Gender in STEM

Viewpoint of a Woman Chemical Engineer

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Brno, South Moravia
14-15 October, 2015

The Czech Academy of Sciences


WE'RE TRYING TO ACHIEVE BETTER GENDER BALANCE...
JOHN BYRNE

Outline

- Introduction
- Historical Perspective
- Science and Technology
- Mathematics
- Engineering
- Why more women for science, technology, engineering and mathematics?
- Recommendations
- Conclusions

Introduction

Throughout the history women have struggled for their rights.

During the last 150 years many trends and attitudes have changed depending upon the needs and the political missions to alter the inequality with respect to gender and in some countries, women found place and fought for their existence also in the STEM area.

Historical Perspective

Actually, how long have people been active in science?

The answer is the same for both women and men –

"as long as we have been human."

Dr. Deborah Crocker at the University of Alabama and Dr. Sethanne Howard retired from the US Naval Observatory
http://www.astr.ua.edu/4000ws

Historical Perspective

- First, science was for religion and scientists served for religion.
- Later both are used for military purposes.
- Now, we want science to be used for humanity and for the human welfair in a sustainable way by scientists (men and women) .

Some conflict examples:

AMONG 340 PAINTINGS OF PICASSO (20th century artist) IN A GALLERY

Mothers

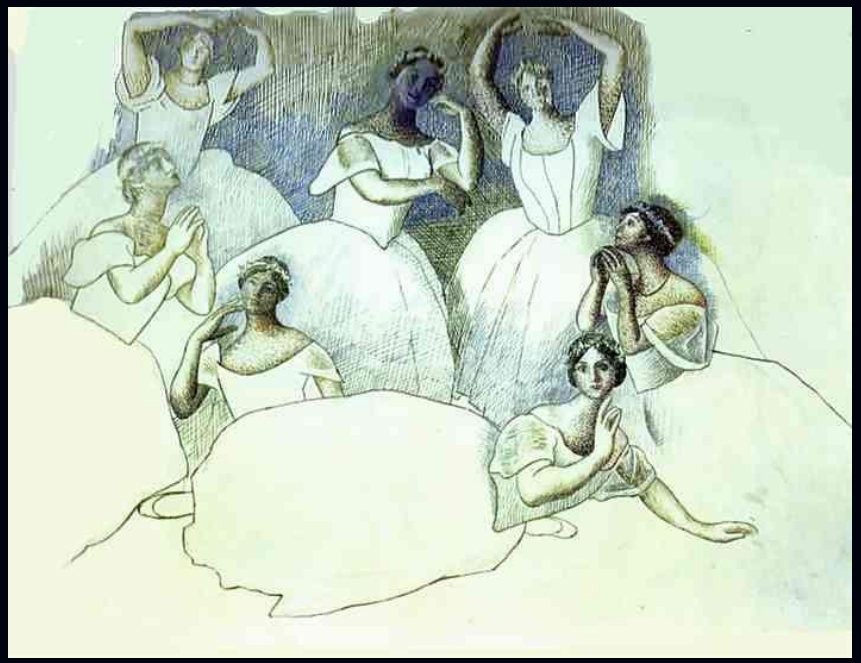
Pablo Picasso,
Mother and Child.
1921-22

Lovers

Pablo Picasso *The Lovers.* 1923.

Entertainers

Pablo Picasso,
Woman Playing the Mandoline. 1909



Dancers

Pablo Picasso. ***Group of Dancers. Olga Kokhlova is Lying in the Foreground.***
1919-20.

Workers

Pablo Picasso, *Woman Ironing*, 1904.

(Among 340 paintings in a gallery) only two differs as:

Reader

Pablo Picasso, *Young Girl Reading a Book on the Beach.* 1937.

Painter

Pablo Picasso. ***Interior with a Girl Drawing.*** 1935.

Even a **Nobel Laureate** Sir Tim Hunt said:

"*If women enters a laboratory three things happen:*

1. *They will fall in love with you,*
2. *You will fall in love with them,*
3. *They will cry when they are criticized.*"

SO WHAT???

