Meeting IEEE's Public Imperative in Education

with emphasis on Standards Education

IEEE 802 LMSC Plenary Sessions
13 July 2009

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IEEE Standards Education Committee

Part 1

IEEE
Celebrating 125 Years
of Engineering the Future

What is the Purpose of this workshop?

- **To tell you what IEEE is doing in the area of standards education**

- **To tell you what IEEE is doing in other areas of education**
  - **And how the Standards Association can participate and enhance these areas**

Call for Action !

Outline

- **The role of Educational Activities in IEEE**

- **Pre-University Education Activities**

- **University-level Educational Activities**
  - IEEE standards education committee
  - Policy on Standards Education

- **Continuing Education Activities**

- **Public Education**

Outline

- **The role of Educational Activities in IEEE**

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Formalities: EAB's Mandate

- **IEEE Constitution:**

  - ARTICLE I - NAME, PURPOSE AND TERRITORY
    - **Sec. 2. Its purposes are: (a) scientific and educational...It shall endeavor to promote understanding of the influence of...technology on the public welfare.**

  - **By-Laws**
    - **The EAB shall be the IEEE interface in education-related matters with external bodies**

EAB's Mandate
IEEE by-laws

- **Recommend to the Board of Directors policies on educational matters**

- **Implement programs specifically intended to serve and benefit IEEE members in educational pursuits**
  - **And the engineering and scientific community, and the general public.**

EAB's Purpose

- To provide members and others involved in IEEE's technical fields of interest with **high quality opportunities for education** on these topics

- To provide **young people**, and their teachers and parents, with opportunities to understand career paths in engineering and technology

- To provide the **profession's perspective** on all key aspects of higher education in IEEE technical fields of interest.

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- **Public Education**

Pre-University Activities

PRE UNIVERSITY ACTIVITIES: BACKGROUND

Pre-University Education Activities

- **Objective:** Increase the propensity of young people to select engineering and computing as career paths

- Sample activities:
  - The on-line portal www.TryEngineering.org
  - Teacher In-Service Program (TISP)

What is the Challenge? (1)

- **Poor performance of young people in mathematics and the sciences**
  - **Coupled with decreased interest**

- **Flat or declining engineering enrollments in many <u>developed</u> nations**

- **Insufficient number of engineers and engineering educational programs in most <u>developing</u> countries**
  - **Asia is far behind Europe and the US in number of engineers per capita**

Percentage of students at each proficiency level on the mathematics scale
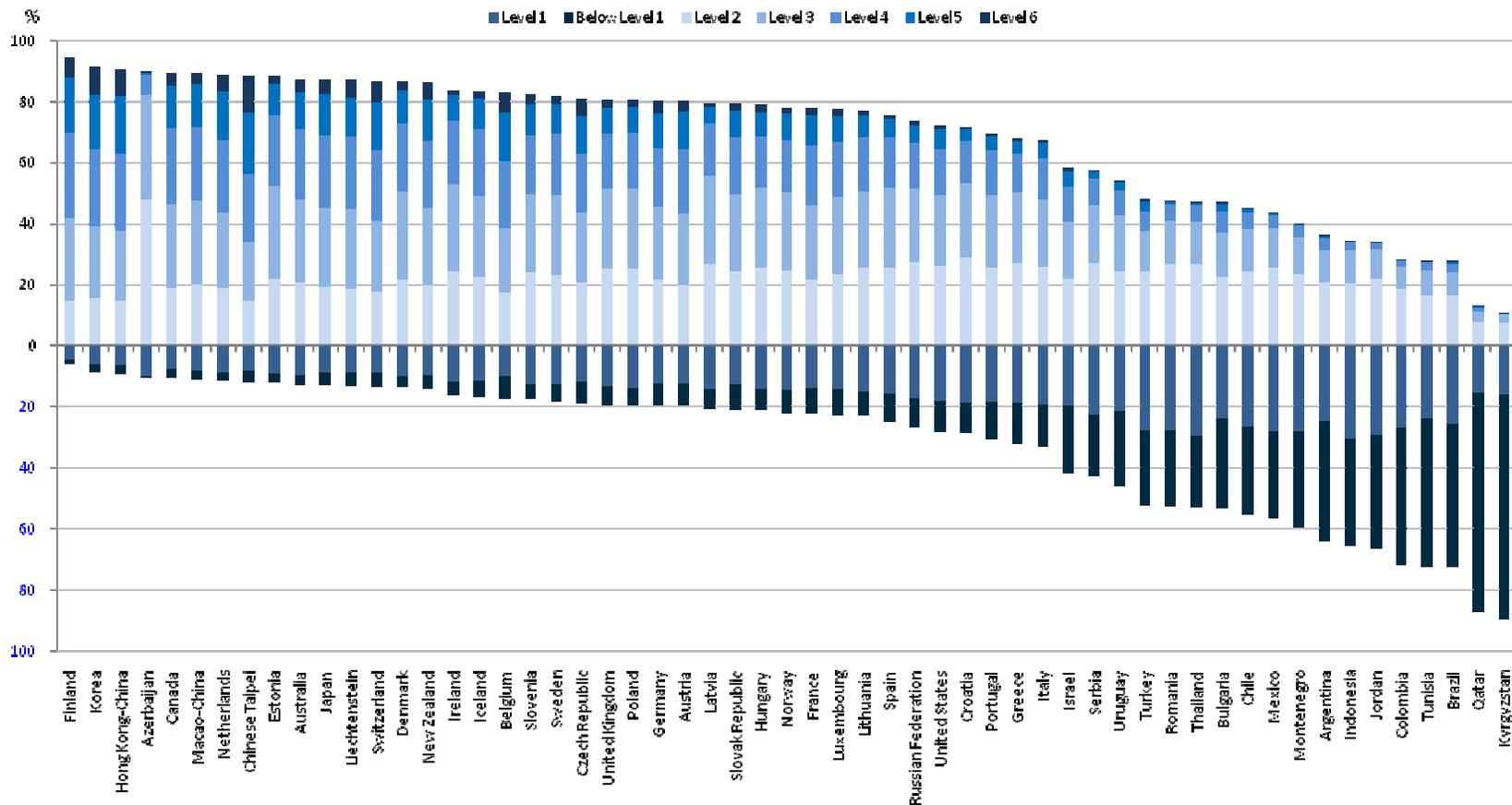
Source, OECD, PISA 2006

