Meeting IEEE’s Public Imperative in Education

with emphasis on Standards Education

IEEE 802 LMSC Plenary Sessions
13 July 2009

David Law and Moshe Kam
IEEE Standards Education Committee

Part 1
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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- Public Education
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 developed nations

- Insufficient number of engineers and engineering educational programs in most developing 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 2-14
S&E bachelor's degrees, by field: 1985–2005

Science and Engineering Indicators 2008

US numbers
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

Thousands

- Social/behavioral sciences
- Biological/agricultural sciences
- Engineering
- Physical sciences
- Medical/other life sciences
- Mathematics
- Computer sciences
Figure 2-37
Natural sciences and engineering doctoral degrees, by selected country: 1985–2005

Thousands

1985 1987 1989 1991 1993 1995 1997 1999 2001 2003 2005

U.S.

China

Germany

UK

Japan

South Korea
Figure 2-34
First university S&E degrees in Asia, Europe, and North and Central America, by field: 2004

Thousands

- Engineering
- Physical/biological/agricultural sciences
- Mathematics/computer sciences
- Social/behavioral sciences

Asia | Europe | North and Central America
---|---|---
800 | 400 | 200
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

Percent

100

80

60

40

20

0

Psychology

Biological/agricultural sciences

Social sciences

Mathematics

Physical sciences

Computer sciences

Engineering

1985 1987 1989 1991 1993 1995 1997 2001 2003 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”
Pre-University Activities
Welcome to TryEngineering.org
TryEngineering.org is a resource for students (ages 8-18), their parents, their teachers and their school counselors. This is a portal about engineering and engineering careers, and we hope it will help young people understand better what engineering means, and how an engineering career can be part of their future. Click here to learn more.

Become an Engineer
Are you thinking of becoming an engineer? Do you want information on engineering degrees, or the numerous options available to those with an engineering degree? Our recommended pre-university course selection, descriptions of engineering and engineering technology majors, and information on summer programs should help you find out more about this fun and rewarding career. Surf TryEngineering and check out tons of great information about how you can Become An Engineer!

TryEngineering is brought to you by:
IBM, IEEE, tryscience

With participation of:
TryEngineering.org
A portal for school counselors, teachers, parents and students

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At present there is no Standards component to most of these

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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
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

At present there is no Standards component to most of these

Call for Action!
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
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- United States
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How can the SA get involved?

- 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

Call for Action!
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
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

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

Call for Action!
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
Meeting the Growing Demand
For Engineers and Their Educators 2010 - 2020

Munich, Germany
9 - 11 November 2007

Arthur Winston, General Chair