A Software Engineer Case: Ms. Isis Wenger

Ms.Isis Wenger
(software engineer)
23rd August 2015

- She started as an **software engineer** in a **OneLogin** company.
- Company used her photograph in their **recruiting campaign** as:


MY TEAM IS GREAT.
EVERYONE IS
SMART, CREATIVE
AND HILARIOUS.
ISIS WENGER
PLATFORM ENGINEER
onelogin.com/careers
onelogi
NGINEERING

Example of some tweets send:

"If she is an engineer I am an astronot."

"Can a woman engineer look like this girl?"

"…., when you were a man, we could talk about your athleticism, your business acumen," …."But now you're a woman, which means your looks are really the only thing we care about."

She writes in **Linkedin** as:

"***Yes, I Do Look Like An Engineer"***

"*Hi, my name is **Isis**. I'm a full-stack **engineer** at **OneLogin.** They asked me to be one of four others participating recruiting campaign that was hastily planned and executed in one day. I was not personally ready for the amount of attention that it has brought me.*"

"Yes, I Do Look Like An Engineer"

- Who knew one simple Medium post could ignite such a profound movement?
- #iLookLikeAnEngineer is now being spread globally in over 50 countries. It has received over 75,000 tweets and has been covered in countless news outlets.

- She writes in **Linkedin** as follows:
- ***"I didn't want or ask for any of this attention, but if I can use this to put a spotlight on gender issues in tech I consider that to be at least one win. The reality is that most people are well intentioned but genuinely blind to a lot of the crap that those who do not identify as male have to deal with."***

Science, Technology, Engineering and Mathematics (STEM)

Science and Technology

"Humanity is our ability to affect and predict our environment.

Science - the creation of structure for our world and to understand the nature

Technology - the use of structure in our world

Mathematics - the common language of structure "

***Dr. Deborah Crocker at the University of Alabama and Dr. Sethanne Howard retired from the US Naval Observatory** http://www.astr.ua.edu/4000ws

" The great book of nature can be read only by those who know the language in which it was written. And that language is mathematics. Mathematics is the way to understand all sorts of things in the world around us."

Galileo

Understanding of **science technology and mathematics by everybody** will only strengthen our life, our work and our world.

MATHEMATICS
is important.

Why Mathematics is so important?

"…According to the famous Philosopher Kant, "***A Science is exact only in so far as it employs Mathematics***".

In this modern age of **Science and Technology,**

"***Mathematics is a Science of all Sciences and art of all arts***."

Jay Prakash, retrieved on Sept, 2015

Why Mathematics is so important?

Mathematics is a creation of human mind concerned chiefly with **ideas, processes and reasoning.**

Mathematics is a **way of thinking,**

a way of organizing a logical proof. As a way reasoning, **it gives an insight into the power of human mind…** creation of human mind concerned chiefly with ideas, processes and reasoning.

Why Mathematics is so important?

"*Mathematics is the most versatile of all the sciences. It is uniquely well placed to respond to the demands of a rapidly changing* ***economic landscape****...*

Mathematics now has the opportunity more than ever before to under-pin quantitative understanding of industrial strategy and processes across all sectors of business."

Jay Prakash, retrieved on Sept, 2015

Engineering

It is a profession that bridges between science and technology.

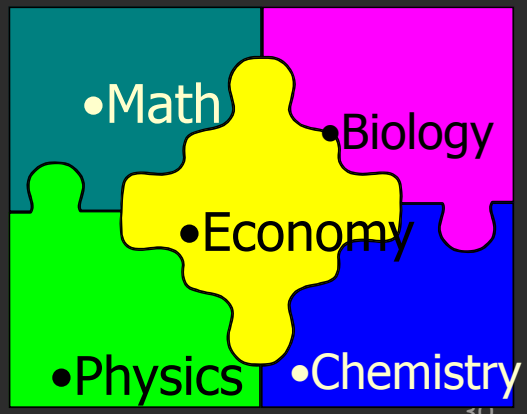
It is a systematic thinking.

