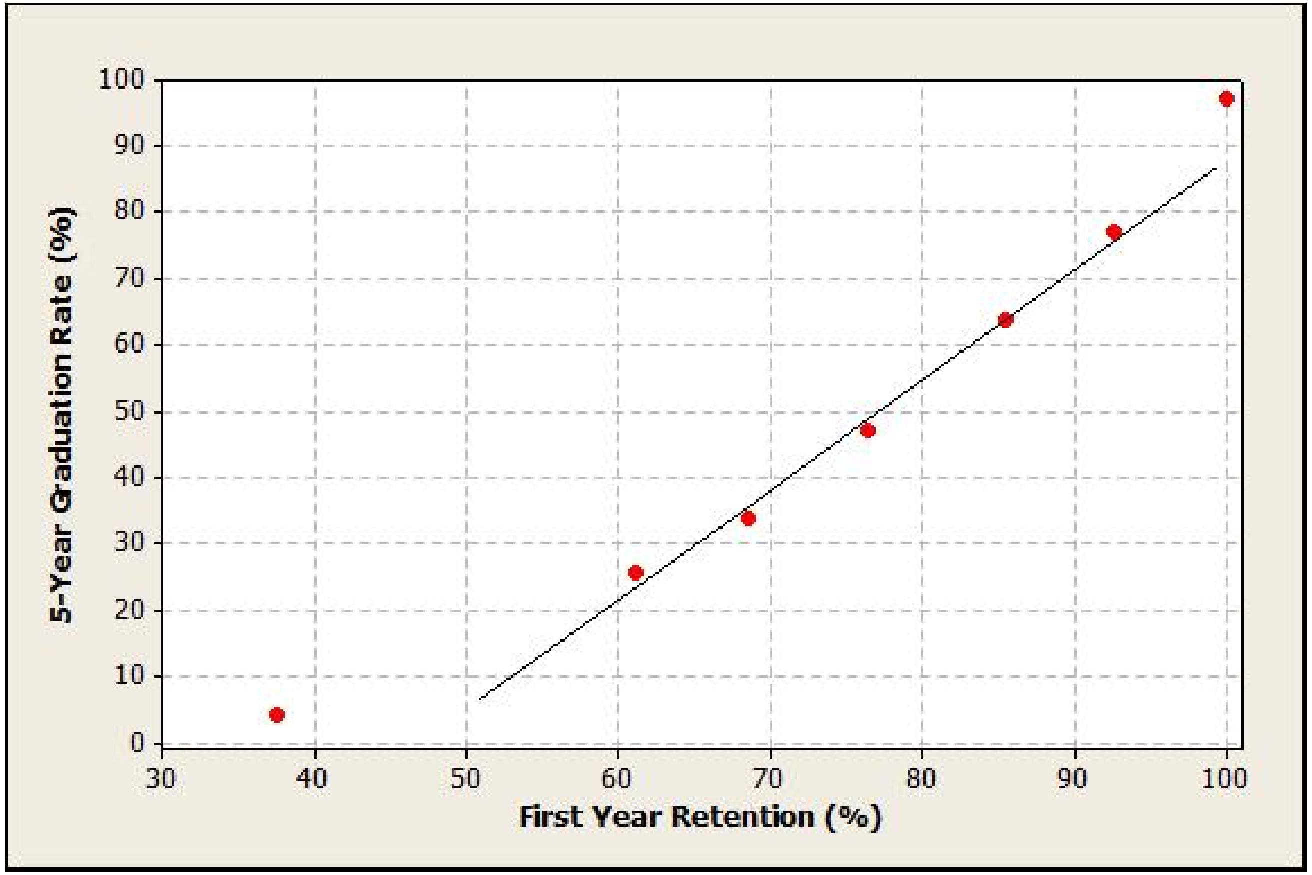
60%

Graduation Rate (2016 – avg. 5-yr)

Graduation Rate (2016 – avg. 5-yr)

50%

5 Year Graduation Rate Data (2016)



(sample of 150 schools)

DataBytes. (2016, February) In Grose, T. (Ed) *ASEE Connections*, Washington DC:ASEE.

