

Engineering for All A National Priority

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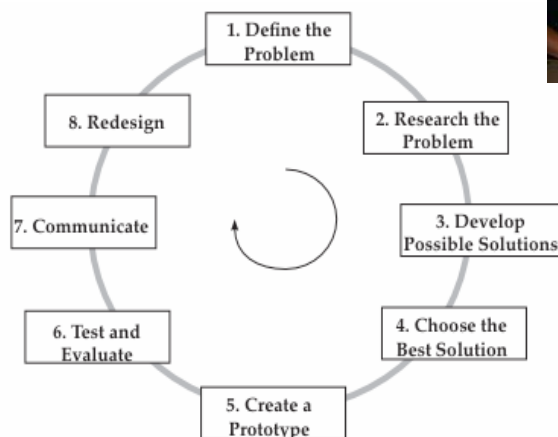
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Engineering is a Way of Thinking



**The Engineering
Design Process**

Similar Processes—Different Goals

Science

- Identify a question
- Research the question
- Generate ideas
- Formulate a hypothesis
- Conduct an experiment
- Communicate results
- Identify a new question

Engineering

- Define a problem
- Research the problem
- Generate solutions
- Create a prototype
- Test the prototype
- Communicate product
- Redesign

Adapted from Engineering Professor Chris Rogers, Tufts University

Why “Engineering” rather than “Technology”?

1. **Engineering** is more easily understood and valued than technology.
2. **Engineering** elevates the field to a higher academic level.
3. **Engineering** provides a solid framework to design curriculum.
4. **Engineering** is ideal for integrating mathematics and science.
5. **Engineering** provides a focused career pathway for students.

Adapted from an article by Robert C. Wicklein, University of Georgia



Jamie Drouillard, MIT

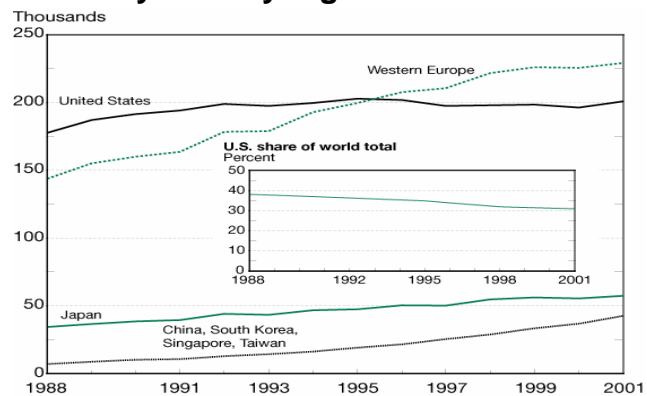
The “Pipeline” Rationale



- China graduates six times more engineers than we do.
- It’s harder to import talent from abroad.
- Engineering drives our economy.
- Engineering is essential for sustainable development.
- Few students learn what engineers do, so they’re not likely to choose it as a career.