It is a process of facing a need in a functional, technical, economic, aesthetic way, in quality and in time, by applying scientific knowledge to practical problems.

Engineer

- The profession of engineer takes the knowledge of mathematics and natural sciences gained through study, experience and practice and applies this knowledge with judgement to develop ways to utilize the materials and forces of nature for the

benefit of human.



ENGINEERS
(Men and Women)
ARE PROBLEM SOLVERS.
We are in need of them in everywhere!!!

STEM

- *" It is economically unacceptable to have only men in STEM, because of the waste of human resources, since it prevents half of the population from taking part in building the world.*
- *"It is intellectually unacceptable, because it deprives scientific and technological research ideas and methods in a world of creativity. " **

*Mayor, F., Women, science and technology, Towards a new development. UNESCO, Imperimerie Landais Pb. Noisy-le-Grand, 1999.

Why more women in STEM?

Four main arguments are *

- ***"The recruitment argument: There are not enough male students to fill the needs for more engineers in the future.***
- ***Equality argument: Women should have equal opportunities and equal possibilities to go into STEM.***
- ***Power argument: Engineering as a profession represents a lot of power in society and power ought to be shared between all groups.***
- ***Value and culture argument: Women might bring other values into STEM and change the culture of technology. "***

***Brandell, G., Gender in Engineering Education , Lule' University, Department of Mathematics, Sweden, 1996**

As women work more in STEM

- At the meeting of B20 in September 2015, a section of G20 in work place and W20 subject to women in work place, it is said by Christine Lagard (Head of IMF) that:

"As women take part in workplaces, they reduce the poverty and inequality, and this is seen clearly in those countries where there are women in different economies… The key is the education and to strengthen the position of women in the society."

General Secretary of OECD Angel Gurria said:

"When we look areas of science, technology, engineering and mathemetics, the problem is not that women in these areas (STEM) are less successful, but the problem is that we don't have women in these areas."

Study of STEM will help women to be leaders and managers.

