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 2

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Celebrating 125 Years
of Engineering the Future

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**

University-level Educational Activities

- Objectives:
  - Improve <u>academic curricula</u> and ensure their purposeful adaptation to the changing technical and business climate

  - Improve <u>delivery and effectiveness</u> of engineering education

  - Improve <u>retention</u> of engineering and technology students

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EDUCATION ABOUT STANDARDS

IEEE Standards Education Committee (SEC)

- **A joint standing committee of IEEE Educational Activities Board (EAB) and IEEE Standards Association (SA)**
  - **four members from each organization**

- **Committee is open to participation from all interested parties** **Call for Action !**

Mission of the Standards Education Committee (1)

1. Promote the <u>importance of standards</u> in meeting technical, economic, environmental, and societal challenges

2. Secure and disseminate <u>learning materials</u> on the application of standards in the design and development aspects of educational programs.

3. Secure and provide <u>short courses</u> about standards needed in the design and development phases of professional practice.

Mission of the Standards Education Committee (2)

4. **Actively promote the <u>integration of standards into academic programs</u>.**

5. **Lead other education initiatives planned jointly by EAB and the SA as needed.**

Who benefits?

Undergraduate Students	
Graduate Students	
Entry-level technology professionals	
Candidates for licensure	
Experienced technology professionals	– **Standards developers** – **Product developers** – **Standards managers**
Marketing professionals	
Business leaders	
SSO/SDO	– **Committee leaders** – **Committee participants** – **Governance participants**

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Comments on use of Standards in high education

- **About 450 schools have full access to IEEE standards through IEL**

- **Only 8-10 schools make use of this feature...**

- **Standards are mentioned in the ABET program criteria, but in general use of Standards in most curricula is sparse**

IEEE Standards Education on the Web

- **IEEE Standards Education website** http://www.standardseducation.org

- Focal point for delivery of information on education about standards

- Content is freely available
  - Developed with the support of a US NSF Grant

http://www.standardseducation.org

IEEE Home » IEEE Education » **Standards**

Standards Education Main Menu

- Standards Education Home
- Why Standards Education
- ▶ Tutorials
- Case Studies
- ▶ Student Application Papers
- Standards Reference Directory
- Glossary
- Announcements
- Additional Resources

Attend the IEEE 802 Standards Education Workshop: The World of IEEE 802 Standards

This full-day workshop covers the world of IEEE 802® Standards and each of the working groups developing standards in both the wired and wireless areas.

Standards Education

Printer Friendly

As the world's leading standard developer, the IEEE is also a leading source of information and resources on standards, their applications, and their impact on designing new products, processes, and services.

We are committed to:

What do you want to do?

- Find a standard
- Shop for standards
- Subscribe to standards
- Search standards projects
- Sign up for standards publication alerts
- Learn more about standards development
- Log-in and ballot on a standard
- Get IEEE 802® standards

Tutorials

» Read More

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Tutorials
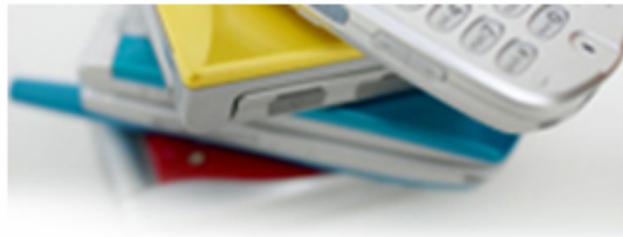
» Read More

Objectives

- **To support the incorporation of the <u>teaching of standards</u> in undergraduate programs**
  - **engineering and engineering technology**

- **To help undergraduate programs <u>incorporate standards in their learning processes</u>**

- **To benefit students and faculty mentors who face challenging <u>design</u> processes**

- **To provide <u>learning tools</u>**
  - **learning about standards and their impact on design and development**

Content useful to the practicing professional...

Call for Action !

- **SEC is working to increase such content**
  - To educate practicing professional about standards, their applications, and their impact on designing new products, processes and services

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Standards Education Tutorials

- Tutorials are free online comprehensive learning modules

- Provide guidance on how to assemble and apply standards appropriate to the development of a product or process

- Now available:
  - The Role of Standards in Engineering and Technology
  - The Role of Standards in Cellular Telephony
  - The Role of Standards in Electrical Power Systems
  - SystemVerilog (IEEE Std 1800™-2005)

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Standards Education Case Illustrations

- **Case Illustrations are examples of the application of standards in a real-world context**
  - **Wireless Routers**
  - **Multimode Mobile Phones**

- **Coming in 2009…**

  - **Tutorials and Case Illustrations on Metric Units**

  - **Tutorial on Intellectual Property**

  - **Tutorial on IEEE Std 802.16**

- **More are needed!** | **Call for Action !**

Snapshot of Tutorial

THE ROLE OF STANDARDS in engineering and technology ◈IEEE

This tutorial addresses the subject of technical standards. The standards discussed in this tutorial deal with subjects ranging from architecture and operations to physical, environmental and electrical aspects of a product or service. In the body of this tutorial the term 'standards' is to be taken as 'technical standards," as opposed to standards, such as ethical and business, which are also important but are not covered by this tutorial.