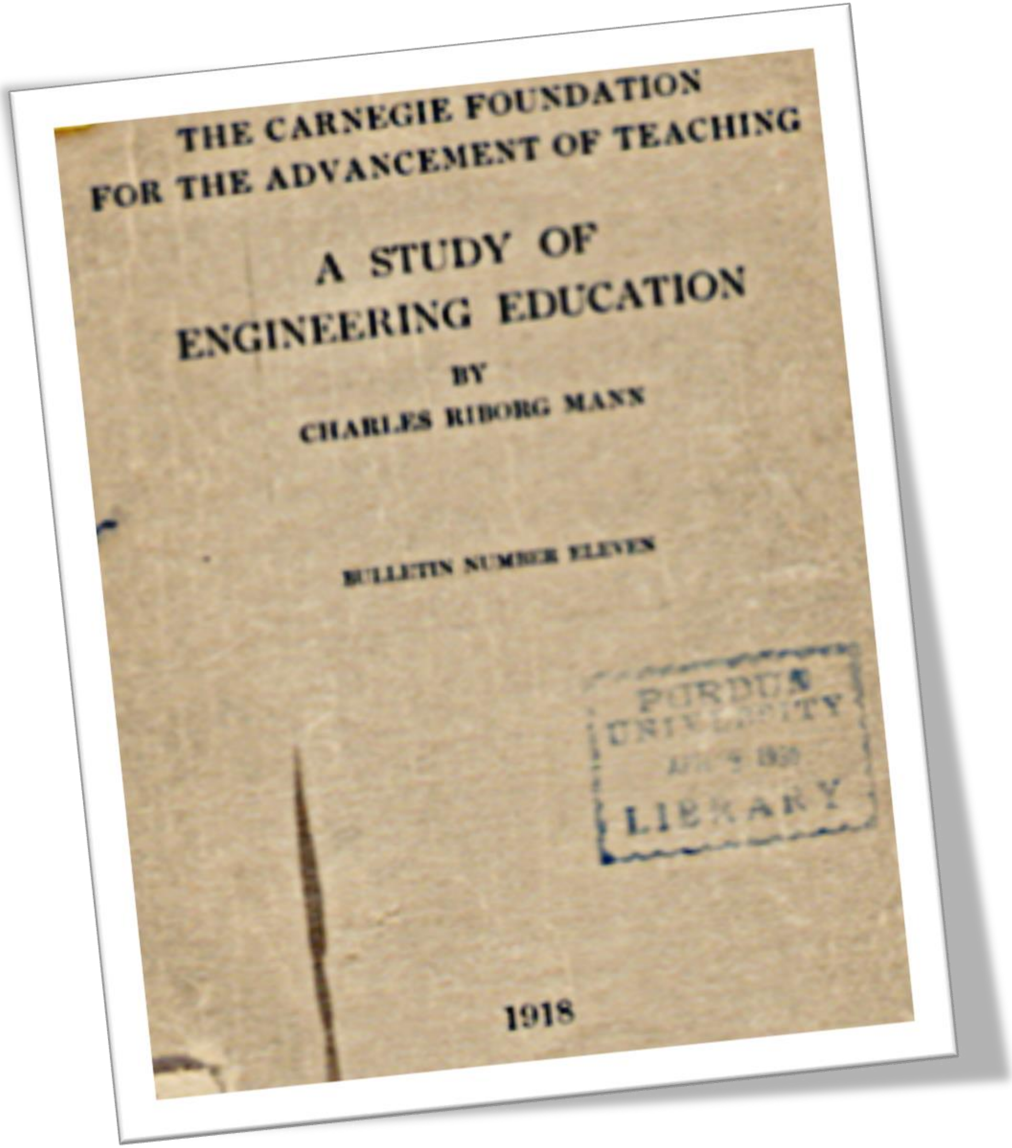
5 Year Graduation Rate in 2016 (%)

$$= 1.676 \times (1^{st}\text{ Year Retention Rate}) - 79.22$$

DataBytes. (2016, February) In Grose, T. (Ed) *ASEE Connections*, Washington DC: ASEE.

