The Next Generation of Women in STEM: Making Transformative Change

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Our mission is to advance engineering and science as welcoming careers that serve our world through holistic understanding and creative, appropriate and sustainable solutions.

www.wwest.ca
Female Talent Pool

Percentage of Women at Stages of the Career Pipeline:

60% of university students
48% of the overall workforce
40% of scientists
37% of managers
18% of VPs and senior executives
15% of Boards
11% of Engineers
6% of Fortune 500 CEOs

Catalyst Research (2012)
Today’s Discussion:
- Find Facts
- Debunk Fiction
- Share Strategies

Create Transformative Change
A note:
This discussion is based on generalizations. They apply to populations, but not necessarily individuals.
Unpacking Facts and Fiction

Boys have better math & spatial skills

Girls just aren't interested in STEM topics

There isn't really a need for more diversity, anyways
Fact or Fiction:
Boys are inherently better suited to careers in science, engineering, technology, and math
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Does math ability predict participation?

- Mean math ability for males and females are the same.
- The maximum variance ratio between males and females in the literature is 1.21 (two-tailed).
- To account for only 20% women in engineering because of “math ability” alone, engineering would have to require only math geniuses ... (4 SD above average, 1:20,000)
Math Performance

Theoretical normal distributions for males (orange line) and females (green line) when their means are identical \[true\] and the M:F Variance Ratio = 1.2 \[maximum in literature\]

Hyde J S, and Mertz J E PNAS 2009;106:8801-8807
But there are differences

Whether biological or sociological, there are some general differences by the time kids are in school.

**Boys**
- Visual tracking of fast-moving details from a distance
- Mental rotation of 3-D objects (spatial skills)*
- Upper body strength
- Risky behaviour

**Girls**
- Colour acuity
- Verbal language skills
- Perceptual speed
- Anxiety levels
Are our initial assumptions about what skills people in STEM need actually correct?
Large STEM companies in the UK made a list of skills employers want:

1. Communication & interpersonal skills
2. Problem solving skills
3. Initiative and self-motivation
4. Working under pressure and to deadlines
5. Organisational skills
6. Team work
7. Ability to learn and adapt
8. Numeracy
9. Valuing diversity and difference
10. Negotiating skills
Fact or Fiction:

STEM careers just aren’t interesting to girls.
Fact or Fiction:

STEM careers just aren’t interesting to girls.
Stereotypes are not the reality

It’s a 
marketing 
issue
ENGINEERING:

a creative engaging rewarding profession where people solve problems design solutions help local & global communities and love what they do
Engineers solve problems

- Food
- Climate Change
- Clean Energy
- Clean Water
- Transport
- Urbanization
- Biomedical
- Healthy Advances
- Data Security
- Communication
- Exploration
- Health Advances
AJung Moon

Designing robots that can interact well with people.

Humanizing assistive technology.
Kristy Meents
Designing solutions for the oil and gas sector that work for everyone.
Contributing to one of Canada’s largest economies.
Engineers are changing our world. Belinda Li is collaborating to bring reliable and sustainable access to safe drinking water to communities in Malawi. Creatively solving global problems.
Fact or Fiction:
There is no pressing need to increase diversity in STEM.
Fact or Fiction:
There is no pressing need to increase diversity in STEM.
Solutions to Skills Shortages

95,000 professional engineers will retire by 2020

“Canada will face a skills shortage because the workforce cannot be replaced fast enough.”
Exhibit 2.2
National Engineering Employment Growth by Industry (Expansion Demand)
Index 2009 = 100

Source: Prism Economics & Analysis, C4SE
Business Case Summary

- Access of employers to a broader talent pool
- Increased innovation potential and market development
- Stronger financial performance
- Improved governance
- Greater return on human resource investment

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The chart plots the collective intelligence scores of the 192 teams in the study against the percentage of women those teams contained. The red bars indicate the range of scores in the group of teams at each level, and the blue circles, the average. Teams with more women tended to fall above the average; teams with more men tended to fall below it.

Fact or Fiction:
There is nothing we can do to change the numbers.
Fact or Fiction:

There is nothing we can do to change the numbers.
Strategies for changing the story
Know & share the context
Implicit Bias: the assumptions and conclusions we jump to without thinking

Women are 50% more likely to advance in an orchestra audition if they can’t be seen.³

US science professors were asked to evaluate a CV for a lab manager:²

$30,230.10
$26,507.94

The male candidate was offered a higher salary...

... more mentorship

... and was rated more “competent” and “hireable.”

The catch? Other than the names at the top, the CVs were identical.²
Stereotype Threat: Concern with being viewed through the lens of a stereotype.

Impact on STEM
Reduced: Performance\textsuperscript{18} of women & minority students on the SAT, by 50 points\textsuperscript{18}

Job Engagement & Organizational Commitment in academia\textsuperscript{11} & in the engineering industry\textsuperscript{12}

Coping Strategies & Alleviating the Threat
Role Models
Show that others have struggled and succeeded\textsuperscript{9,17,20}

Self-Affirmation
Write about your core values\textsuperscript{21}

Reframing the Situation
Create identity safe contexts e.g. gender-fair tests\textsuperscript{3}

Learning about Stereotype Threat
Performance improves when stereotype threat is explained before a test\textsuperscript{14,15,19}

Attribute the anxiety to the stereotype, not the self\textsuperscript{14}
“Threat in the air”
Integrated process model of stereotype threat
(adapted from Schmader, Johns, & Forbes, 2008)

This process does not have to be conscious.
the biggest influencer on youth?
the biggest influencer on youth?

parents

(teachers are number 2)
Marketing Matters

STEM is more than they think
Try this:

Picture a scientist or engineer
Did I guess right?