As women work more as leaders

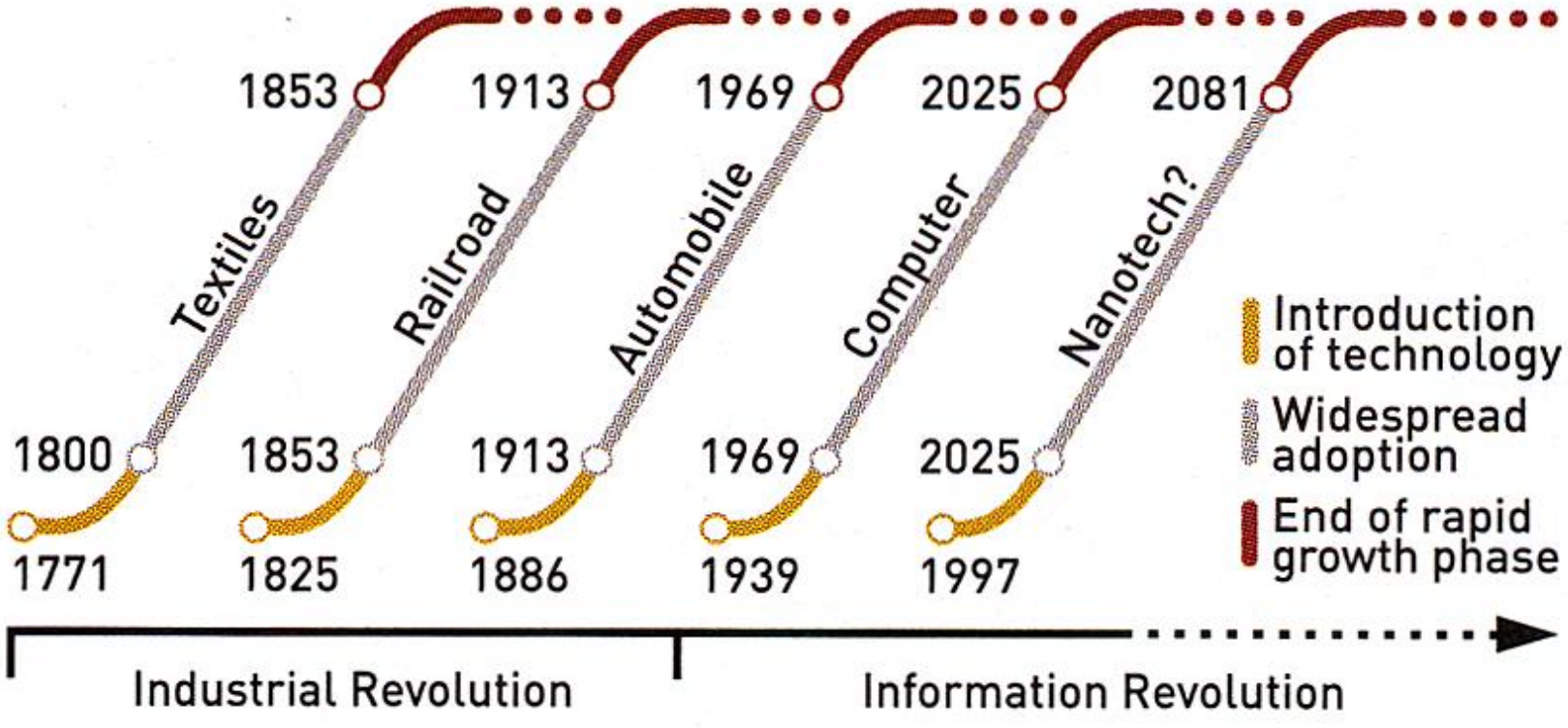
- "As women gain greater power at the **political level**, many **economic** shifts can occur.
- In Britain since 1997 they doubled female representation in the parliament by **18.2%**. As a result family issues such as tax credits, **health care, child care, education** have received more money and more attention.
- In India, female council **leaders** have taken on **60%** more water projects then the male counterparts.
- If women with political power can help do goverments' spend more on health, education and social safety, they may be catalysts of a better world."*

*Anita Kirpalani, Newsweek 2009

In 21st Century
new fields of research
in STEM area for men and women

REVOLUTIONARY FORCES

Basic advancements in science and technology come about twice a century and lead to massive wealth creation.



SOURCE: Norman Poire, Merrill Lynch

In 10 Years

- *"The income of **knowledge jobs** will be 5-7 Billion $*
- ***Wind and solar energy** will face **16%** of the electric energy and thus **1.5 Million** peoples' transportation without any accidents will be guarantied by vehicles without any drivers.*
- *Virtual global factories will be producing in increasing trends."*,**,***

New Technologies

- ***"Knowledge technologies***
  - *New Swarm Robots in micro and macro scale will be used as a result of automation and mechanization.*
- ***Numerical technologies,***
  - *3D printers, synthetic materials will be used in industrial productions.*

***Examples**: Baxter www.rehinkrobotics.com/baxter/*

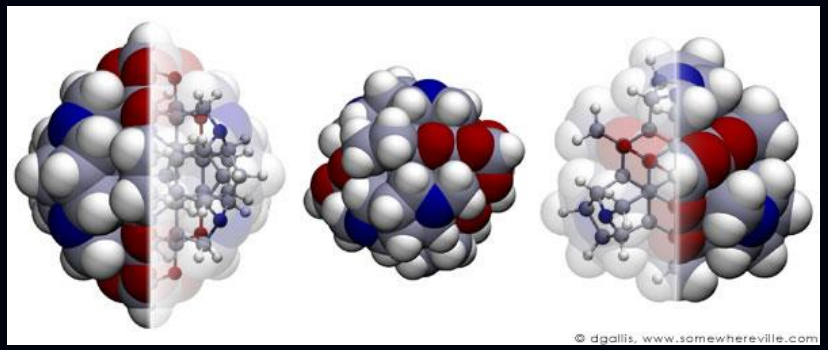
Kiva , Watson PC"

*Erdal Musoğlu, CBT 1485, Sept 4th, 2015

**http:// secondmachineage.com/

***www.economist.com/node/21553017

- Women will be working in all these areas, computer science, medicine, in virtual systems, nanotechnology, nanomedicine etc. as engineers.



