

# Women in High Performance Computing

Changing the face of HPC



## WHPC: Striving for Equality for Women in High Performance Computing

### **Our mission**

To promote, build and leverage a diverse and inclusive HPC workforce by enabling and energising those in the HPC community to increase the participation of women and to highlight their contribution to the success of supercomputing. To ensure that women are treated fairly and have equal opportunities to succeed in their chosen HPC career. To ensure everyone understands the benefits of promoting and achieving inclusivity.

## WHPC: Striving for Equality for Women in High Performance Computing

**Communication:** Raise awareness of the under-representation of women and of the impact of this under-representation on women, the community and research outputs and progress.

**Dissemination:** Highlight diversity & inclusion initiatives, actions and their positive results to key stakeholders in the supercomputing community.

**Research:** Establish a body of evidence on the demographics of the HPC community.

**Visibility:** Raise the visibility of women role models in HPC.

**Networking:** Provide women with the opportunities to develop their personal professional networks.

**Best practice:** Inspire key stakeholders in the supercomputing community to embrace diversity and inclusion initiatives.



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## Challenges and Opportunities: Diversifying your workforce

Toni Collis, Women in HPC and Appentra Solutions

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WHPC

[www.womeninhpc.org](http://www.womeninhpc.org)

How many women are  
there in High Performance  
Computing?

WHPC



womeninhpc



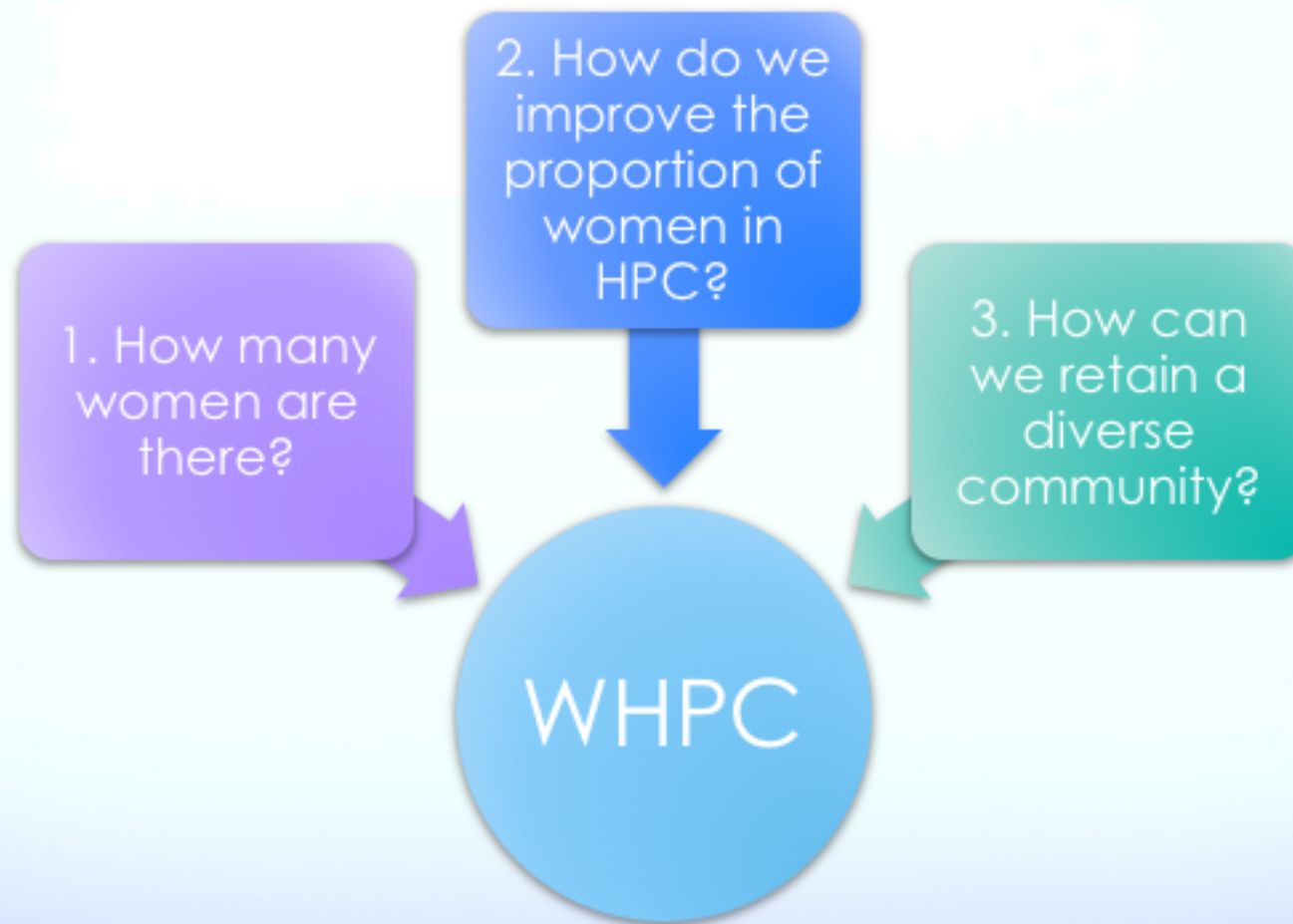
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How many women are  
there in High Performance  
Computing?





## Why is HPC different?

### How is HPC similar to 'niche' communities?

- A field that spans multiple 'traditional' subjects.
- Users of HPC maybe the only group, or individual in their department.
- HPC specialists often have very diverse educational/experience backgrounds (e.g. a computer scientists in a biology department).





## What do we know?

How many women are in our community?