The U.S. is Losing Ground Worldwide

Science and Engineering articles by country/region : 1988–2001

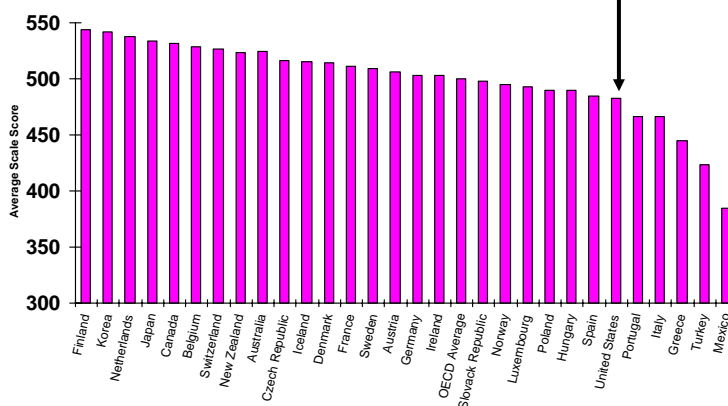


- National Science Board, Science & Engineering Indicators—2004

The “Engineering for All” Rationale

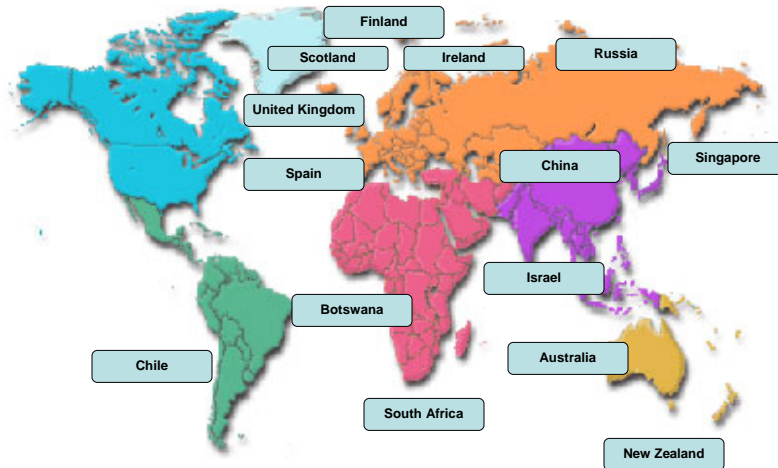
- Understanding engineering is essential for all citizens, workers, and consumers in a modern democracy.
- Public support of engineering is necessary if the U.S. is to continue to play a significant role in the world economy.
- Technology and engineering are viable careers only if students take the appropriate courses in high school.
- Engineering education for all is an important aspect of equity for girls and minority students.
- The capability to formulate and solve problems is a valuable life skill.

2003: U.S. Ranked 24th out of 29 OECD Countries in Mathematics



Source: Organization for Economic Cooperation and Development (OECD), PISA 2003 Results, data available at <http://www.oecd.org/>

Countries with Modern K-12 Engineering Education Programs



The Massachusetts Model Engineering Standards for All

K-5 Engineering Design, Tools, Materials & Machines.

6-8 Engineering Design, Tools, Materials, and Machines, Communications, Manufacturing, Construction, Transportation, Bioengineering

9-12 Engineering Design, Construction, Energy and Power: Thermal, Fluid and Electrical Systems, Manufacturing, Communications.



Massachusetts Model Assessment for All



- **In grades K-8:** Assess all students in science and technology/ Engineering
- **In grades 9-10** Offer end of course assessment for Tech/ Engineering as alternative to biology, physics, or chemistry



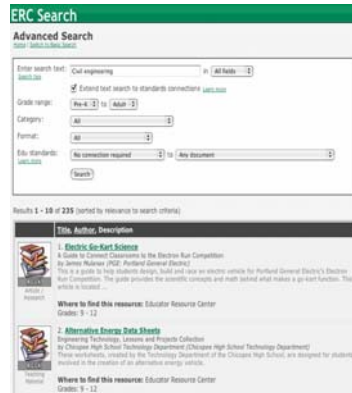
Mission: Leverage the Museum's unique position as a science center, its expertise in working with students, educators and the public, and its spirit of fun education to promote technological literacy nationwide among people of all ages.

1. Create Educational Products
2. Conduct Research
3. Assist Others through Advocacy and Outreach

NCTL

Technology and Engineering (TEC) Review www.mos.org/TEC

- Online Searchable Database
- Instructional materials in technology & engineering evaluated by teachers
- Mapped to national and state standards



NCTL: Elementary Curricula Engineering Is Elementary

- Integrates engineering, reading, and science
- Provides engaging stories about engineers and hands-on activities
- Children from different ethnic and national backgrounds are role models
- Integrated with core elementary science concepts & curricula



"Marvelous Machines"

NCTL: High School Curricula **Engineering the Future: Science, Technology, and the Design Process**

- Full-year high school course *for all students. (Not just students on pre-engineering or vocational tracks.)*
- Introduction to fields of engineering, physics and math
- Minimal investment in facilities and materials.
- Published by Key Curriculum Press
www.keypress.com/ETF

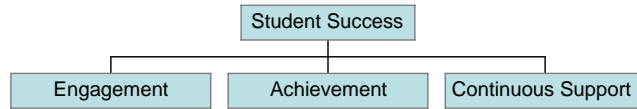


NCTL: Programs for School District Leadership



- Gateway program provides leadership training to school district teams.
- Share ideas, best practices in person and online.
- Produce case study reports of how the model is working in Massachusetts.

Critical Factors



**Engagement, Achievement & Support
for learners of ALL AGES.**

From “Engagement, Capacity, and Continuity: A Trilogy for Student Success,” by Jolly, Campbell, and Perlman, 2004.

Oregon’s Treasure Chest

Schools, Businesses & Science Centers

