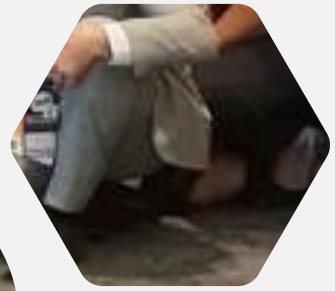

Measuring Gender Equity in Space Sciences: lessons from research and practice

Space4Women Expert Meeting

Daejeon, Republic of Korea | 17 Aug 2022

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Background

- Previously worked with UNOOSA for the first 2 years of the Space4Women mentorship program.
- MSc Aeronautics and Astronautics & Technology and Policy Program, MIT
- Currently in the final year of PhD at the Massachusetts Institute of Technology in space systems engineering
- Involved with women's advocacy groups in STEM including Graduate Women of Aeronautics and Astronautics and gender minority employee resource group

Measuring and and communicating gender disparities

Quantitative metrics of representation and parity give insight into outcomes, but do not tell the full story of gender equity in a field.

Metrics of representation:

- For example: % of women in field at each stage of career
- Outstanding questions: Why are women leaving the field? What contributes to the “leaky pipeline” problem?

Metrics of parity:

- For example: median salary by gender in STEM fields
- Outstanding questions: Does gender account for all pay disparity or are women self-selecting into lower paying roles within fields? Is this due to flexibility, nature of the work, environment differences, etc.?

Table 3.1. **Share of female employment in different types of occupations, selected space organisations**

Latest available year								
	CSA, CAN (2017)	SANSA, ZAF (2017)	CNES, FRA (2014)	NASA, USA (2017)	DLR, DEU (2017)	ESA (2016)	JAXA, JPN (2015)	ISRO, IND (2017)
Share of total staff	47%	39%	37%	34%	32%	26%	22%	20%
Share of “non-administrative and/or non-clerical staff”[1]	23% (scientific and professional positions)	37% (engineers and scientists/researchers)	26% (engineers)	23% (science and engineering occupations)	20% (scientific staff)	21% (executive staff, translators and “off-scale”, e.g. directors, staff)	12% (researchers)	16% (science and technology occupations)

Source: OECD [1]

To develop initiatives to address gender disparities and to evaluate the effectiveness of these programs, we need to understand the sources and impact of the disparities.

Lessons from Space4Women and the research

What questions do we need to ask and measure to understand if gender equity initiatives are reaching their intended goals?

Access

- Are women and girls aware of career and educational opportunities in space fields, and can they access and envision themselves in these roles?

Inclusion

- Do women, girls, and gender minorities view STEM environments as places where they are included and can succeed?

Formalized practices

- What gendered definitions of success and merit may exist in metrics used to evaluate performance and excellence?

Understanding and communicating access

Are women and girls aware of career and educational opportunities in space fields, and can they access and envision themselves in these roles?