- Women make up no more than 17% of our community
- 13% of SC15 and SC16 attendees were female
- Other conferences show as little as 5% (PGAS) and no more than 17% (PraceDays16)
- MPI Forum: 8% women



# What do we know? The Broader Community

- Physics & Astronomy: 17%
- Chemistry: 27%
- Biological sciences: 45%
- Earth, marine & environmental science: 36%
- Engineering & technology – 19%
- Computer sciences – 22%
- Mathematical sciences – 29%

Data from HEFCE UK <http://www.hefce.ac.uk/>

## Women in IT Occupations:

- US: 25%

*NCWIT report: Ashcraft, C., & Blithe, S. (2010). Women in IT: The Facts, 52.*

- Europe: 16%

*British Computer Society. (2017). Diversity Report 2017.*

- UK: 17%

- Women's participation as a proportion of the IT workforce has remained static in the last decade
- Overall workforce size has increased (up 19% 2004-2014)

*British Computer Society. (2017). Diversity Report 2017.*

# The Opportunity: The benefits of diversity

Address the workforce shortfall:

- US:19% increase in the computer science related workforce in the decade to 2024.<sup>1</sup>
- Europe: 756,000 IT sector job shortfall by 2020<sup>2</sup>
- Canada:182,000 IT positions.<sup>3</sup>

1. U.S. Bureau of Labor Statistics, O. E. S. program. (2014). Occupations with the most job growth. Retrieved May 29, 2017, from [https://www.bls.gov/emp/ep\\_table\\_104.htm](https://www.bls.gov/emp/ep_table_104.htm).

2. Hüsing, T., Korte, W. B., & Dashja, E. (2015). *e-Skills in Europe: Trends and Forecasts for the European ICT Professional and Digital Leadership Labour Markets (2015-2020)*.

3. Faisal, S., Asliturk, E., Bourgi, S., Savard, A., Aquilina, A., & Castillo, D. Del. (2015). *The Smart Economy Reshaping Canada's Workforce: Labour Market Outlook 2015—2019*. Retrieved from <http://www.digcompass.ca/wp-content/uploads/2015/07/Labour-Market-Outlook-2015-2019-FINAL.pdf>

## The Challenge:

How do we diversify our community?

"It's not our problem"

"The problem is down to schooling: the pipeline is leaky all the way up to us"

"The HPC community cannot influence diversity – the problem is elsewhere"

***But we can have a significance impact.***

# The Challenge:

## The pipeline problem

The problem (in IT at least) is getting worse:

- Education: women completing Computer/IT degrees:
  - 1985: 37% of CS/IT bachelor degree graduates
  - 2008: 18% of CS/IT bachelor degree graduates
  - 2016: 15% of CS/IT bachelor degree graduates
- Workforce: women in professional-IT related jobs
  - 1991: 36% of positions
  - 2008: 25% of IT positions (but 57% of all professional occupations)
  - 2016: 17% of IT positions (47% of all employees)

*NCWIT, By the Numbers 2009.*

# The Challenge:

## The pipeline problem

The leaky (IT) workforce:

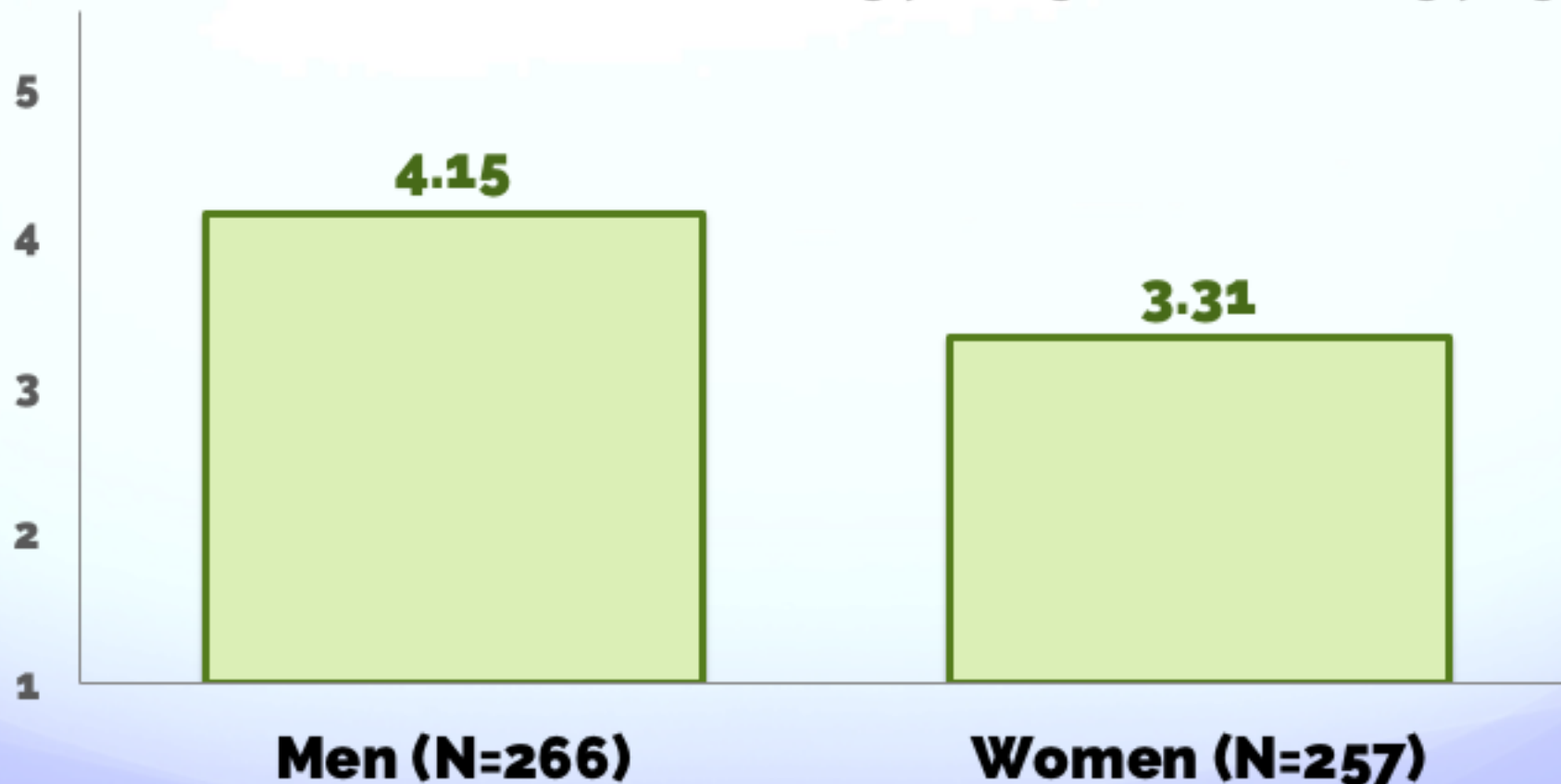
- At 10 years into a career:
  - 41% of women leave the IT sector
  - 17% of men leave the IT sector
- At career mid point 56% of women leave the IT sector
  - 49% go on to use their IT skills
  - 51% abandon their training