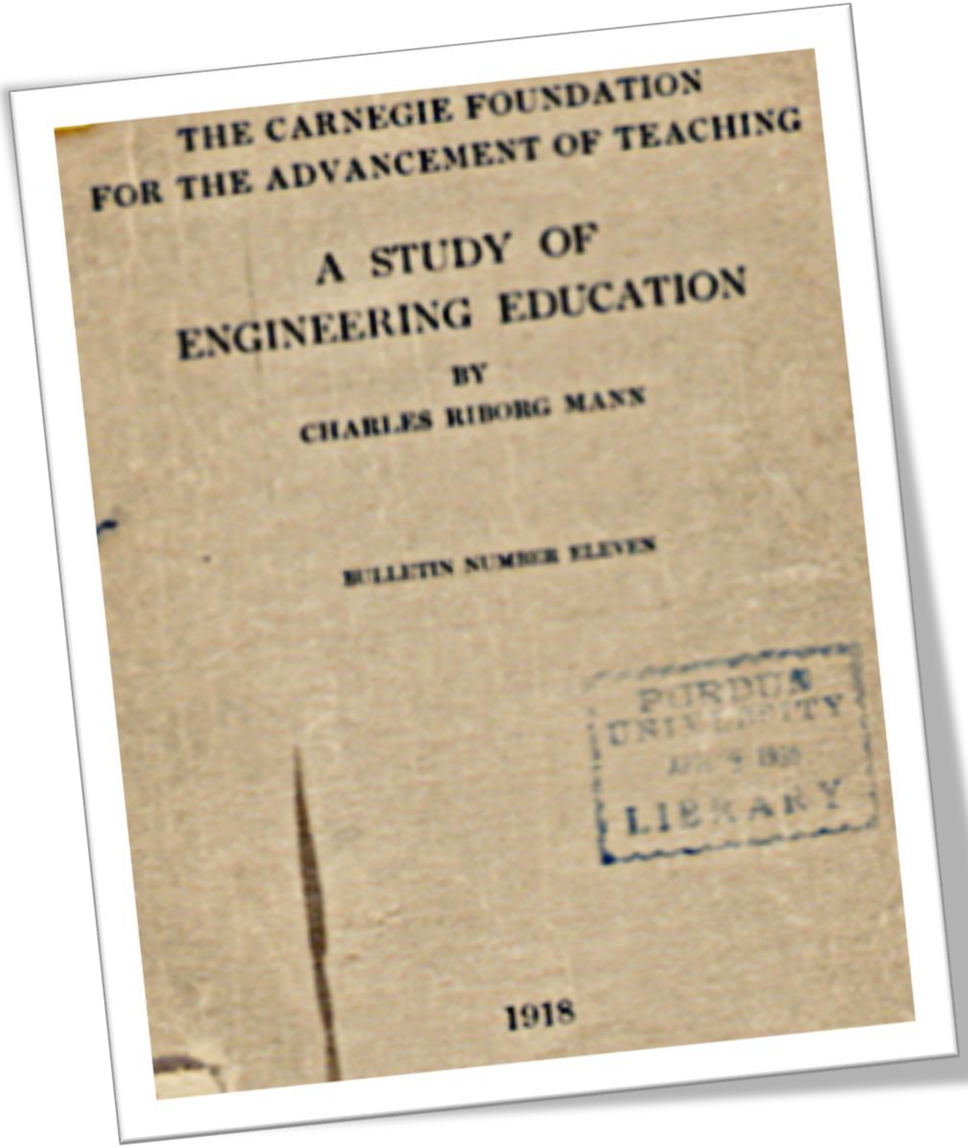
The Mann Report (1918)

"Changes must be made from time to time to meet conditions as they arise, and any attempts to solve the problems of engineering education must be of so flexible a nature as to admit of improvements."

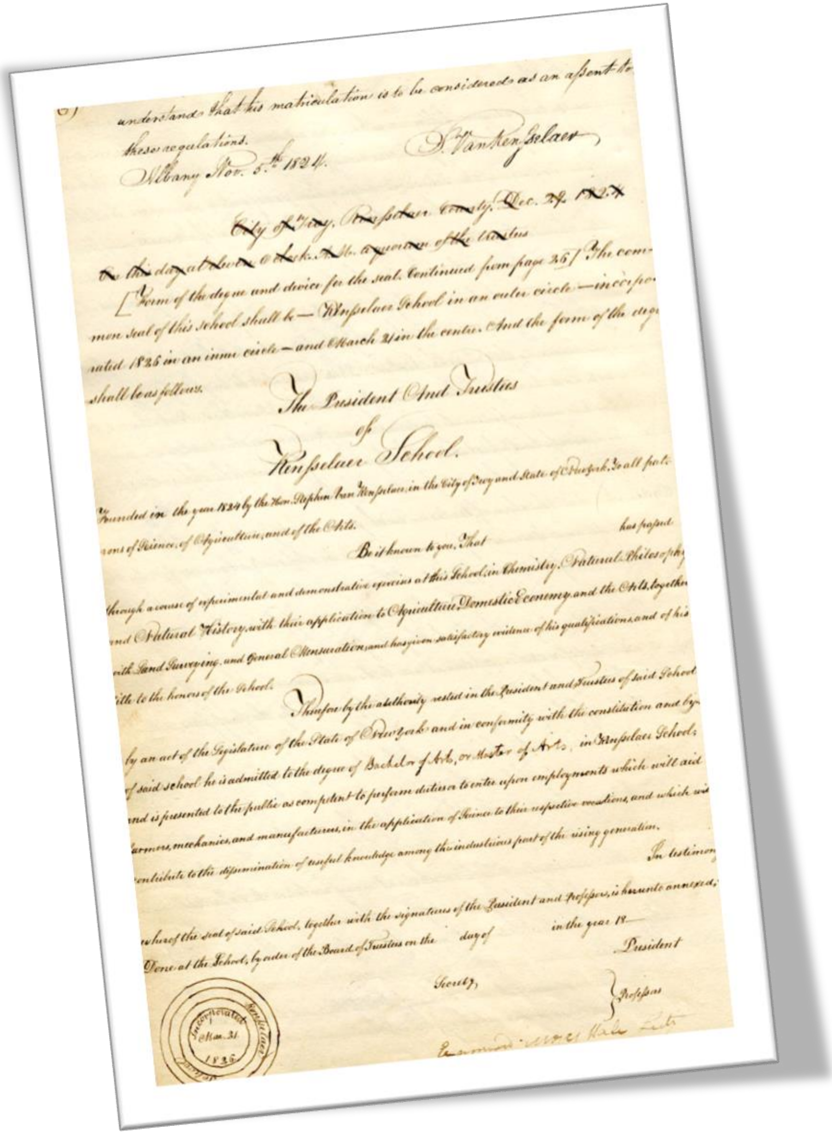


The Mann Report (1918)

“There probably never was a time when the minds of teachers were so intently alive and receptive to rapid changes, as at the present moment.”