We need to tell real, relatable stories
Engineers are Changing Our World

Annelies Tjebbes developed VersiCool, a medical device inducing therapeutic hypothermia to improve survival rates of cardiac arrest.
Engineers are Changing Our World

Tagg Jefferson and Lin Watt developed a portable field device to measure water quality with laboratory-grade accuracy.
Talk – a lot

- Talk about problem solving and impacts on society… not just technical details
- Use role models that are relatable and real
- Inclusive language
- Images that reflect the diversity of the larger community
- If given the opportunity to talk to the media, take it
- Use social media
Don’t do it alone
Investing in success

Find groups doing good things

Invest in training, development, and seed funds

Create a BIG impact
Works in many contexts

- WWEST Partners
- Non-Profits
- Workshop Pilots
- High School Teacher Training
- Co-Branded Marketing Materials

Shared investment builds sustainable capacity
Goal: To increase the **capacity** and **sustainability** of **existing organizations**, and build a network

- **Up to $6000 over 3 years**
- **Support and collaboration network**
- **In-person training meetings**

- Allows for long-term planning and stability
- Create or expand programs
- Increase sustainability
- Prove efficacy

- Fundraising
- Reporting
- Measuring Efficacy
- Succession Planning
WWEST Partners Impact

Youth
- GIRLsmart
- Girl Guides of Canada
- Girls Exploring Physics
- GEERing Up!
- Physics Outreach
- IEEE WiE STAR
- Science Adventures

Post-Secondary
- UBC-O WISE
- UBC-O Mentoring
- UBC WISE
- Leadership Through Diversity
- ABC WIE
- SFU WEG & WICS

Industry
- WIE-VR
- SCWIST

Conferences
- BC Young Women in Physics (2 years)
- Canadian Undergraduate Math Conference
- SWEET (Ecology and Evolution)
- NCWIE
- PIMS (Math) Young Research)
**Workshop Pilots**

- **Partner**
  - Find existing resources and help bring them to your region.

- **Build Relationships**
  - Create bridges with industry and professional associations

- **Show Value**
  - Measure efficacy to show value to industry leaders
  - Occupational Self-Efficacy is a strong predictor of career persistence

- **Mainstream**
  - Goal to **mainstream** targeted P.D. opportunities & make them sustainable
High School Teacher Training

- **Teachers**
  - Attended event on Pro-D day
  - Have a large **impact** on career decisions and student self-efficacy

- **University**
  - Organized event **logistics**
  - **Invited teachers** and provided lab tours, networking lunch

- **WWEST**
  - Provided **content**: engineering-related activities directly tied to Prescribed Learning Outcomes for Science 8, 9, & 10
  - Provided **supply kits** to teachers (~$10/teacher)

- **Low investment**
  - Large impact

- Pie chart: More likely to recommend engineering to female students

  - Yes: 84%
Co-Branded Marketing Materials

**Need**
- Clear, powerful, cited visuals on key topics

**Issue**
- High time investment to do the research & summarize for non-experts

**Solution**
- Create fact sheets, and help strategic partners co-brand for wider distribution

You’re making that up!

I need to see proof.
Stay the course
stick to it
over the long haul
“Our belief is that, as more women join boards without the imposition of quotas, the more they can demonstrate the value they can add.

“By the time we get to 30%, the system will be self-perpetuating.”

- Helena Morrissey, CEO, Newton Investment Management
Percentage of Women at Stages of the Career Pipeline:

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Catalyst Research (2012)
Create Connections ’09

Predictability can be good
Creating Connections 2013

- May 2013 at UBC Vancouver
- Over 300 participants: women and men, engineers, scientists, and business people
- Main objectives:
  - Build awareness of the importance of gender diversity in STEM
  - Encourage career persistence for women in STEM attendees
Value the small steps
“You miss 100% of the shots you don’t take”

- Wayne Gretzky
“You miss 100% of the shots you don’t take”

- Wayne Gretzky

They will decline 100% of the invitations you don’t extend.
Actively encourage her to explore all of her interests, even if they are dirty / difficult / un-“ladylike”

Avoid judgemental language around tasks

Encourage her to find solutions to problems in her everyday life, at home, and in the community
Dads who do chores help daughters grow up with broader career goals (with video)

BY IAN AUSTIN, THE PROVINCE  JUNE 4, 2014

Dads who do chores bolster daughters’ aspirations

May 2014

Fathers who help with household chores are more likely to raise daughters who aspire to less traditional, and potentially higher paying, careers, a new University of B.C. study says.

Fathers who help out around the house raise less traditional daughters, a University of B.C. study has found.
Encourage her to keep her options open and stick with math and science.
Let her try it out

Summer camps, outreach programs, and more.

www.geeringup.ca
engineering.ubc.ca/connects

wwest.ca