This core publication of 'The Role of Standards in Engineering and Technology' presents introductory material that is applicable to most classes of standards. It then makes use of existing standards from the telecommunications and information technology fields to provide direct examples on how standards and technical developments interact.

Each section in this module is navigated by a toolbar at the top of the page. This toolbar has five choices:

TABLE OF CONTENTS	GLOSSARY	FURTHER READING	INDEX	GO TO
The Table of Contents listing all the sections in the module.	A list of all terms in the module with their definitions and links to further material, as appropriate.	A reading list for the module, linked to additional material as appropriate.	A full index of content in the module, linked as appropriate.	A menu to jump to different parts of the SETF site.

BEGIN MODULE

Return to IEEE Standards in Education Portal

http://www.ieee.org/web/education/standards/tutorials.html

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IEEE Mini-Grants and Student Application Papers

- **SEC is offering Mini-Grants to students and faculty mentors**

- **Help with graduate and capstone design projects with an industry standards component**

  - **$500 grants for students**
  - **$300 grants for faculty advisors**

Next deadline: 15 October 2009

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IEEE Mini-Grants and Student Application Papers

- **Projects must illustrate how specific standards were applied to a task in the classroom**

- **students and/or faculty describe how standards impacted the design process**

- **Results are published as Student Application Papers**
  - **http://standardseducation.org/applications**

Next deadline: 15 October 2009

Final student papers are now posted on the following topics:

- Applications of IEEE 802.11b Wireless Standards in the Realization of a New Service Paradigm for New Jersey's Garden State Parkway

- Dynamic Backoff for IEEE 802.15.4 Beaconless Networks

- Wireless Body Area Networks for Healthcare: A Feasibility Study

- Wireless Wearable Motion Sensor for Use in Medical Care

- Environment Temperature Control Using Modbus and RS485 Communication Standards

- Wireless Telemedicine as Part of an Integrated System for E-medicine

- Build an IEEE 802.15.4 Wireless Sensor Network for Emergency Response Notification for Indoor Situations

- http://standardseducation.org/applications

Next deadline: 15 October 2009

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IEEE Standards Education Web Site: the Remaining Sections

- Glossary of key standards terms

- Reference Guide

- Alphabetical listing of standards development bodies and standards-related terminologies

- News and Features

- Gateway to other learning opportunities

WORKSHOPS AND SYMPOSIA

IEEE Standards Education Workshops

- **Targeted at practicing professionals as part of our continuing education efforts**

- **First workshop: November 2007 in Globecom**
  - **On IEEE 802 Wireless Standards**

- **Second workshop: November 2009**

  - **IEEE 802 Standards**
  - **intellectual property**
  - **standards process**
  - **include panel discussion on the value of standards**

2009 workshop

- "A full day of immersion into the world of IEEE 802® Standards and cover each of the working groups developing standards in both the wired and wireless areas"

-

- Co-located with IEEE Globecom 2009 at the Hilton Hawaiian Village, Honolulu, Hawaii, USA

- http://www.ieee.org/web/education/standards/802_workshop.html

- Will propose a repeat in IEEE Region 8
  - Repeat above in some form at MELECON 2010
  - Need to engage with organizing committee

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IEEE Standards Education
How you can help...

- **Spread the word about Mini-Grants for Student Application Papers**
  - **$500 for students/$300 for advisors**

- **Let us know if there are open agenda slots for standards and standards education topics in your local activities**
  - **student, GOLD, local meetings, conferences and seminars**

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Call for Action !

IEEE Standards Education
How you can help…

- Invite Standards Guest Lecturers
  - At colleges, universities, or companies

- Propose topics for relevant new Tutorials and Case Studies for students and educators

- Consider active participation in the IEEE Standards Education Committee activities

- Participate as a content provider/partner

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Call for New Tutorials and Case Studies

- ## We are actively seeking subject matter experts in various technical areas

- ## Objective: create tutorials and case studies demonstrating the application of standards.