Above average

Taiwan, Finland, Hong Kong, Korea Netherlands, Switzerland, Canada, Macao, Liechtenstein, Japan, New Zealand, Belgium, Australia, Estonia, Denmark, Czech Republic, Iceland, Austria, Slovenia

Source, OECD, PISA
2006

At the average

Germany, Sweden, Ireland, France, United Kingdom, Poland

Source, OECD, PISA
2006

Below average

Slovak Republic, Hungary, Luxembourg, Norway, Lithuania Latvia, Spain, Azerbaijan, Russian Federation, United States, Croatia, Portugal, Italy, Greece, Israel, Serbia, Uruguay, Turkey, Thailand, Romania, Bulgaria, Chile, Mexico, Montenegro, Indonesia, Jordan, Argentina, Colombia, Brazil, Tunisia, Qatar, Kyrgyzstan

Source, OECD, PISA 2006

From 2001 to 2006, mathematics scores are getting…

- ◼ **Better – in France, Japan, Lichtenstein, Iceland and Belgium**
  - – **All are *above average* countries**

- ◼ **Worse – in Brazil, Greece, Mexico and Indonesia**
  - – **All are *below average* countries**

Source, OECD, PISA 2006

Enrollment in Engineering in the US is flat

Figure 2-10
## U.S. engineering enrollment, by level: 1985–2005

Thousands
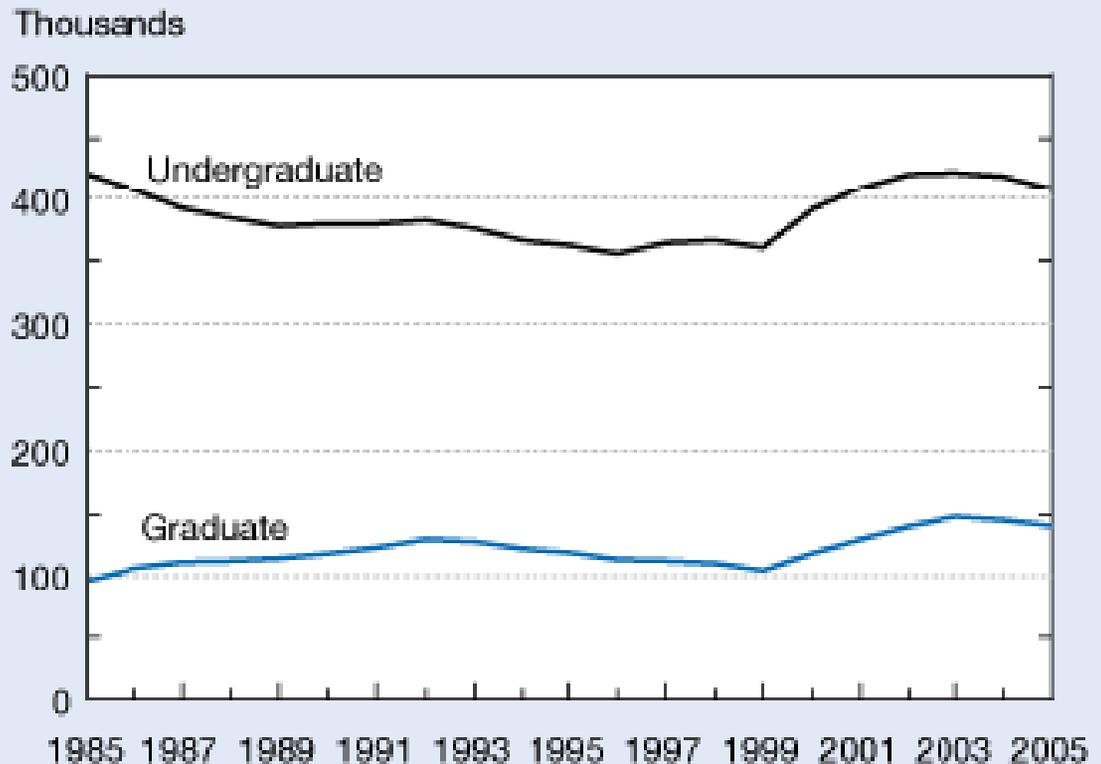
NOTE: Enrollment data include full- and part-time students.

SOURCE: Engineering Workforce Commission, Engineering & Technology Enrollments, Fall 2005, American Association of Engineering Societies (2006). See appendix table 2-19.

Science and Engineering Indicators 2008

Science and Engineering Indicators 2008

US
numbers

Figure 2-14
S&E bachelor's degrees, by field: 1985–2005
Thousands

Science and Engineering Indicators 2008
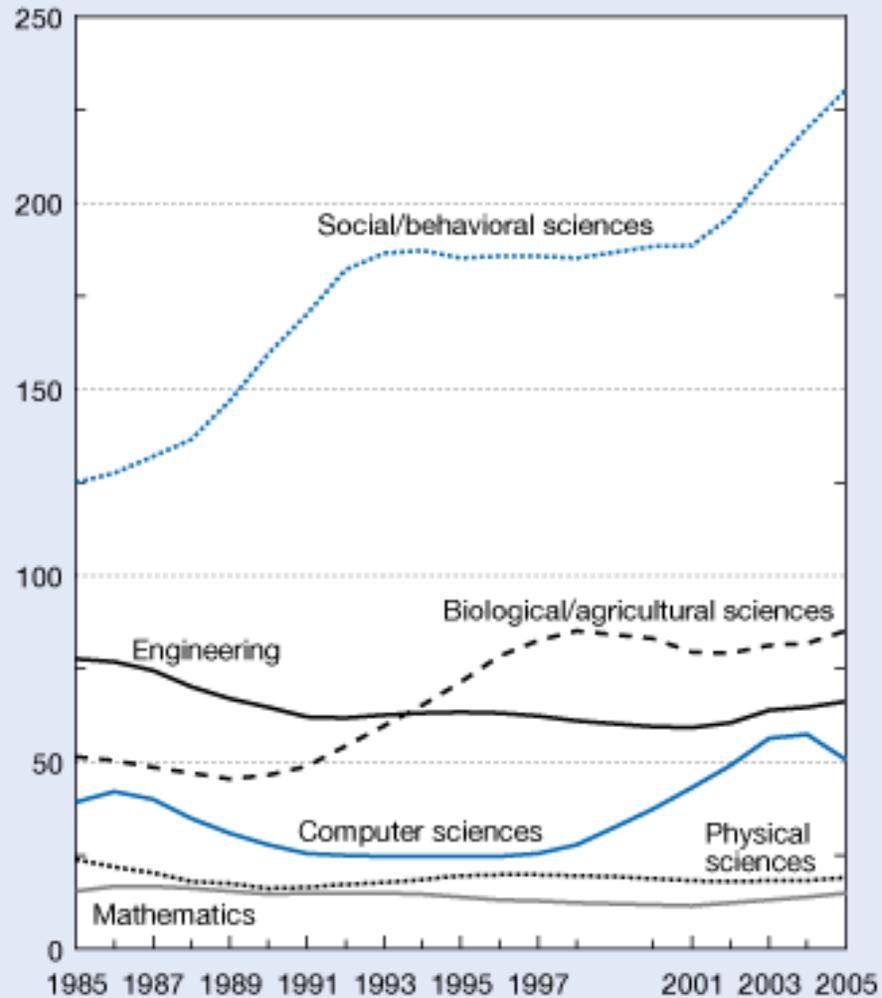
Figure 2-35
First university natural sciences and engineering degrees, by selected countries: 1985–2005