Lessons from Space4Women. Disparity in geographical representation

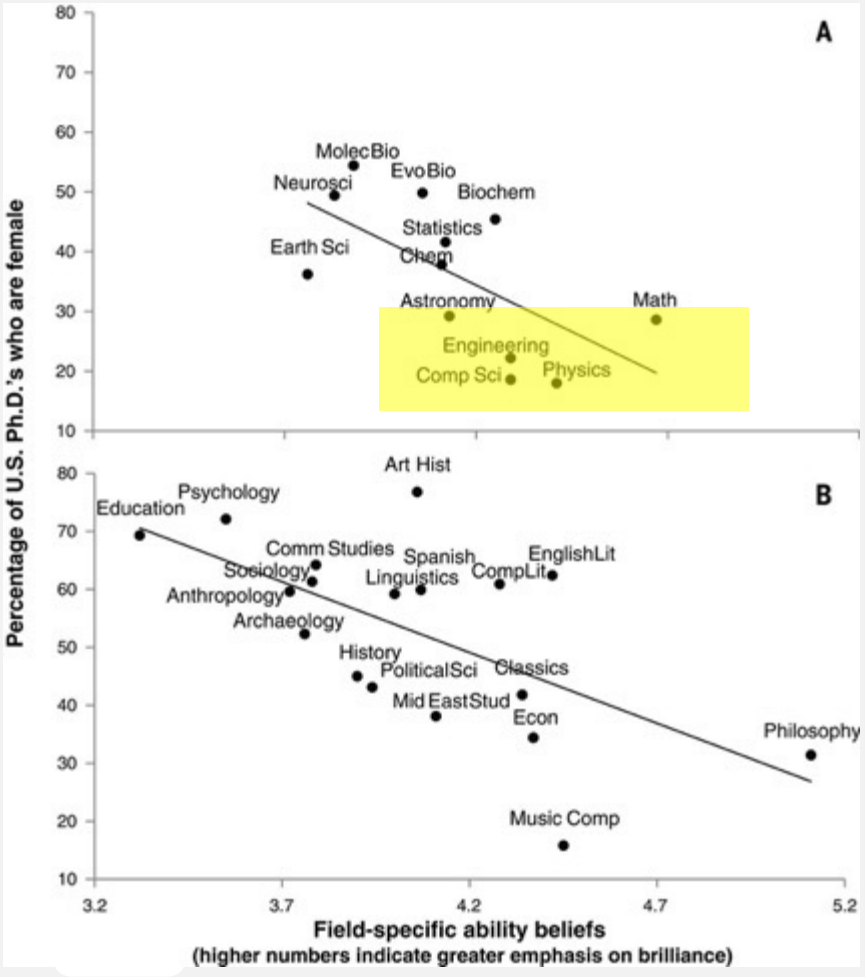
- >50% of the applicants for both mentors and mentees were from Europe or North America
- How to better reach and serve women and girls in areas with emerging space fields?

Lessons from the research. Diversifying space careers

- Women and girls surveyed say they are more interested in seeing the larger applications of their work and making the world a better place, don't necessarily connect this to engineering **[2]**
- How can we emphasize the importance of space applications for Earth applications and the SDGs?

Understanding and communicating inclusion

Do women, girls, and gender minorities view STEM environments as places where they are included and can succeed?



Source: Leslie [3]

Lessons from industry. Bias and lack of accommodations

- Lack of clear, retaliation-free reporting mechanisms for gender-based discrimination and harassment
- Many space industry careers lack paid parental leave to accommodate for caretaking roles which still predominantly fall to women

Lessons from the research. Cultural attitudes and stereotypes in STEM further the gender imbalance

- Surveys reveal pervasive beliefs that the hard sciences require "innate brilliance" or raw talent, whereas beliefs exist that other fields require empathy or hard work [3]
- Women are stereotyped as lacking these abilities and perceived as not suited for STEM fields
- No evidence shows women are less likely to possess intellectual talent or aptitude, and frequently perform similarly to male peers

Understanding and communicating formalized practices

What gendered definitions of success and merit may exist in metrics used to evaluate performance and excellence?

Lessons from MIT. “Objective” measures of performance may reflect the bias of the evaluator

- Women PhD students failed the qualifying examination at much higher rates than male peers with similar credentials
- Studies show assertive communication is viewed differently when done by women and men, and women frequently favor more “consensus-based” styles of communication, which may be viewed as a sign of weakness in technical fields [6]
- After review, some departments switched to a course-based exam style where performance is evaluated across classes and course grades
- Increased the percentage of women who continue on to PhD candidacy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The MechE qualifying exam fails women

Half of all women who failed the MIT Mechanical Engineering doctoral qualifying examination would likely have passed if they were men

By Becca Kurfess, Bethany Lettiere, Jerry Ng, and Nicholas Selby | Aug. 27, 2020

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Half of all women who failed the MIT Mechanical Engineering doctoral qualifying examination would likely have passed if they were men. Although this proportion is appalling, to many of us, it is not surprising.

The MIT Mechanical Engineering qualifying exams are notorious. Students study for months to prepare for the two-day qualifier consisting of three 30-minute oral exams and one hour-long research presentation. Most students pass, but those that do not must repeat the process, forgoing a second semester of research progress to study. If

Bar chart illustrating the exam pass rates of men and women in the department.