A Success Story, Gender Issues related to STEM in Turkey

After the First World War, the newly established state of the Turkish Republic put into action many reforms. The regulations implemented such as;

- outlawing of polygamy,
- establishment of universal suffrage,
- guaranteeing of equality between sexes before the law,
- equal status to women with men in the public.

The equal rights of citizenship, career acquisition opportunities for higher education were given to Turkish women as a sign of Westernization.

"Humanity is composed of women and men. Is it possible to have development in the total of a mass by neglecting one part of it, while developing only the other? Is it possible to raise one part to sky while the other part is bound (stick) to ground?"

M. Kemal Atatürk

Gender Issues in Turkey (cont'd)

- Modernization of the Republic brought out a new Turkish culture emphasizing more on women. **Woman was the project of the new Republic.**
- Self confident, **educated modern women with ideals** had new roles in the society.
- Even Turkish artists painted these ideals.

Şeref Akdik

Ercüment Kalmık

Halil Dikmen

İbrahim Çallı

Zeki Faik İzer

- ***"Turkish experience in the last 90 years has demonstrated that, through deliberate state policies women's entry into the academic community has been made possible"*.**
- *Acar, F.,Women in Science: Token Women or Gender Equality, Ed. By Veronica, Stoline-Heiskanen, Berg Publishers Ltd. Oxford/NY, 1991

The percentages of women academics in different countries*

*Lundberg, I .E., S. Ozen, A.G. Ayata and M.J. Kaplan, Women in Academic Rheumatology, Artrites and Rheumatism, 52(2), 697-706, 2005.

Country	Year	Full Prof.	Assoc.Prof.	Assist. Prof.
Turkey	1996/7	**21.5**	30.7	28.0
Finland	1998	18.4	n.a.	n.a.
Portugal	1997	17.0	**36.0**	44.0
Australia	1997	14.0	23.0	40.7
France	1997/8	13.8	34.2	n.a.
Spain	1995/6	13.2	34.9	30.9
USA	2002	13	24	n.a.
Norway	1997	11.7	27.7	37.6
Canada	1998	12.0	n.a.	n.a.
Sweden	1997/8	11.0	22.0	**45.0**
Italy	1997	11.0	27.0	40.0

Country	Year	Full Prof.	Assoc.Prof.	Assist. Prof.
New Zeland	1998	10.4	10.2/23.5	**45.5**
Greece	1997	9.5	20.3	30.6
UK	1997	8.5	18.4	33.3
Iceland	1996	8.0	22.0	**45.0**
Israel	1996	7.8	16.0	30.8
Belgium (Fr)	1997	7.0	7.0	18.0
Denmark	1997	7.0	19.0	32.0
Ireland	1997/8	6.8	7.5	16.3
Austria	1999	6.0	7.0	12.0
Germany	1998	5.9	11.3	23.8
Switzerland	1996	5.7	19.2	25.6
Belgium (Fl)	1998	5.1	10.0	13.1
The Netherlands	1998	5.0	7.0	20.0

Women in Academia World-wide (percentages)*

Universities in the first 400 (THE, 2013)

Japon	% 27
UK	% 34.6
USA	% 35.9
Sweden	% 36
Norway	% 31.7
Netherlands	% 31
Türkiye	% **47.5**

* Acar Feride, AGEP Presentation, 2015

Women in Academia World-wide (percentages)* (cont'd)

Universities in the first 400 (THE, 2013)

According to fields:

Art and Humanities	% 43
Socal Sciences	% 38.5
Basic Sciences	% 19
Engineering and tech.	% 15

According to titles:

C Group	% 44
B Group	% 37
A Group	% 20

2014

- Considering the **192** universities of Turkish Republic (private ones included) the percentage of **women in**
  - **Full professors 29 %**
  - **Associate professors 35 %**
  - **Assistant professors 40 %**
- The overall women academics are **35.47 %** of the total academics (69153) in all faculties.