*Hewlett, S. A., Buck Luce, C., Servon, L. J., Sherbin, L., Shiller, P., Sosnovich, E., & Sumberg, K. (2008). The Athena factor: Reversing the brain drain in science, engineering, and technology. HBR Research Report, (10094).*

# WHPC HPC Community Survey 2016:

## I never experienced discrimination by colleagues

Scale 1 (Strongly Disagree) – 5 (Strongly Agree)

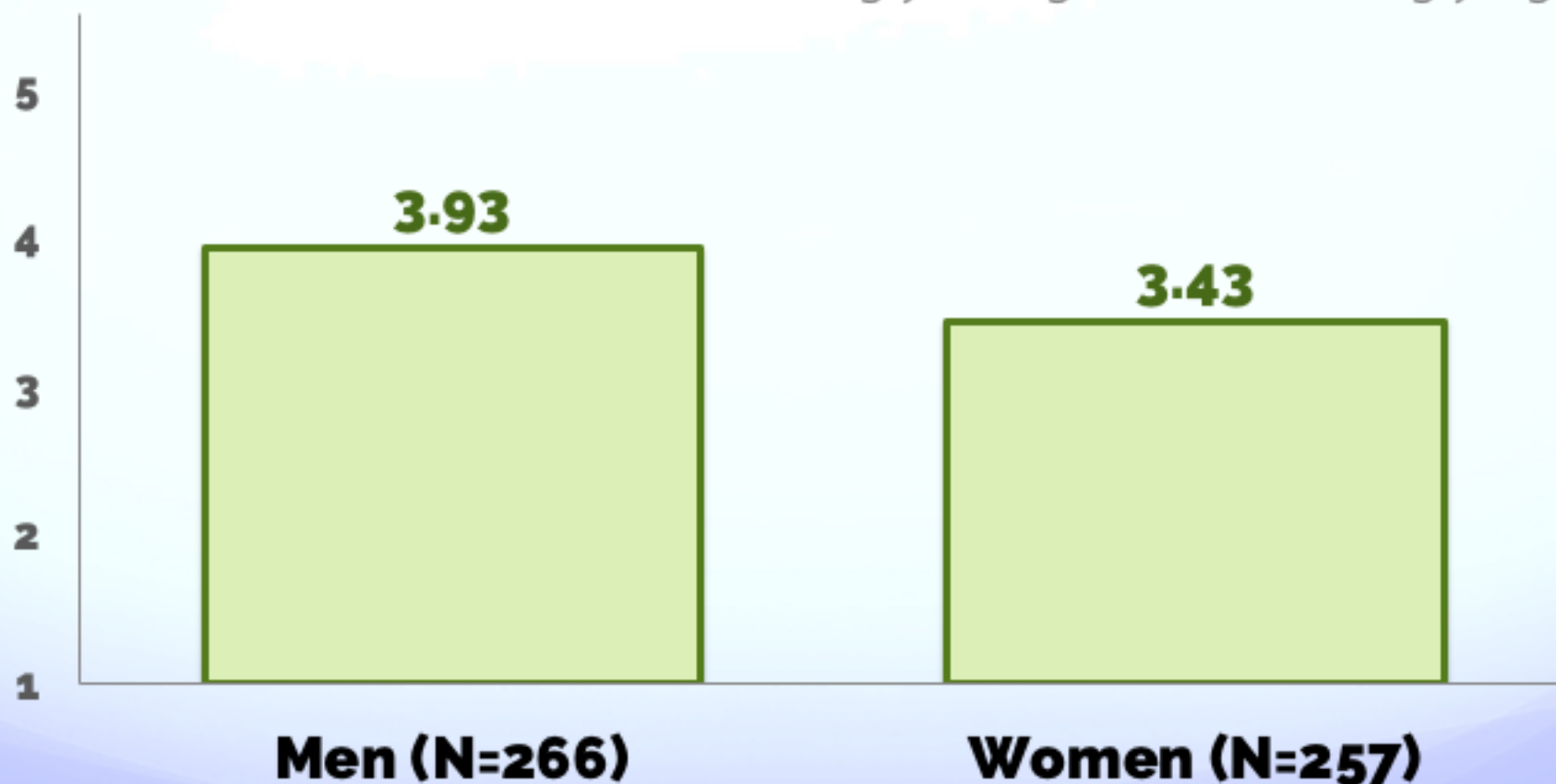




# WHPC HPC Community Survey 2016:

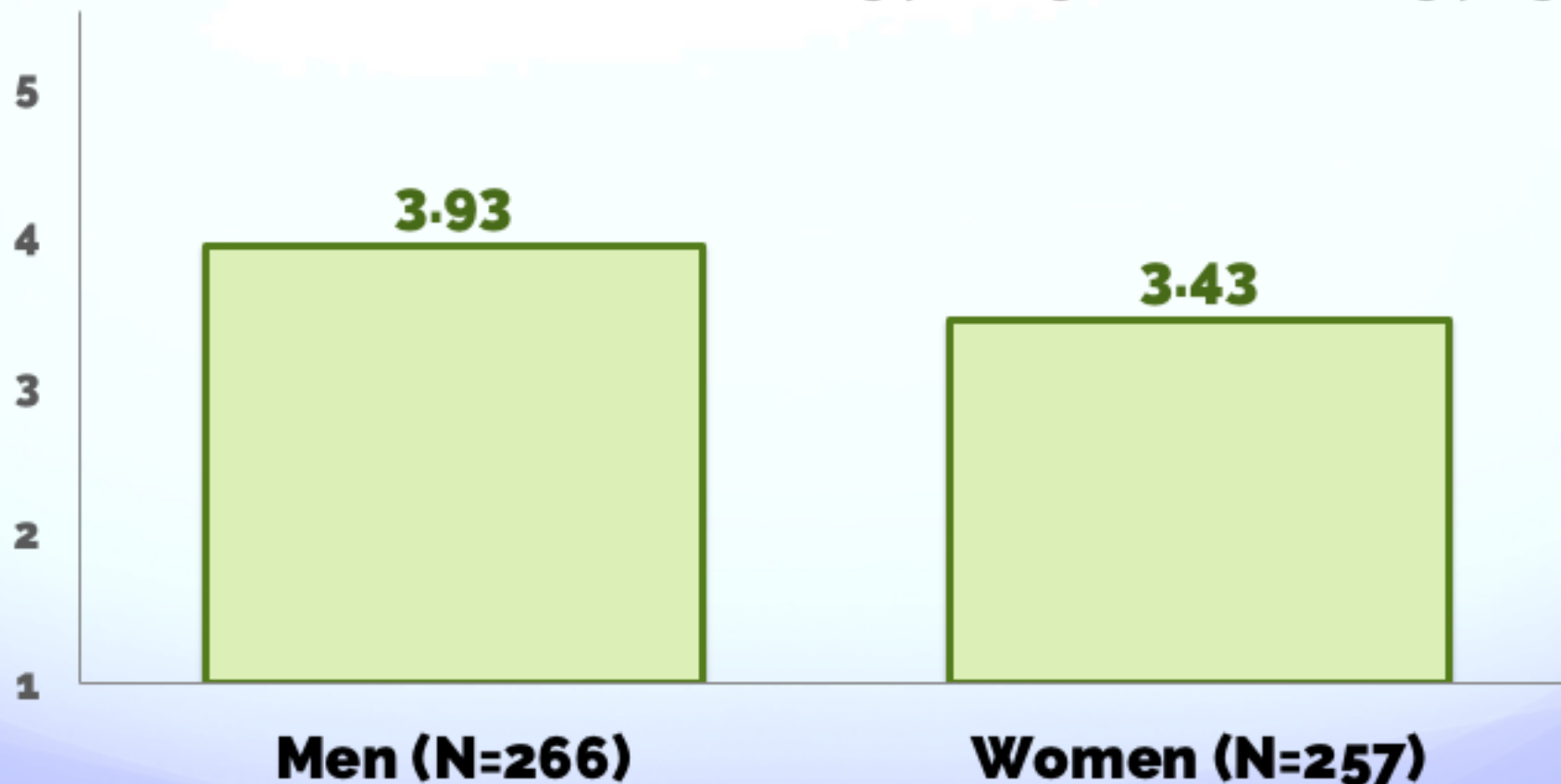
I feel that colleagues in my workplace are treated equally by each other regardless of gender

Scale 1 (Strongly Disagree) – 5 (Strongly Agree)