COURTESY OF NICHOLAS SELBY

Lessons from the research. Women candidates for professorships and publishing are often evaluated differently than men with no variable to account for the differences but gender [4] [5]

- Addresses a portion of the pipeline issue – if women are pushed out of the field at critical points in their career, they cannot continue into higher roles

Actionable steps and policy recommendations

Measuring and increasing access

Opportunities exist for Space4Women and space organizations to increase access to space opportunities and jobs through mentoring and education programs.

Opportunities for change

- Many existing traditional space roles are export-controlled and restricted to citizens of a specific country
- Existing fellowship programs (Brooke Owens fellowship, Patty Grace Smith fellowship, Zed fellowship) have been successful but are concentrated within North America
- As a UN initiative, Space4Women can serve a large need by being the first and only mentorship/ fellowship program accessible to students around the world
- Emphasis on SDG-related jobs and applications is a unique advantage not widely found in other programs

Recommendations

- **Pursue partnerships:** strong industry, academic, and space agency partners that can provide resources such as grants and internship openings for mentees
- **International representation:** opportunities must exist for applicants of all nationalities. Science/ SDG-related roles may be more accessible than military/ defense related roles.
- **Financial support:** grants, funding, and internship commitments for mentees to attend space conferences and be paid fair wages for their work
  - Existing examples: IAC Emerging Space Leaders Grant - international
  - Future Space Leaders Grant – US
  - Brooke Owens fellowship – US

Measuring and increasing inclusion

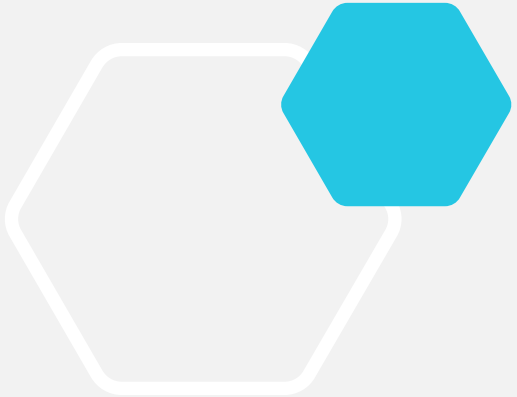
Advocating for evidence-based changes in organizational cultures and policies that adversely impact women.

Opportunities for change

- Organizational culture is frequently cited as a driving factor for women leaving the field or not entering in the first place
- With international reach, Space4Women is well positioned to gather survey data on existing norms and policies related to inclusion in the space sector

Recommendations

- **Advocate for equitable policies:** paid parental leave; clear policies and retaliation-free reporting mechanisms for gender-based harassment and discrimination
- **Gather data:** survey women in the space sector to better understand sources of pay disparities, job cultures, and reasons for leaving the field



Measuring formalized practices

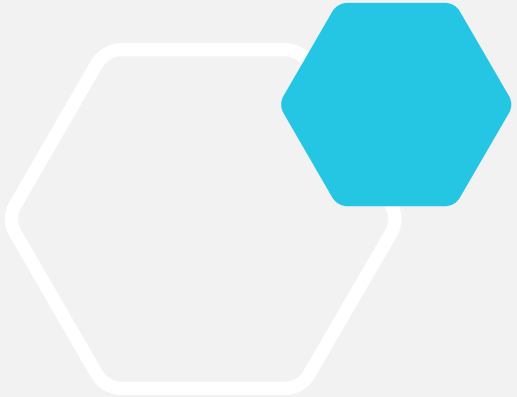
Partner with and support local groups and resources to understand their experiences with field and region-specific practices for hiring and acceptance, retention, and promotion in space sectors.

Opportunities for change

- Formalized practices in different fields, regions, and work cultures can impact the experience of women and gender minorities in unique ways
- These practices and methods of evaluation often occur at critical educational and career stages such as entrance exams, hiring, promotion, and academic publishing

Recommendations

- **Gather and communicate data:** identify mechanisms of promotion, review, and access in space fields to understand the “bottleneck” points in the pipeline issue
- **Partner with advocacy/ resource groups:** industry and field-specific resource and advocacy groups can interface with leadership and make specific concerns known



Thank you

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