1824


understand that his matriculation is to be considered as an assent to these regulations.

Albany Nov. 5th 1824. S. Van Rensselaer

~~City of Troy, Rensselaer County, Dec. 29. 1824~~

~~On this day at [illegible] o'clock P.M. a quorum of the trustees~~

[Form of the degree and device for the seal. Continued from page 26] The common seal of this School shall be — Rensselaer School in an outer circle — incorporated 1826 in an inner circle — and March 21 in the center. And the form of the degree shall be as follows.

The President And Trustees

of

Rensselaer School.

Founded in the year 1824 by the Hon. Stephen Van Rensselaer, in the City of Troy and State of New York. To all persons of Science, of Agriculture, and of the Arts.

Be it known to you, That [illegible] has passed through a course of experimental and demonstrative exercises at this School in Chemistry, Natural Philosophy and Natural History, with their application to Agriculture, Domestic Economy and the Arts, together with Land Surveying, and General Mensuration, and has given satisfactory evidence of his qualifications, and of his title to the honors of the School.

Therefore by the authority vested in the President and Trustees of said School by an act of the Legislature of the State of New York and in conformity with the constitution and by-laws of said school he is admitted to the degree of Bachelor of Arts, or Master of Arts, in Rensselaer School, and is presented to the public as competent to perform duties to enter upon employments which will aid farmers, mechanics, and manufacturers, in the application of Science to their respective vocations, and which will contribute to the dissemination of useful knowledge among the industrious part of the rising generation.

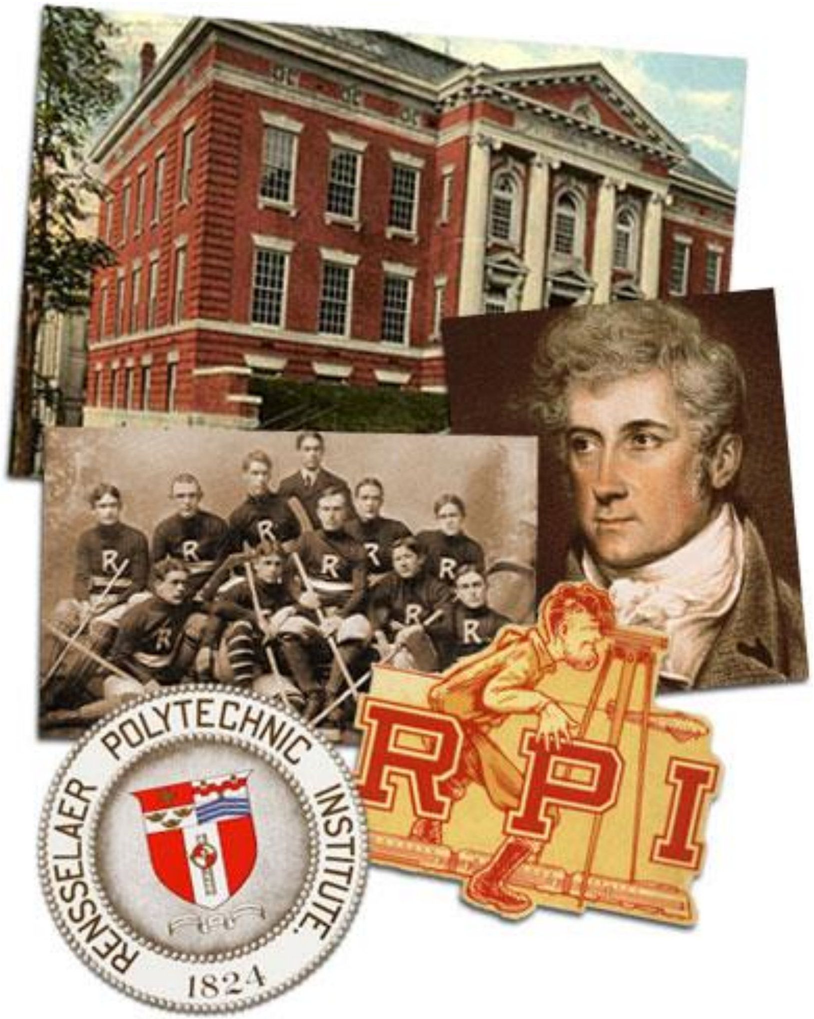
In testimony whereof the seal of said School, together with the signatures of the President and Professors, is hereunto annexed. Done at the School, by order of the Board of Trustees on the day of in the year 18—

President

Secrety.