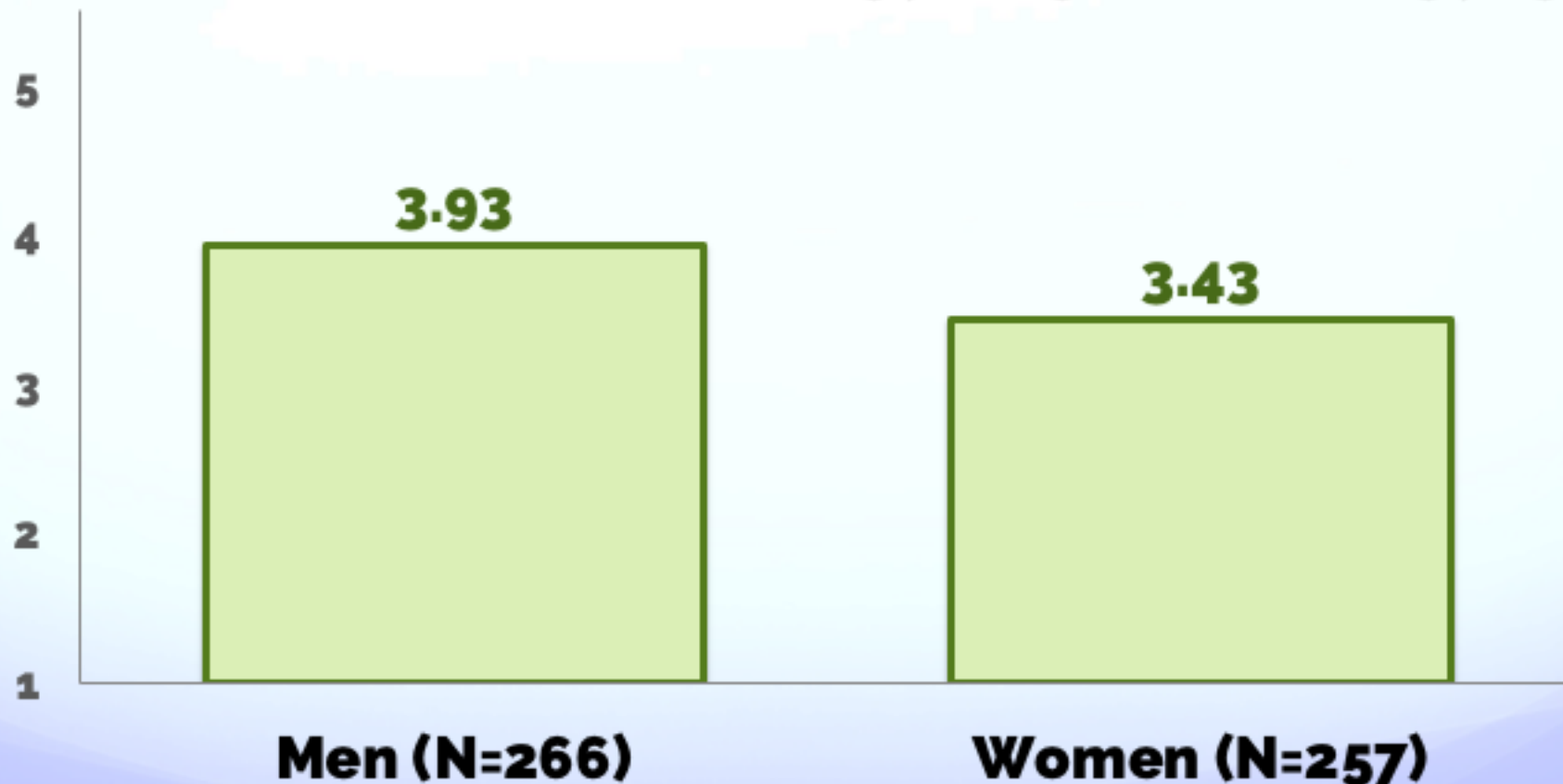
"I sometimes get the impression that "professionalism" is rather narrowly defined as "behave like the stereotypical white male"

Scale 1 (Strongly Disagree) – 5 (Strongly Agree)



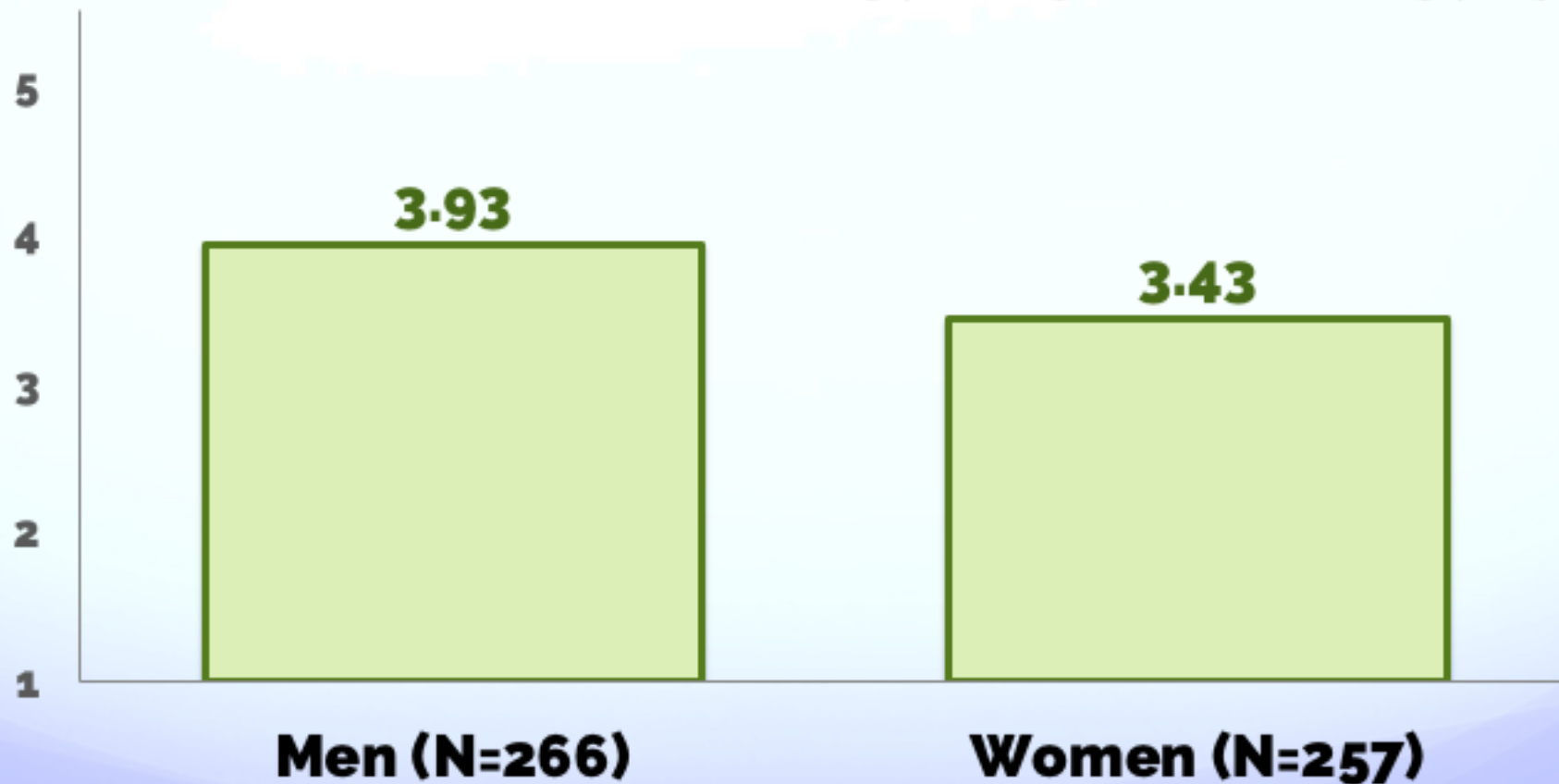
"My department has a weekly meeting on the topic of cosmology. One week, I brought a cosmology paper I wanted to discuss. Right after I mentioned this, a male postdoc in the group said that he wanted to discuss a paper that was not about cosmology and was therefore off-topic for the meeting. We discussed that paper instead of the one I wanted. I felt that my suggestion was not taken seriously. Was it because of my sex, my junior status, or something else? I don't know. I haven't attended that meeting since then."