* http://www.yok.gov.tr/istatistics

Middle East Technical University (METU)

A Beautiful Environment

Middle East Technical University (METU)

METU is proud to employ about 1115 faculty (professors, associates professors and asst. prof.), 324 academic instructors and 1,259 research assistants.

There are three campuses.

It is offering education to ~28,000 students.

Now, the total number of the alumni is above 120,000.

METU is among the Top Three Universities of the World in Emerging Economicies Rankings 2015

METU is among the Top 100 Universities of the World in 10 subjects according to UK based QS rankings 2015

METU*

	Women(%)	Men(%)
Students	44	56
Academics and Research Personnel	52	48
Administrative and Technical Personnel	32	68

*Prof. Dr. Feride Acar, AGEP Presentation, 2015

METU*

TITLE	Women (%)	Men (%)
Full Prof.	32	68
Assoc. Prof.	45	54
Asst. Prof.	47	53
Instructor	78	22
Research Assist.	50	50
TOTAL	52	48

*Prof. Dr. Feride Acar, AGEP Presentation, 2014

METU- Faculties*

Faculty	Women(%)	Men (%)
Art and Sciences	53	47
Economic and Administrative Sciences	52	48
Engineering	32	68
Architecture	62	38
Education	68	32

*Prof. Dr. Feride Acar, AGEP Presentation, 2014

METU Faculty of Engineering

Engineering Departments	Women (%)	Men (%)
Mechanical	11	89
Aerospace	16	84
Computer	23	77
Metallurgical and Materials	25	75
Electrical and Electronics	26	74
Mining	28	72
Civil	29	71
Geological	31	69
Engineering Sciences	32	68
Petroleum and Natural Gas	35	65
Chemical	60	40
Environmental	63	37
Industrial	63	37
Food	67	33
TOTAL	32	68

Still, we are far away from gender equality especially in engineering faculty!!!