Professors

Incorporated Mar. 21 1826 Rensselaer



Over the past 50 years...

- Numerous reports have identified issues and concerns about declines in STEM comprehension, workforce capabilities, and national competitiveness – *many have also suggested solutions...*

For example . . .

We Know: *Why Students Leave*

- Lack of role models – particularly as women and underrepresented minority faculty
- Poor teaching
- Poor performance in the first math courses
- Poor advising
- Fear that jobs may disappear

We Know: *Why Students Leave*

- Perception that other majors have easier classes & more fun, feeling of isolation
- Coursework too restrictive for more varied interests
- Rising costs – disproportionate impact on students from low income families *(worse due to > 4yr degree completion)*
- Lack of connection between what is studied and exciting engineering practice

We Know: *There's a Dichotomy*

- In school, problems almost always are clearly defined, confined to a single discipline, and typically have one right answer

- In the workplace, problems are usually ill-defined, multi-disciplinary, and have several possible answers *(none of which are perfect)*

Creativity Definition (D. Pink)

Topic	Industry	Academia
Problem identification or articulation	**1**	**9**
Ability to identify patterns of behavior or new combination of actions	2	3
Integration of knowledge across different disciplines	3	2
Ability to originate new ideas	4	6
Comfort with notion of “no right answer”	5	11
Fundamental curiosity	6	10
Originality and inventiveness in work	7	4
Problem solving	**8**	**1**
Ability to take risks	9	8
Tolerance of ambiguity	10	7
Ability to communicate new ideas to others	11	5

We Know: *from Research*

- Learning is highly dependent on **prior knowledge**
- **Motivation** is critical – it determines, directs, and sustains what students do
- How students **organize knowledge** influences how they learn and apply what they know
- Goal-directed practice, coupled with **targeted feedback**, enhances learning quality (vs. a grade)

We Know: *from Research*

- **Climate** *(intellectual, social, and emotional)* has significant impact on student perception and outcomes
- On average, online course-taking reduced student learning (1/4 to 1/3 – Oct. 2015 DeVry study)
- Active learning **trumps** passive methods, hands-down...**period**.

We Know: *from Students*

- Schools are paying insufficient attention to an array of KSAs needed to produce the desired T-shaped engineers
- Students acquire most of the KSAs through extracurricular activities and student-driven projects, conferences/ workshops, co-ops/internships, competitions, along with membership in student organizations and **professional societies**.
- Need to focus on real-world impact, show why what is being taught is important

We Know: *from Students*

- Need to help professors learn how to teach
- Track whether courses fulfill the promise suggested in syllabi – require accountability
- Allow faculty members to teach subjects they're passionate about or really skilled at teaching
- Connect the applications to engineering in first-year math and science courses – calculus, physics, and chemistry

So…

Why are we here?

Engage Academia, Societies, Industry and Government Representatives in:

Guiding, Develop, and Implementing a Plan that Transforms UG Engineering Education

A Plan to:

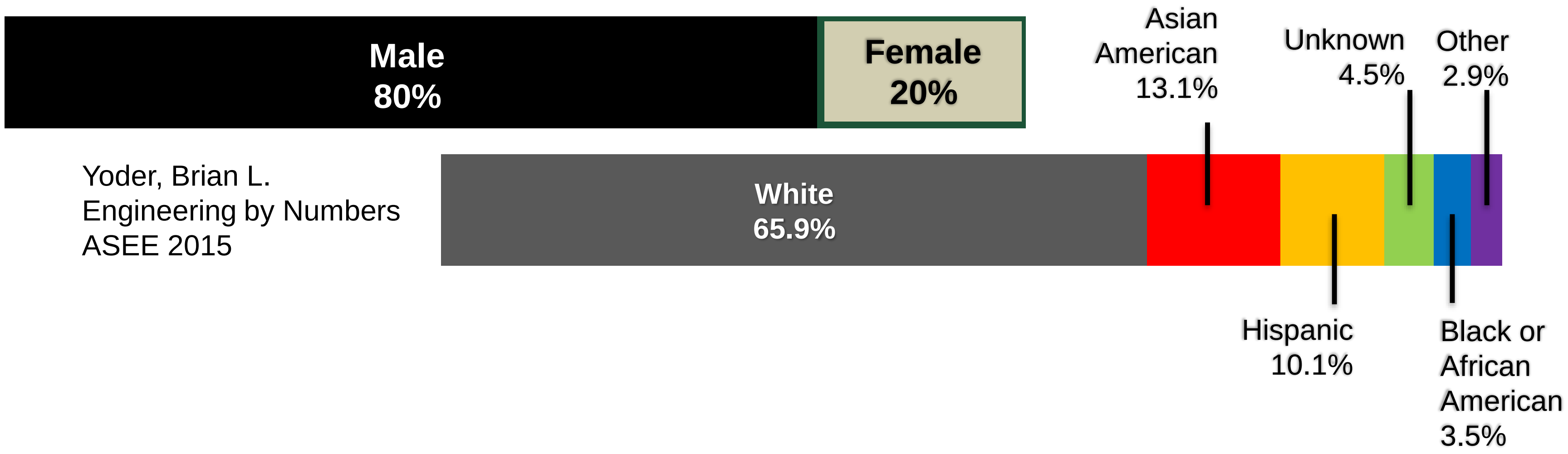
- Enable students to better acquire KSAs
- Employ engineering-specific learning theories/ frameworks
- Diversify pathways to, and through, engineering education
- Understand how to scale engineering education innovations and do it!