Science and Engineering Indicators 2008
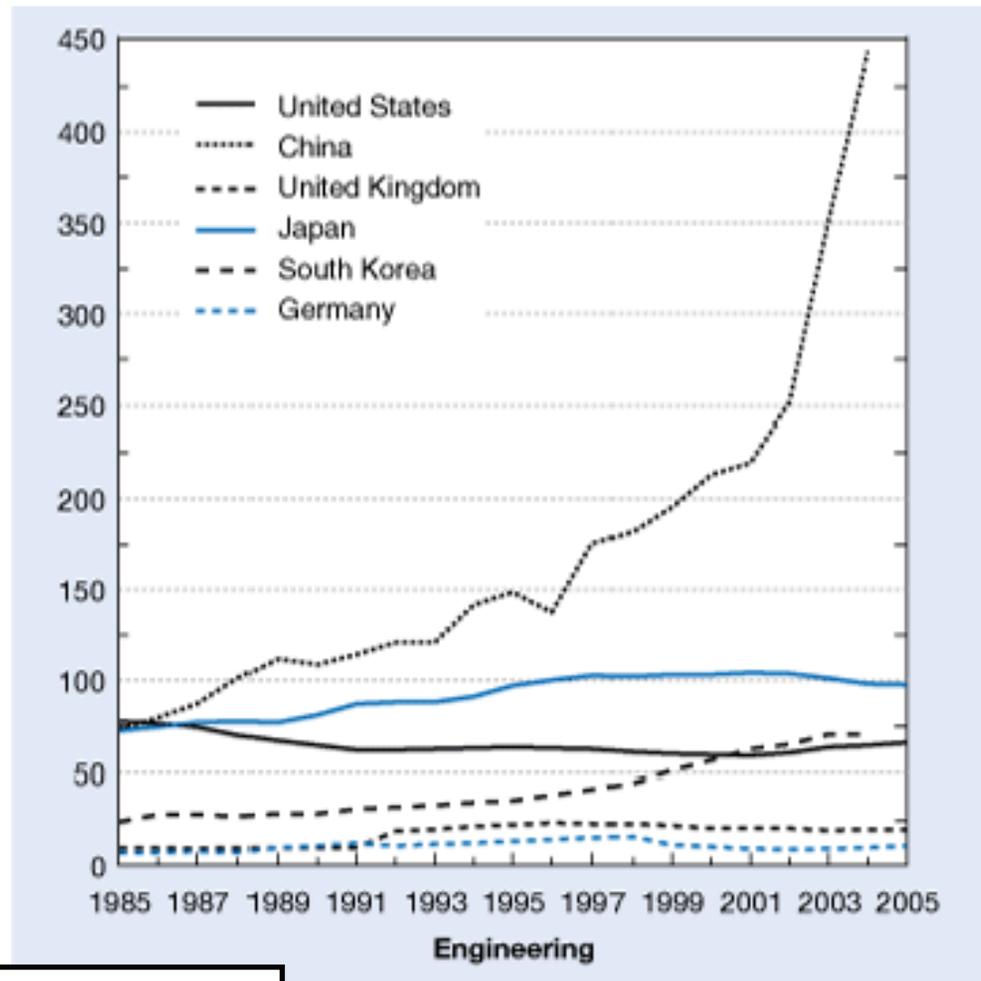
Figure 2-20
S&E doctoral degrees earned in