Recommendations for having more women in STEM

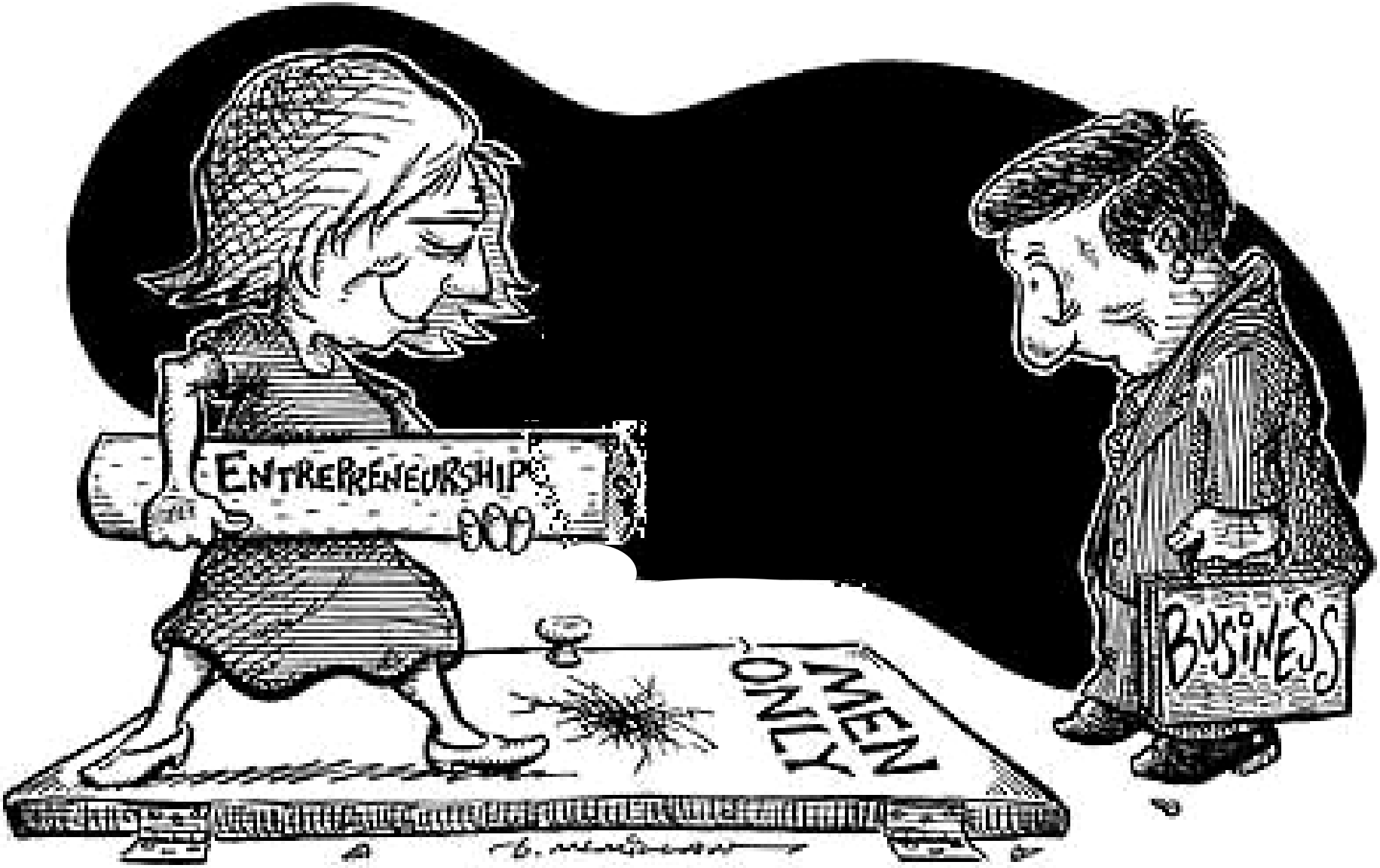
Recommendations for having probably more women in STEM *

- *"enrich girls experience of science at all levels,*
- *draw attention to eminent women scientists as role models and bring women scientists to schools to explain science and engineering,*
- *modify teaching practice to increase teacher sensitivity to gender issues in STEM,*
- *inform parents about the importance of STEM education"*

*Newhouse-Maiden, L., Life Career Histories of Women Engineers – A Socialist Feminist Perspective, PhD Thesis, Curtin University of Technology, 2003.

Conclusions

- Women in STEM will continue to work every day to solve problems and make the world a better, cleaner, safer place.
- These women are also actively will be involved in their communities, raising families, end enjoying all kinds of sports and hobbies.


ENTREPRENEURSHIP
MEN ONLY
BUSINESS

Turkish case may be a good example of how political will and affirmative action in 1930's resulted in a significant change.

Deliberate state policies promoting women's upward mobility and empowerment through education have contributed to the high percentage of women in academic life which is still continuing basing on this heritage.