A Plan to:

- Shift emphasis from how students learn engineering to how engineers are formed
- Build a deep understanding of how to enact change
- Increase focus on the effectiveness of pedagogy
- Focus on inclusion (climate) vs. diversity (numbers)

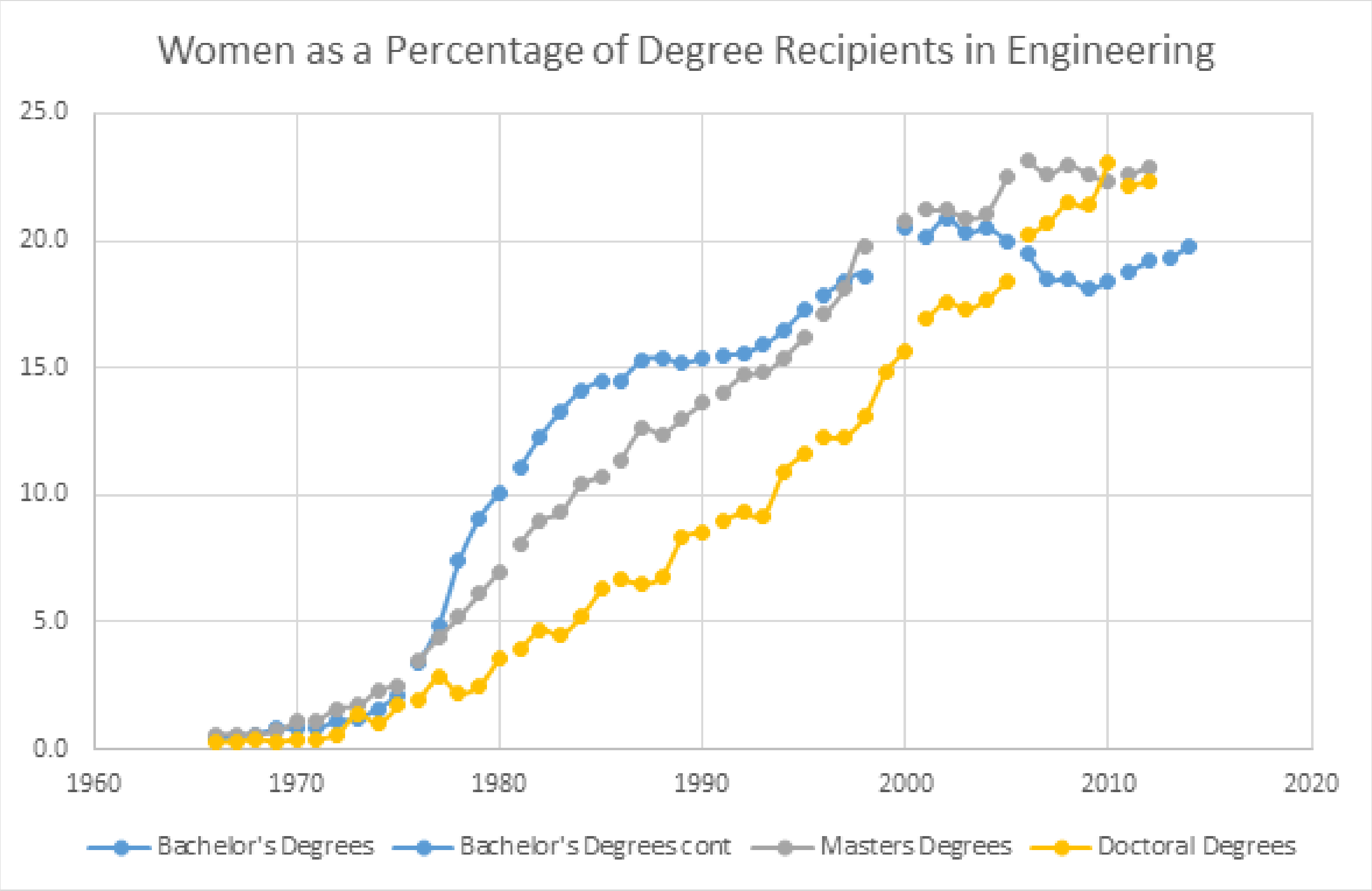
Broaden Participation

- Address educational inequalities
- Expand support systems and social networks
- Increase interest and sustain participation in engineering across underrepresented demographic groups