  - ### Offering honorariums:
    - #### $2,000 for tutorials
    - #### $1,000 for case studies

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Additional Information

- **Website**
  http://www.standardseducation.org

- **SEC Chair**
  - **Steve Mills, steve_mills@hp.com**

- **SEC Vice-chair**
  - **Moshe Kam, m.kam@ieee.org**

- **SEC Member**
  - **David Law, David_Law@3com.com**

- **IEEE Standards Education Program Manager**
  - **Jennifer McClain, j.mcclain@ieee.org**

Outline

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IEEE Policies on Education

- **Approved by IEEE Board of Directors**
  - at the recommendation of EAB and other OUs

- **Currently…**
  - IEEE Position Paper on Accreditation of Academic Programs in Engineering Computing and Technology
  - IEEE Position Paper on the First Professional Degree in Engineering
  - IEEE Position Paper on Standards in the Curriculum

IEEE Position Paper on Standards in the Curriculum

- **Approved by the IEEE Board of Directors in June 2009**

- **States the desired role of technical standards in the academic curriculum**
  - Programs in engineering and computer science

- **Will be used in model curriculum development and in discussions with accrediting bodies**

Purpose

- ...to define the desired role of technical standards in education within engineering, technology, and computing (ETC) academic curricula in the technical areas of interest of IEEE

- [followed by a <u>definition of a standard</u> and rationale of including standards in the curriculum]

Definition of means of incorporating standards in the curriculum

- **By reference**

- **By indirect introduction**
  - **extraction of principal aspects**

- **By direct use of a published standard**
  - **or a significant excerpt**

- **By regular use and reference to technical standards**

Recommended levels of incorporation in the standard ECT curriculum

- **Routine exposition *by reference***

- **Multiple exposition to *principal technical specifications of a standard***

- **Extensive *direct exposure* during next-to-last year of undergraduate studies**

- ***Extensive use* during last-year project**
  - **Including standards search**

What's next

- **Distribution of the position papers to IEEE volunteers active in accreditation**

- **Distribution to accreditation agencies and the general education community**

REAL WORLD ENGINEERING PROJECTS

The problem…

- In most countries women are under-represented in the engineering student body

- While women made significant progress in **Medicine** and **Law** they have not increased their participation in **Engineering** to the same degree

- The dropout rate of women from engineering programs is high

Undergraduate Enrollment in Engineering- Percent Female
Source: National Science Board, Science & Engineering Indicators-2000.
Arlington VA; National Science Foundation, 2000 Appendix 4-33
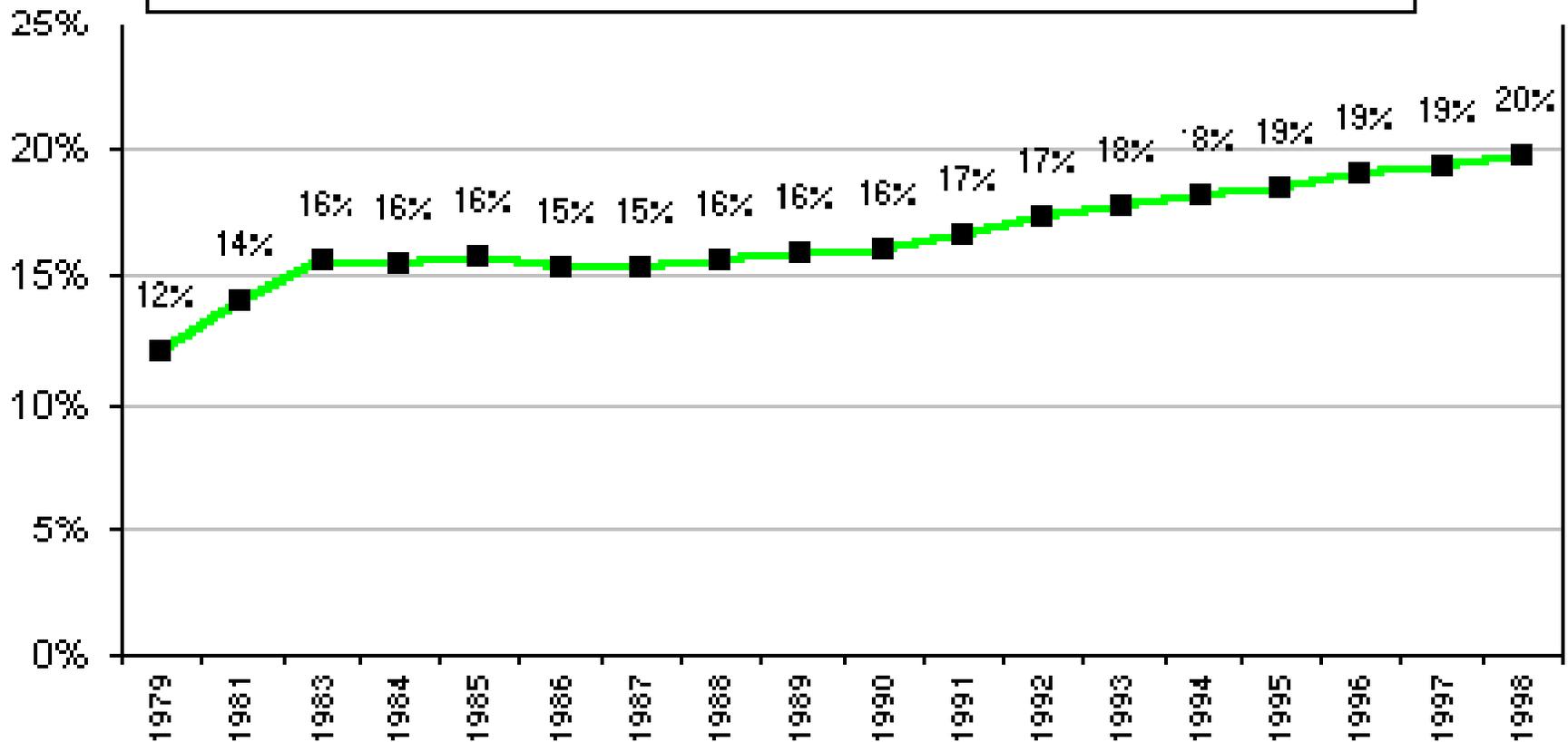
US
numbers