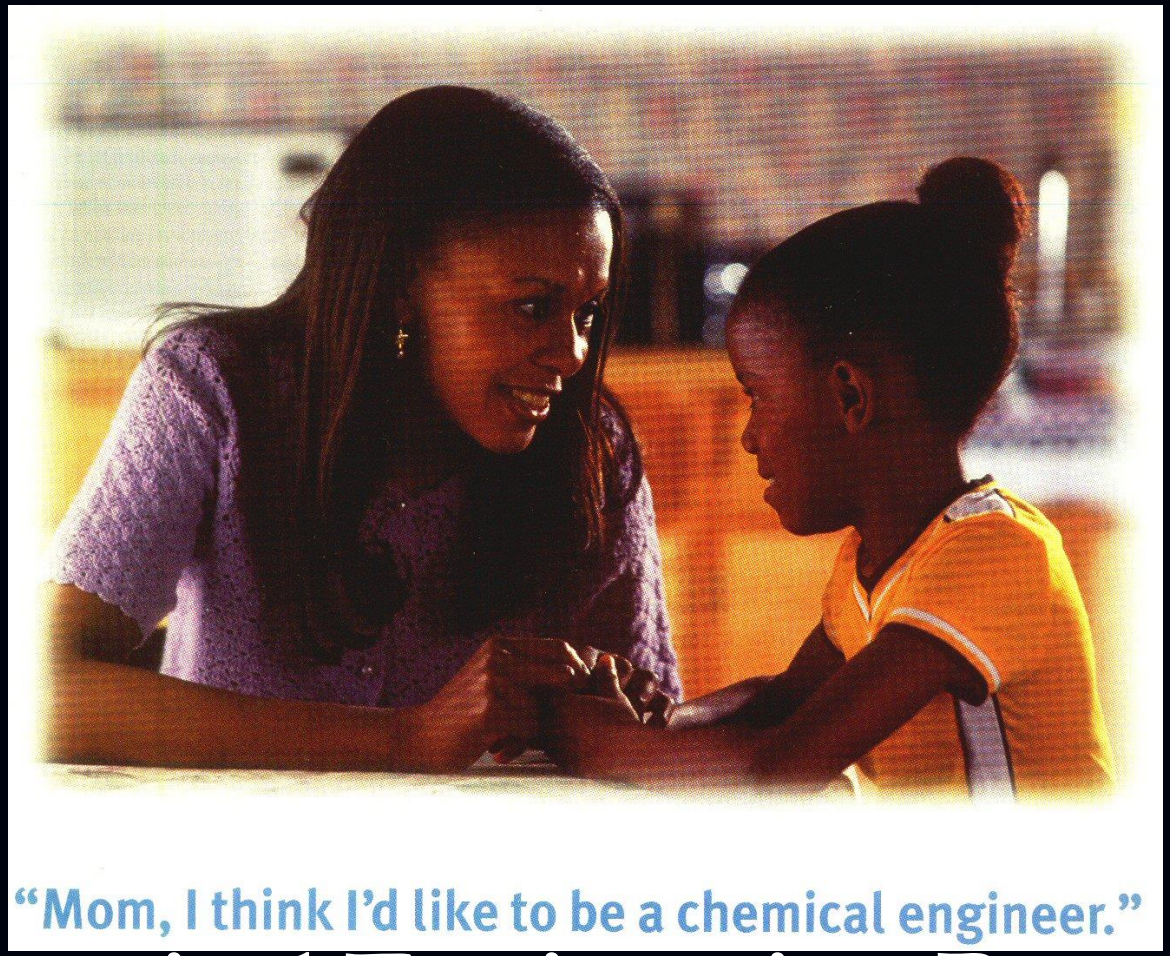
Conclusions (cont'd)

Diversity in faculty will facilitate creativity in academic research and scientific discoveries, thus the community of science will be able to respond to a wider array of needs and demands.

As academics, we have to attract and retain those individuals with skills in **science and leadership**.

We must use **advertisement** and role models to facilitate more women in STEM and establish more societies like **SWE.**

Advertisement



Chemical Engineering Progress,

Jan 2002, p 90.

In every country, societies such as "The Society of Women Engineers" (SWE) can be founded.

- Founded in 1950, is a not-for-profit educational and service organization.
- SWE is the driving force that establishes engineering as a highly desirable career aspiration for women. SWE empowers women to succeed and advance in those aspirations and be recognized for their life-changing contributions and achievements as **engineers and leaders.**

It is believed that in 21st century, sustainable economic and social development can be achieved only by **gender equality**, human rights and by environmental concerns.

Dalsu Özgen, 1985 Intern. Human Rights Society's Art Award in Painting

THANK YOU