U.S. universities, by field: 1985–2005
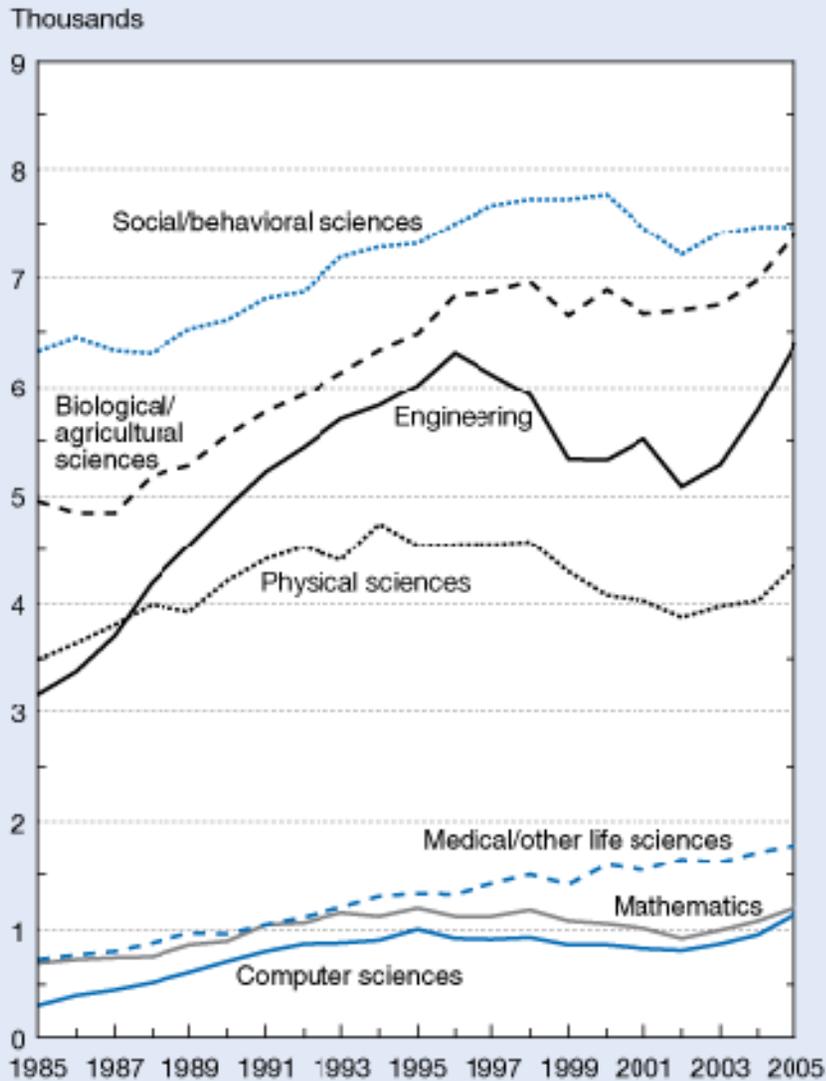
Figure 2-37
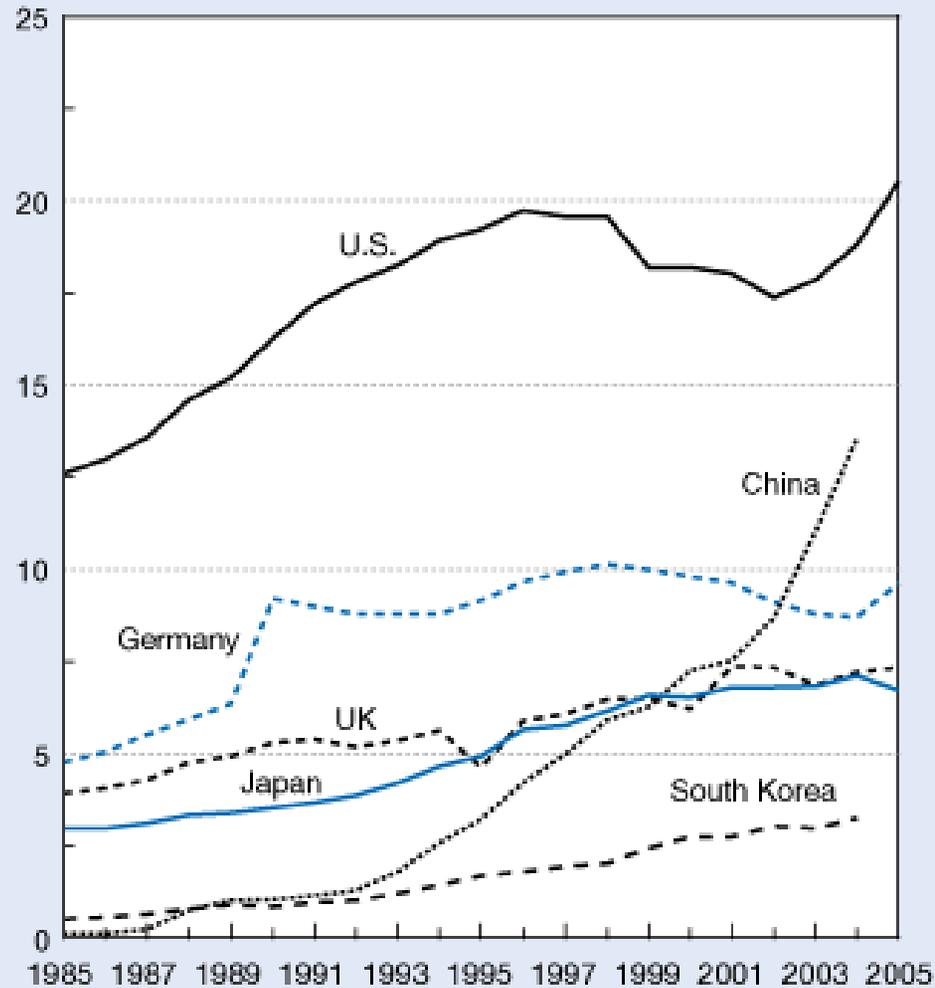