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

Percent
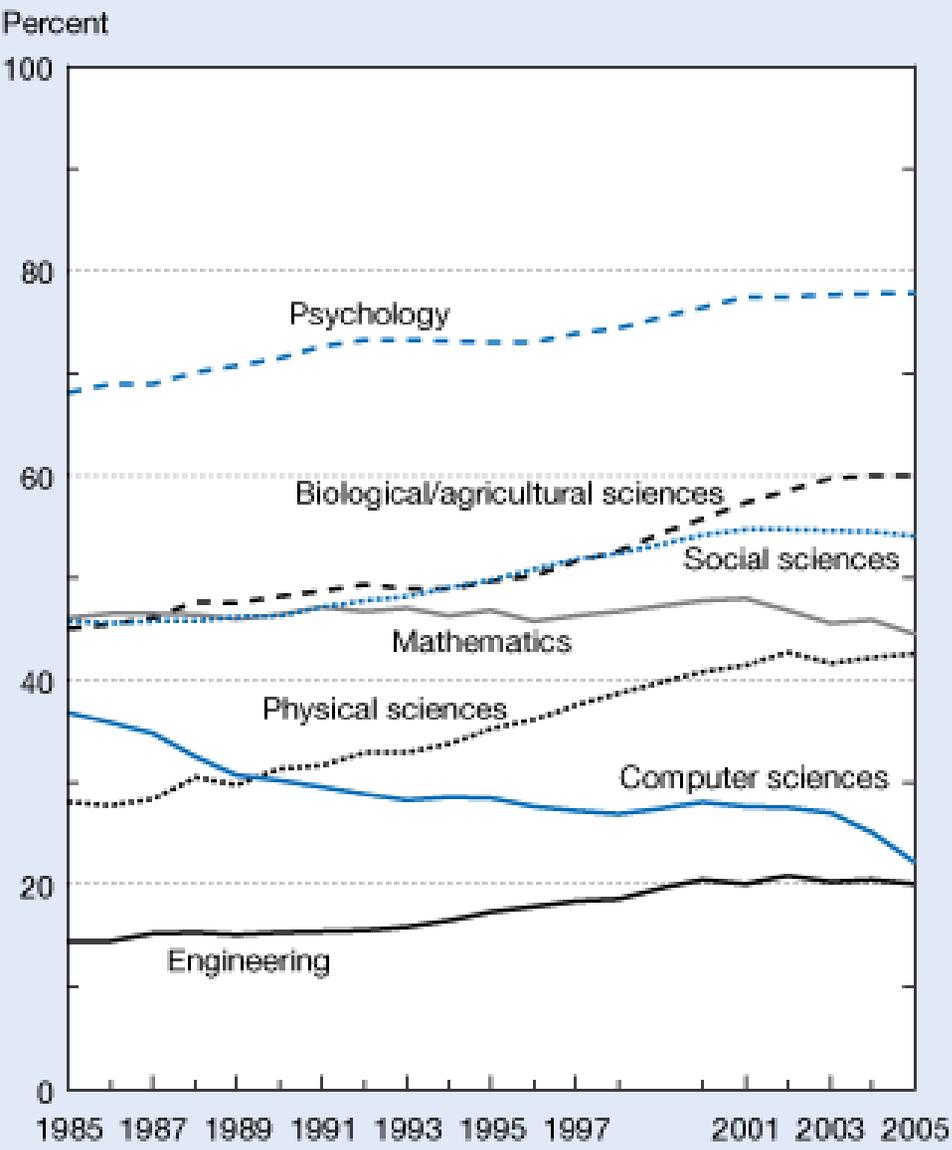
Figure 2-18
S&E master's degrees, by sex: 1985–2005