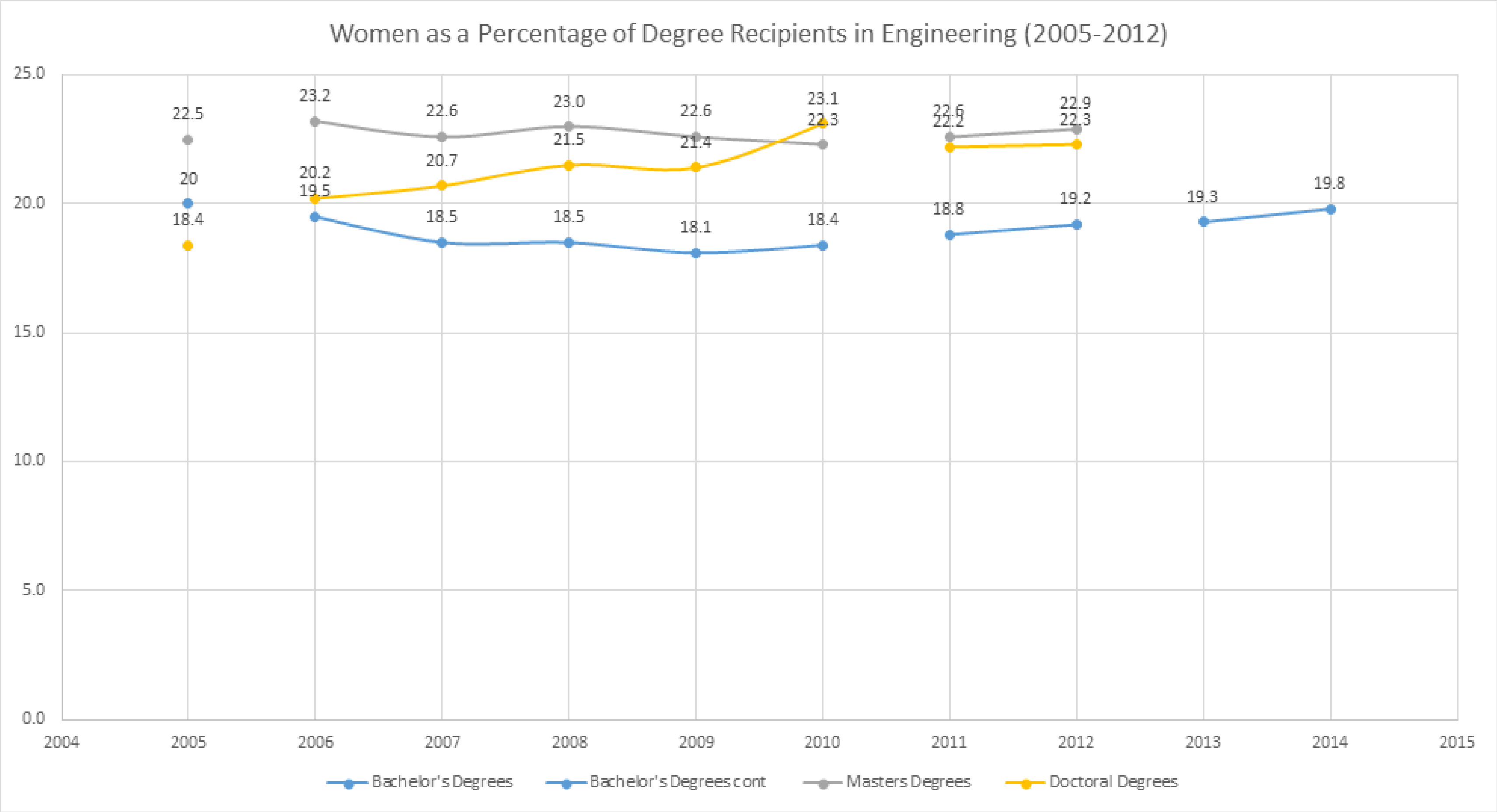


Yoder, Brian L.
Engineering by Numbers
ASEE 2015

For Example: *Women in Engineering*



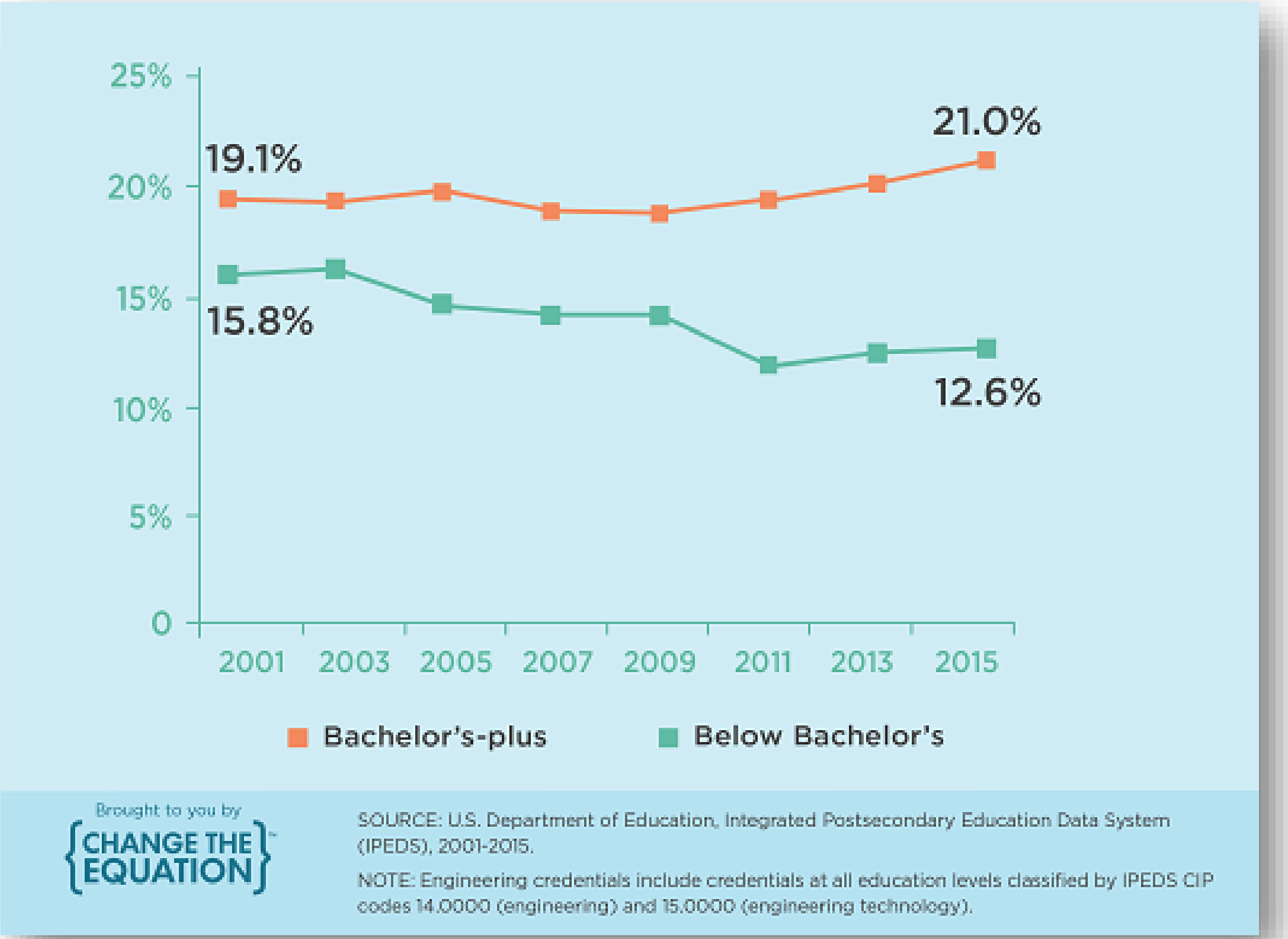
For Example: *Women in Engineering*



A Challenge:

Double the % of women in Engineering

(20% → 40% in 5-10yrs)



A Potential Strategy – Collective Impact

Common Agenda

- *Develop a technology-relevant, best-practices-based framework/approach to engineering education*

Shared Measurement

- *Collect learning data using common tools (e.g., TDOP)*
- *Shared accountability across courses, depts., schools*

Mutually Reinforcing Activities

- *Coordinated national curriculum/framework*
- *Regional/National industrial collaborations*

Continuous Communications

- *Professor training, web collaboration, mentoring*
- *Co-teaching, shared monitoring*

Backbone Organization

- *National Engineering Education Network*
- *Communication, data acquisition/integration/analysis*

Source: www.collaborationforimpact.com

Suggestions

- Stay cognizant of the goals/objectives
- Don’t get caught repeating past efforts, build upon prior work (e.g., *www.dia2.org*)
- Ideas w/out actions ≠ change
- Be realistic, identify where each group can best contribute
- Form and sustain a community of practice
- **Commit** - one workshop won’t produce a transformation

Think, Share, and Enjoy the Workshop!

Thank you.

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We can change the world…

One life at a time.

http://tinyurl.com/m6xjq7c