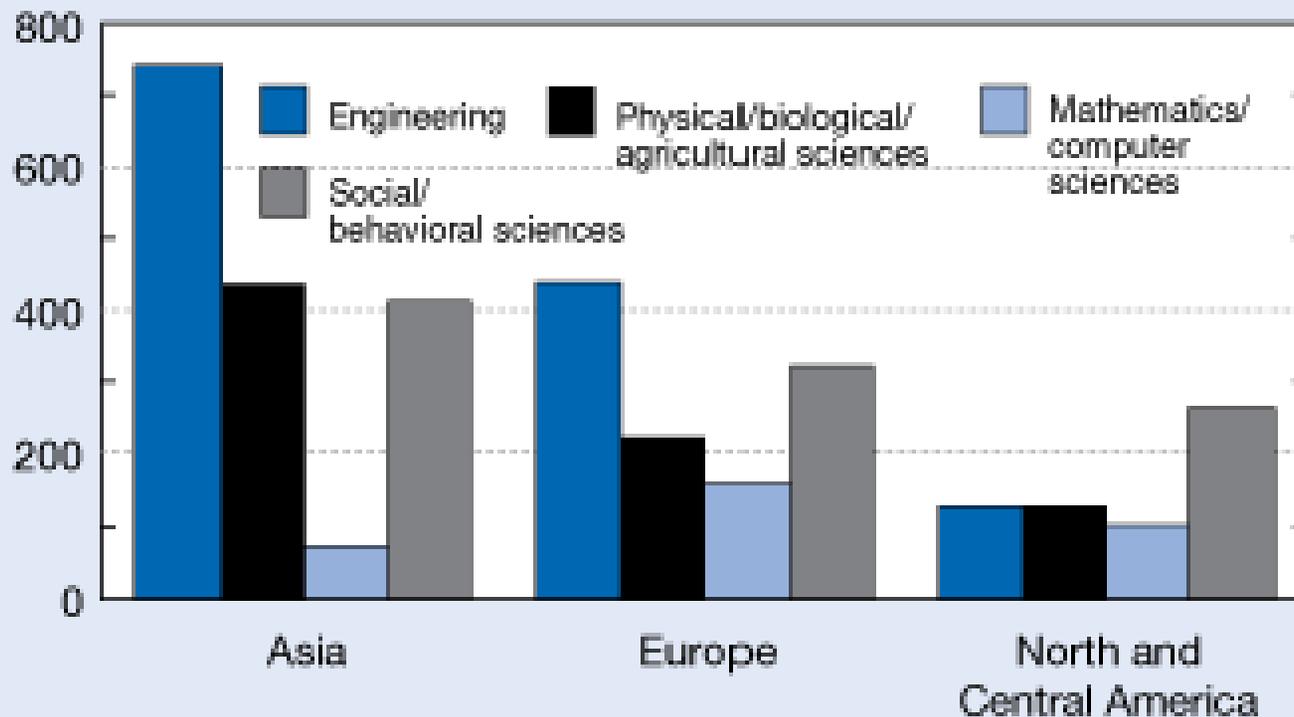Natural sciences and engineering doctoral degrees, by selected country: 1985–2005