Thousands
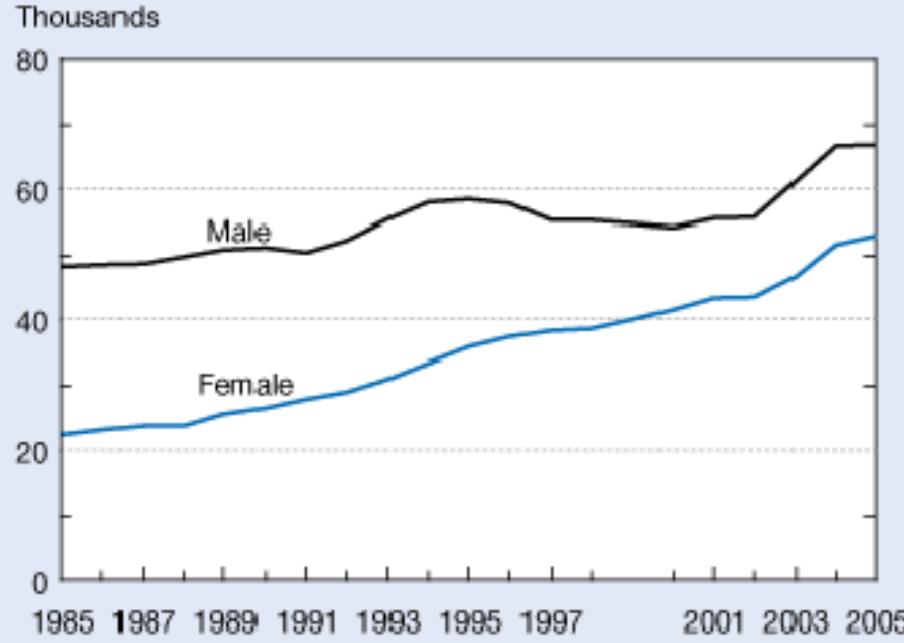
US numbers

Women and Science
Statistics and Indicators

She Figures 2006

Proportion of female PhD Graduates in EU-25

	Life Sciences	Mathematics & Statistics	Computing	Engineering
EU-25	54.4	31.6	18.6	17.1
Hungary	43.0	42.2	30.0	33.3
Germany	46.7	27.9	11.9	6.8
US	45.7	27.0	21.0	17.2

http://ec.europa.eu/research/science-society/pdf/she_figures_2006_en.pdf

MOVING UP OR MOVING OUT
How the proportion of men and women varies through Europe's scientific ranks
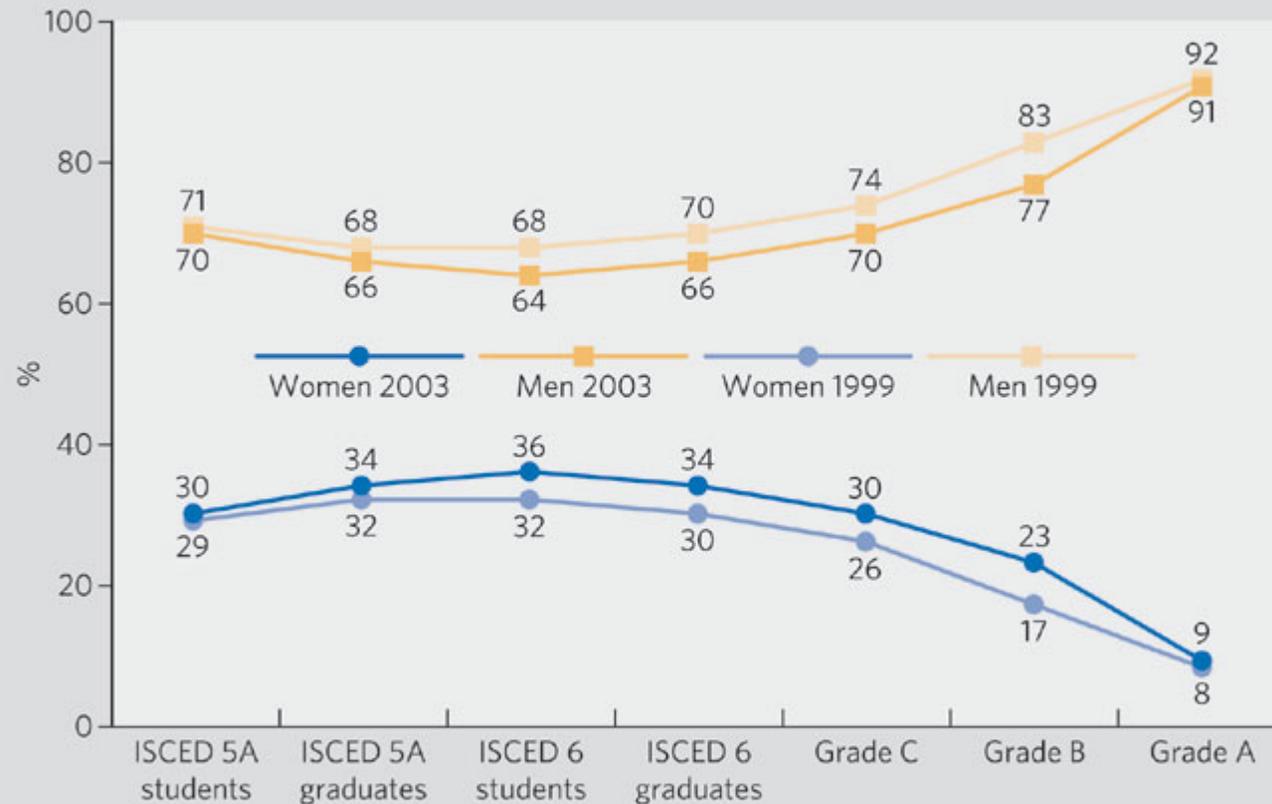
Grade A represents the highest level research posts. Grade B identifies researchers in intermediate positions. Grade C is the first post for a new PhD graduate. ISCED 6 refers to students in programmes leading to a PhD or other advanced degree, and ISCED 5A refers to students of tertiary programmes that yield marketable skills for a research profession. Data from ref. 1.