Scale 1 (Strongly Disagree) – 5 (Strongly Agree)

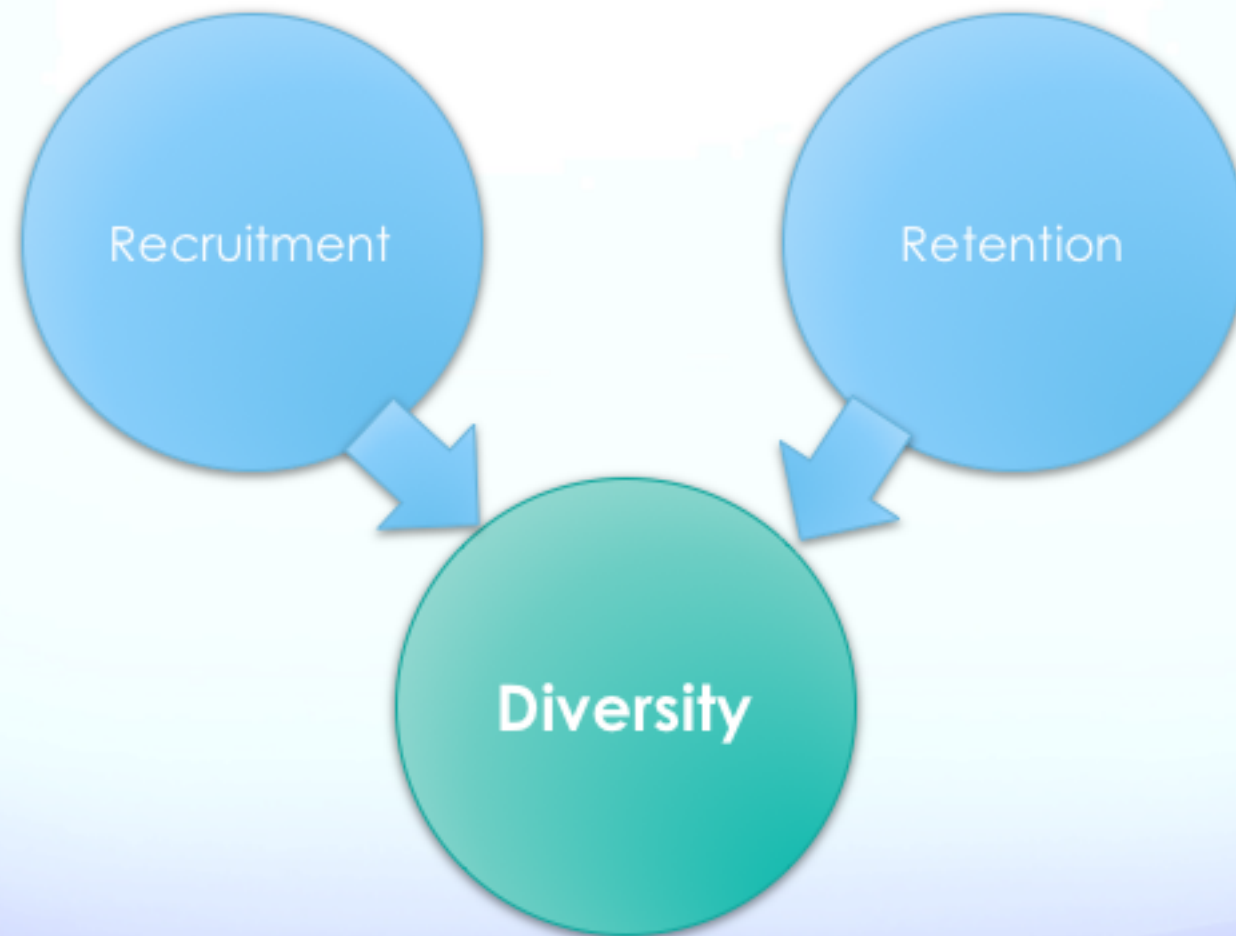


"I am feeling that my personal/professional progression is impeded by not granting permission to travel more, visit collaborators, publish publications, etc. when other colleagues have these opportunities."