Science and Engineering Indicators 2008

Figure 2-34
First university S&E degrees in Asia, Europe, and North and Central America, by field: 2004
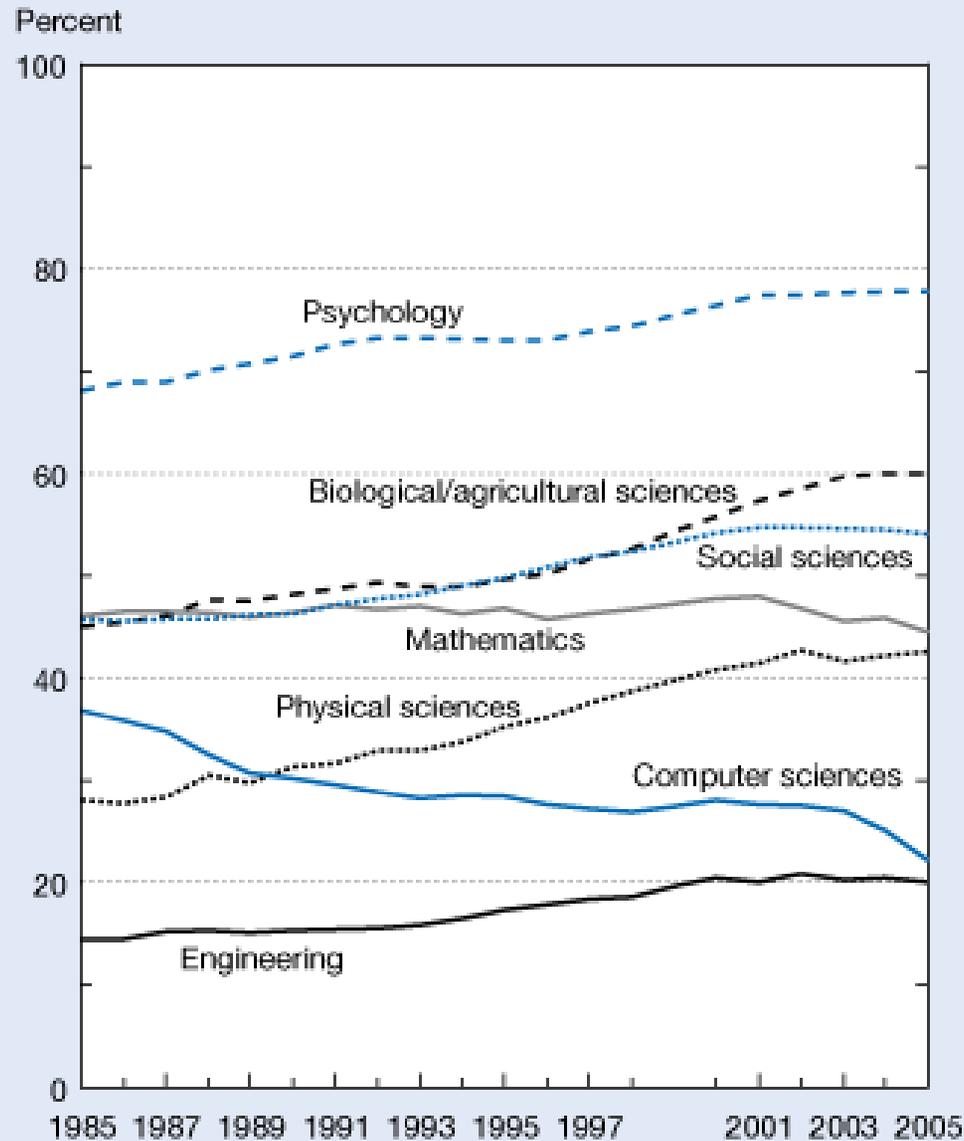
What is the Challenge? (Part 2)

- **Women and minority students conspicuously under-represented**

- **Public perception of engineers/ engineering/ technology is often misinformed**
  - **Resulting in early decisions that block the path of children to Engineering**

Figure 2-15
Female share of S&E bachelor's degrees, by field: 1985–2005

US numbers

IEEE Board of Directors: 2005 decisions

- **Approved a new initiative in 2005**
  - *Launching Our Children's Path to Engineering*

- **Requested review all IEEE activities in the area of pre-university education in Engineering, Technology, and Computing**

- **Requested development of programs for wide outreach**
  - **in cooperation with other Engineering Associations and Industry**

- **"Launch, test and institutionalize"**

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Pre-University Activities

TRYENGINEERING

TryEngineering.org

A portal for school counselors, teachers, parents and students

University search	Explore Engineering –
By location, program, environment **25 countries, 1739 universities**	**Discipline Descriptions, Day in the Life of an Engineer, Preparation Tips**
Virtual Games	**54 lesson plans for teaching engineering design**
Ask an Expert – Ask an Engineer, Ask a Student	**Undergraduate Student Advice**
E-Newsletter	**Student opportunities –** summer camps, fellowships, etc.