Figure 1.5: Proportion of scientists and engineers in the total labour force[1] by sex, 2004

EU-25: women are 29.7% of S&E labor force

Ireland: 48.8%

Lithuania: 55.5%

France: 14.6%

UK: 20.7%

Germany: 21.4%
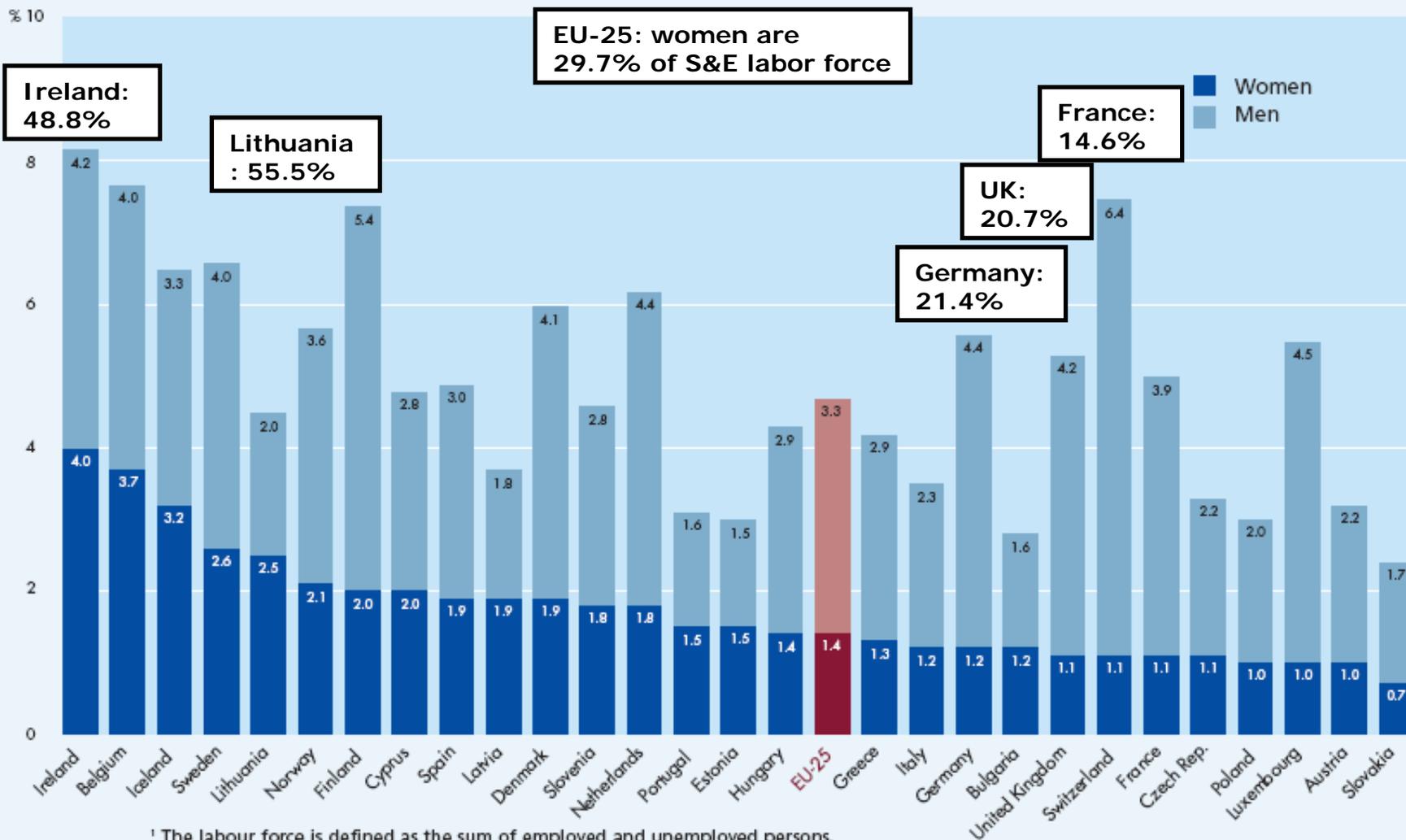
Women
Men

[1] The labour force is defined as the sum of employed and unemployed persons.

Source: Eurostat Community Labour Force Data
Exception to the reference year: NO: 2002; DK, LV, NL: 2003
Data unavailable: MT, RO

What does the research tell us…

- **Women (and many men) tend to become much more enthusiastic about engineering if they see early…**
  - **The impact of engineering on society, especially as a <u>humanitarian discipline</u> that increases public welfare**
  - **They get <u>hands-on experience</u> with engineering related projects**
    - **It is much too late to wait to the last year**

Retention:
Real World Engineering Projects

- Develop new projects for first year students of EE, CE, CS and EET that…
  - Focus students on Real World problems with solutions that benefit society
  - Get students excited about their own, original creative solutions
  - Increase student retention through personal satisfaction and accomplishment
  - Enhance student accomplishment through achievement
    - www.realworldengineering.org/

Standards and RWEP

- **Standards are largely missing from the current RWEP portfolio**

- **We have an opportunity to introduce standards to first-year ECT students**

- **Needs to be done in a way that is attractive and related to human welfare**

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ACCREDITATION OF ACADEMIC PROGRAMS

IEEE's Role in Accreditation (1)

- **IEEE considers accreditation a key vehicle to ensure active involvement of IEEE in maintaining the <u>quality</u> and <u>relevance</u> of engineering education**

- **IEEE seeks a leadership role in accreditation within <u>all the areas of its technical activities</u>**

IEEE's Role in Accreditation (2)

- **IEEE seeks leadership in accreditation <u>worldwide</u>**
  - Including participation in development and administration of accrediting bodies