Scale 1 (Strongly Disagree) – 5 (Strongly Agree)



## The Opportunity



## Innovation:

# How can the HPC community directly impact diversity?

**Case Study: Student attendees of the International HPC Summer School 2015  
(PRACE, XSEDE, RIKEN, Compute Canada)**

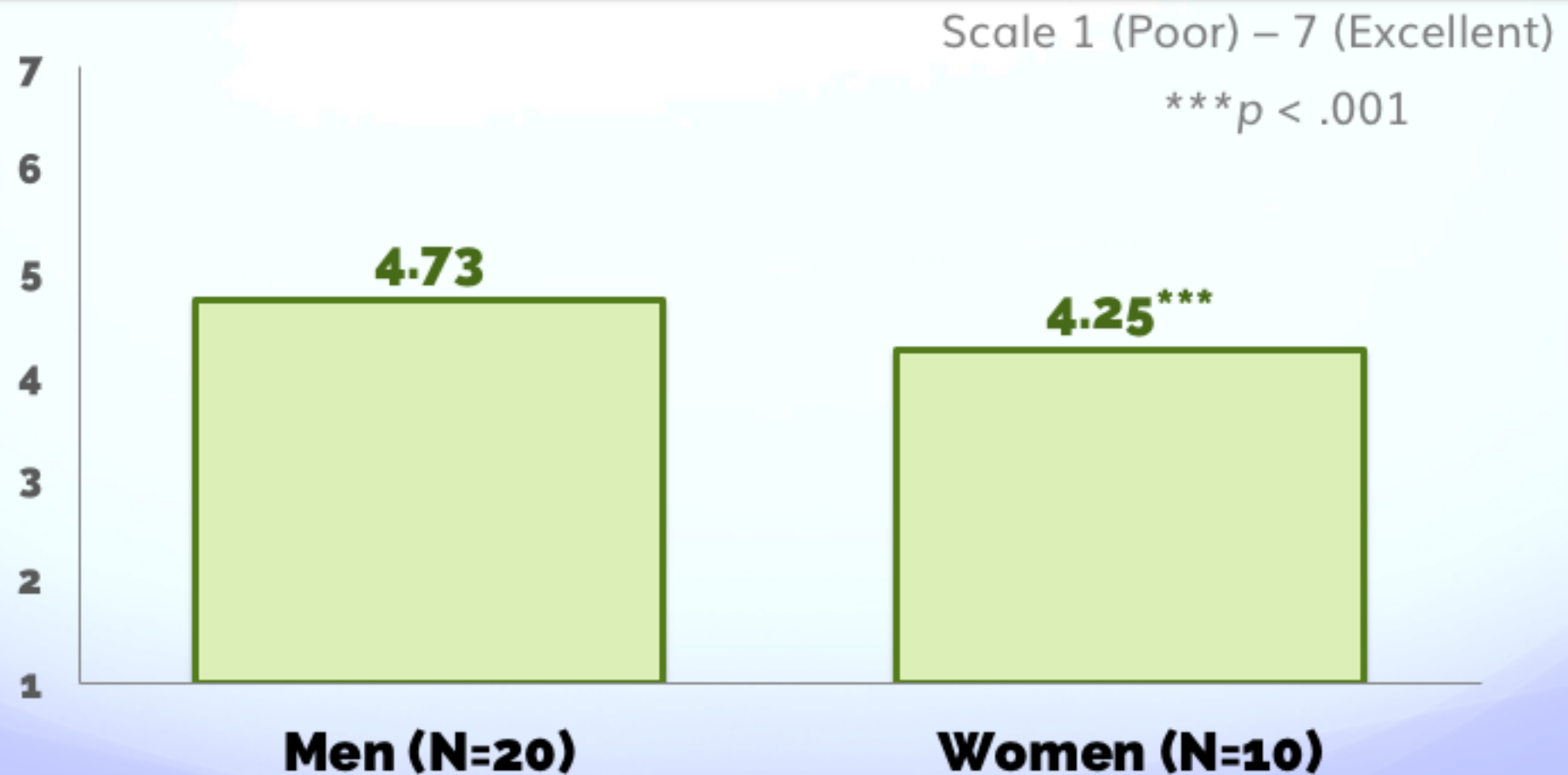
WHPC/XSEDE collaboration

Considers:

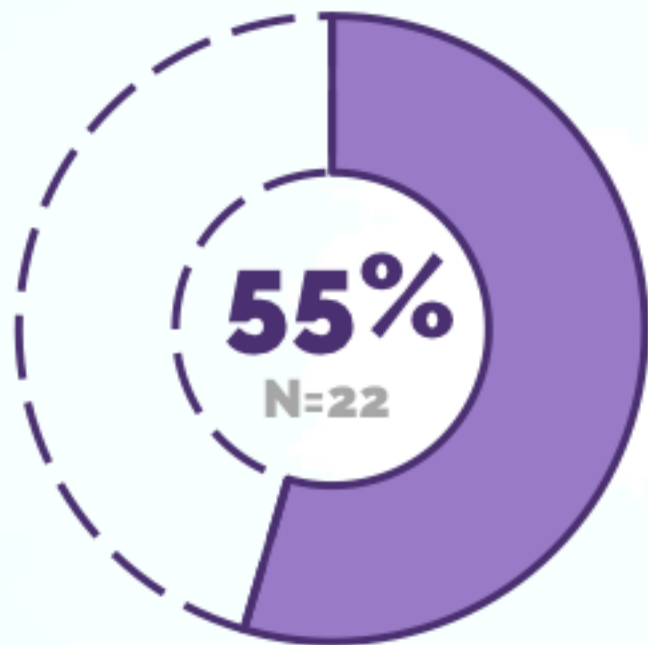
- Reviews of applicants (based on two reviews)
- Pre-survey completed by successful applicants (i.e. the attendees)
- Survey of the reviewers
- On-site attendee 'mini' test