Call for Action ! # TryEngineering.org

At present there is no Standards component to most of these

University search **By location, program, environment** **25 countries, 1739 universities**	**Explore Engineering –** **Discipline Descriptions, Day in the Life of an Engineer, Preparation Tips**
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TryEngineering.org - Measures of Success

- **Available in 8 Languages**
  - Chinese, English, French, German, Japanese, Portuguese, Russian, and Spanish
- **2.5 MILLION HITS IN 2007 … 4.5 MILLION HITS IN 2008**
- **In 2009= 1.91 million page hits (1 Jan. through 31 May)**
- **Visitors come from the US, India, China, Canada, UK and scores of other countries**
- **Selected Statistics:**
  - 45,509 = average # of unique visitors per month
- **73,593 = highest number of total unique visitors (May 09)**
  - 260,504 = average # of page hits per month
  - 9911 = average # of university searches per month
  - 13,892 = average lesson plan downloads per month
  - 37 minutes= average time a visitor spends on the site

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Most Requested Lesson Plans

- **Build your own robot arm**
- **Series and Parallel Circuits**
- **Pulleys and Force**
- **Cracking the Code (bar codes) ***
- **Electric Messages**
- **Adaptive Devices**

Leg goes this way

Center of gravity goes that way

0 12587 60032
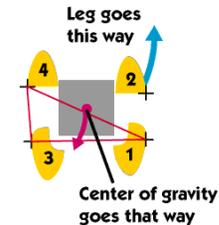
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Call for Action !

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University Searches: 25 Countries

- Argentina
- Australia
- Austria
- Belgium
- Brazil
- Canada
- France
- Germany
- India
- Ireland
- Japan
- Korea

- Malaysia
- Mexico
- New Zealand
- Pakistan
- Portugal
- Russia
- Singapore
- South Africa
- Switzerland
- Taiwan
- Turkey
- United Kingdom
- United States

Languages

中文	Chinese
Deutsch	German
Español	Spanish
Français	French
邦人	Japanese
Português	Portuguese
русский	Russian

How can the SA get involved?

Call for Action !

- ▣ **Provide professionals engaged in Standards for interviews for "Life of an Engineer"**

- ▣ **Enhance existing lesson plans by contents related to Standards**

- ▣ **Propose lesson plans focused on Standards**

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Pre-University Activities

TEACHER IN SERVICE PROGRAM (TISP)

Teacher In Service Program

"Engineering in the Classroom"

The Teacher In Service Program (TISP)

- **A program that trains IEEE volunteers to work with pre-university teachers**

- **Based on approved Lesson Plans**
  - Prepared/reviewed by IEEE volunteers
  - Tested in classrooms
  - Designed to highlight engineering design principles

How does it work?

- **Volunteers gather for a day and a half of training**
  - With teachers and school administrators

- **Volunteers spread the program in their school districts**

- **Section volunteers run a TISP training event**

- **EAB provides logistical support and instructors**

2008 Training Workshops

- **Córdoba, Argentina (R9)**

- **Port of Spain, Trinidad and Tobago (R9)**

- **Los Angeles, California (R6)**

- **San Francisco, California (R6)**
  - Over 300 volunteers attended these training workshops

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2009 TISP Training Workshops

- **March: Atlanta, GA USA**
- **May: Montevideo, Uruguay**
  - **mostly teachers**
- **May: Montreal**
- **July: Shenzhen, China**
- **November: Guayaquil, Ecuador**
  - **mostly student branch leaders**

TISP Impact

- **IEEE volunteers have conducted over 120 presentations...**

- **Attended by more than 3000 educators who represent more than 316,000 students each year**

- **Presentations have occurred in many countries, including: Malaysia, South Africa, Brazil, Columbia, Peru, Argentina, Uruguay, China, Canada, and the US**

Training Sessions

- **A full-scale TISP training for volunteers**

- **Open to all Sections in a Region or an Area**
  - All expenses are paid by IEEE-EAB

- **We are looking for volunteers who will follow up and take the activities to the schools**

Call for Action !

- **If you want to have a training session in your area, please let EAB know**
  - Participation is not limited to IEEE members

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Where do we seek to have TISP sessions?

- **Where under-subscription to engineering programs is a problem**

- **Where there is a strong group of 4-6 volunteers who can carry the program for at least 4 years**

- **Where there is enough interaction and interest of educators and local school administration**

How the SA can help?

- **Review existing lesson plans used for TISP and suggest a Standards component**

- **Propose a Standards-based lesson plans**
  - **All you need to do is provide the basic idea**
  - **EAB will implement**

Pre-University Activities

WORKSHOPS AND SYMPOSIA

Transforming Engineering Education: Creating Interdisciplinary Skills for Complex Global Environments

Dublin, Ireland
April 6-9, 2010

Arthur Winston, General Chair

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