- **IEEE seeks to develop and support <u>local accrediting bodies</u> where such bodies do not exist at the present time**

IEEE's "Traditional" Role in Accreditation

- In the US – active participation in accreditation activities as a founding member of ABET

- Outside the US – symposia and workshops on accreditation and higher education

EAB's Recent Accreditation Projects

- **Development of IEEE's position paper on accreditation**

- **Development of a comprehensive on-line resource on accrediting bodies and mutual recognition agreements: Accreditation.org**

- **Assistance to emerging accrediting bodies and accreditation projects worldwide:**
  - China, the Caribbean, South America: Peru, [El Salvador, Ecuador]

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Accreditation in the Caribbean (CACET)

Accreditation in China (with CAST)

Accreditation in Peru (ICACIT)

Accreditation in Peru (ICACIT)

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ACCREDITATION.ORG

THE TECHNICAL ENGLISH PROGRAM

Technical English Program

Technical English Program

- **Provide Technical English training for undergraduate students, and others, who are non-native speakers of English**

- **Program initiated by the Russia Northwest Section**

- **EAB's intent is to spread the program to other venues in 2010-2012**

- **A pilot program in South America was launched in July 2009**

- **http://www.ieee.org/web/education/technical_english/index.xml**

IEEE Technical English Workshop

St. Petersburg, Russia
20 December 2008

Part I: Data compression
Part II: Secure data communications

October 2009 – "show and tell" in St. Petersburg

- ▣ **EAB and the Russia-Northwest Section will conduct a workshop**
- ▣ **IEEE volunteers from other Sections will be invited to observe**
- ▣ **Observers will attend pre- and post-workshop sessions to examine applicability to their own Sections**
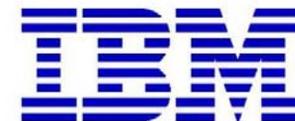- ▣ **EAB will assist Sections that wish to start their own TEPs**

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WORKSHOPS AND SYMPOSIA

General Objectives of the Conference

- **Identify the desired skills and knowledge that future engineers would require**
  - as it applies to both products and services

- **Understand who will deliver education that meets these needs**
  - And what are the structural and curricular adjustment that are needed

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Standards in the future curriculum

- There is room in the program for papers on the role of Standards in the curriculum

- There may be room for a plenary speaker or participants on panels who will bring to the conference Standards-related issues

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Continuing Education

- ▣ **Objective:**
  - **To provide IEEE members and all persons involved in IEEE's fields of interest with accessible and affordable high quality continuing education products**
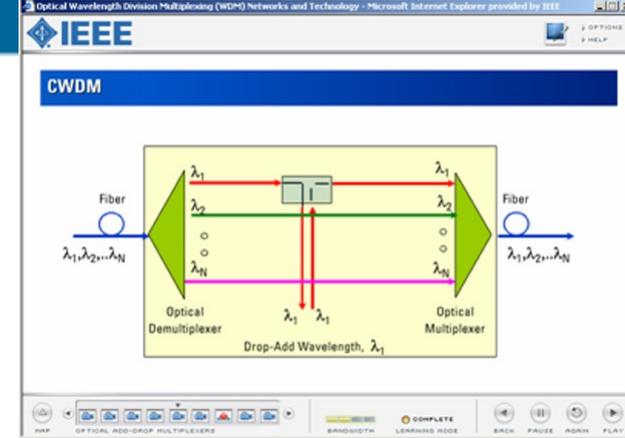
Main Activities

- **On-line tutorial library:** IEEE Expert Now

- **On-line course library:** Educational Partners Program

- **Development of** certification programs

- **Consolidation of** on-line continuing education offering across IEEE

IEEE EXPERT NOW

Expert Now IEEE

- **The best of IEEE's educational content delivered in one-hour long online learning modules**
  - Approximately 100 modules are included in the current version

- **The latest information on emerging technologies and seminal works**
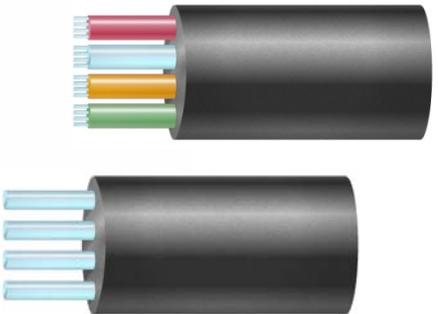 - Presented at the best of IEEE's conference tutorials, short courses and workshops

Optical Fiber Communication

Selected Titles

SOCIETY	SME	TOPIC
Communications Society	Kai Siwiak	UWB Radio Technology
Computer Society	Dwight Borses	Wireless Sensor Networks
Electron Devices Society	John Cressler	RF Devices & Circuits
Engineering Management Society	Mike Aucoin	Transition to Management
Industry Applications Society	Eric Perrson	Inverter Power Stage Design for Appliance Motor Drives
Lasers & Electro-Optics Society	Ira Jacobs Joe Campbell	Introduction to Fiber Optics Optoelectronic Devices for Fiber Optics
Power Electronics Society	David Middlebrook	Design-Oriented Feedback and Analysis
Reliability Society	Wayne Ellis	Effects of Reliability Mechanisms on VLSI Circuit Functionality
Solid-State Circuits	Arya Behzad	Wireless-LAN Radio Design

Expert Now Modules about Standards

Title	Who sponsored	Presenter
Home Networking Standards	ComSoc	Marie-José Montpetit
Introduction to IEEE 802	EAB/SA	Todor Cooklev
Introduction to IEEE 802.11	EAB/SA	Todor Cooklev
Introduction to IEEE 802.15	EAB/SA	Todor Cooklev
Introduction to IEEE 802.16	EAB/SA	Todor Cooklev
Introduction to IEEE 802.11n* Physical Layer	ComSoc	Eldad Perahia
Introduction to IEEE 802.11n* MAC Layer	EAB/SA	Robert Stacey

*Based on draft (and so marked)
Will be updated as warranted

The Grand Vision...

- New standards and major revisions to standards will be accompanied by an Expert Now module

- Part of the standard proposed package for purchase of a new standard

In addition to their availability for corporations…

- **The library modules are available to the membership for rental**

- **The library modules are available for Sections for educational activities**
  - **First trial run was in Singapore**

IEEE Education Partners Program

- **Program offers IEEE members a 10% discount on courses through partnerships with academia and industry**

- **The program is offered as a Member benefit**

- **Over 3500 courses are available**

- **The Continuing Professional Education Committee provides volunteer oversight**

Main Programs Reviewed Today

- **Teacher in Service Program**
- **TryEngineering.org**
- **IEEE Workshops**
  - **Including the 2010 Dublin Conference**
- **Accreditation**
- **Accreditation.org**
- **Standards Education**
- **Technical English Program**
- **IEEE Expert Now**

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