# IHPCSS study:

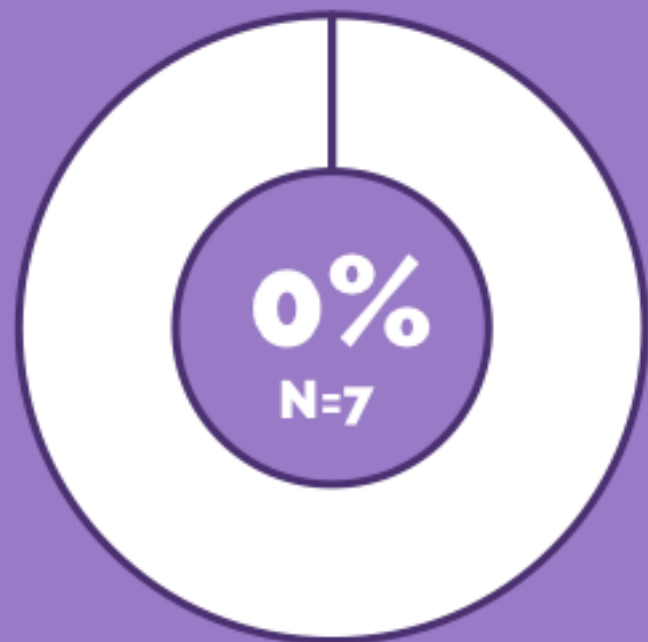
Selected male applicants were rated significantly higher than selected female applicants.



[www.womeninhpc.org](http://www.womeninhpc.org)



IHPCSS attendee pre-survey: 55% of the 22 self report knowledge & experience scale (novice – expert) items were rated significantly higher by men than women.



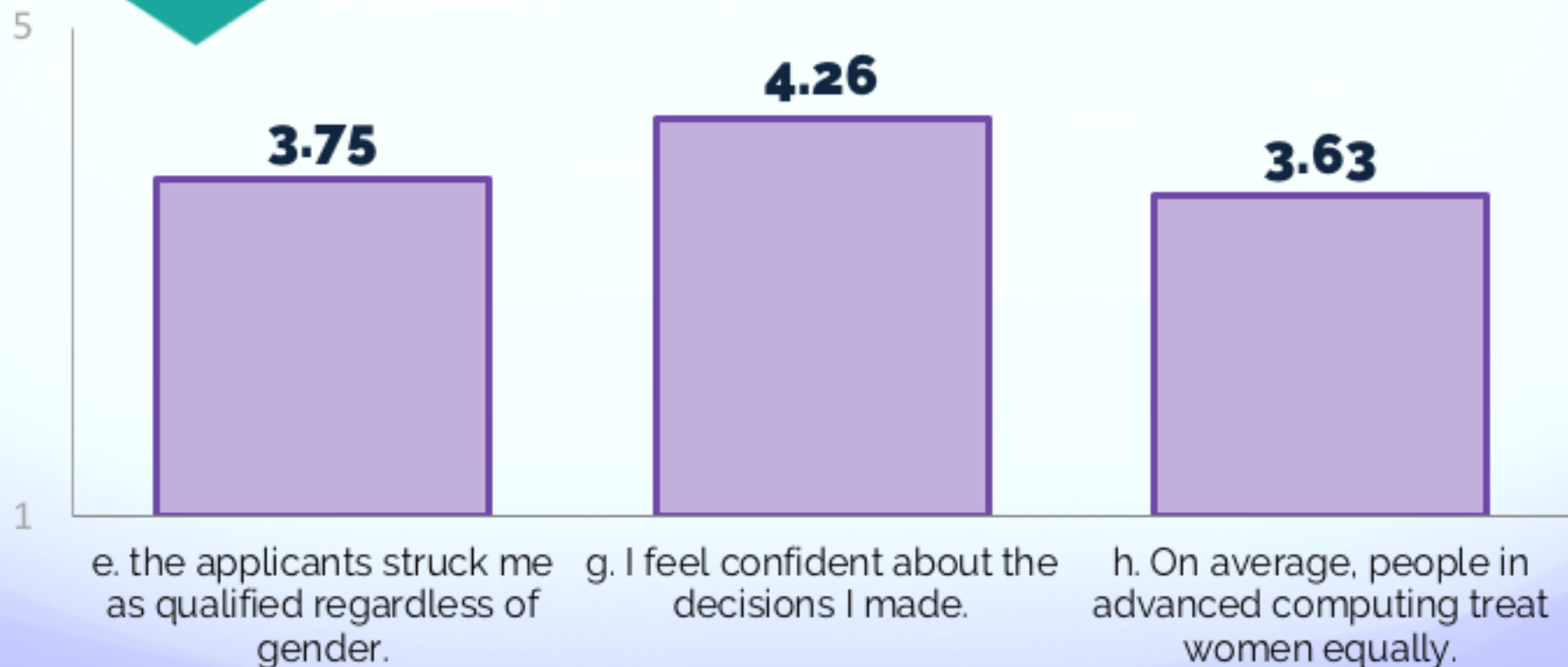
None of the 7 self report frequency scale (almost never – almost always) items demonstrated significant gender differences.



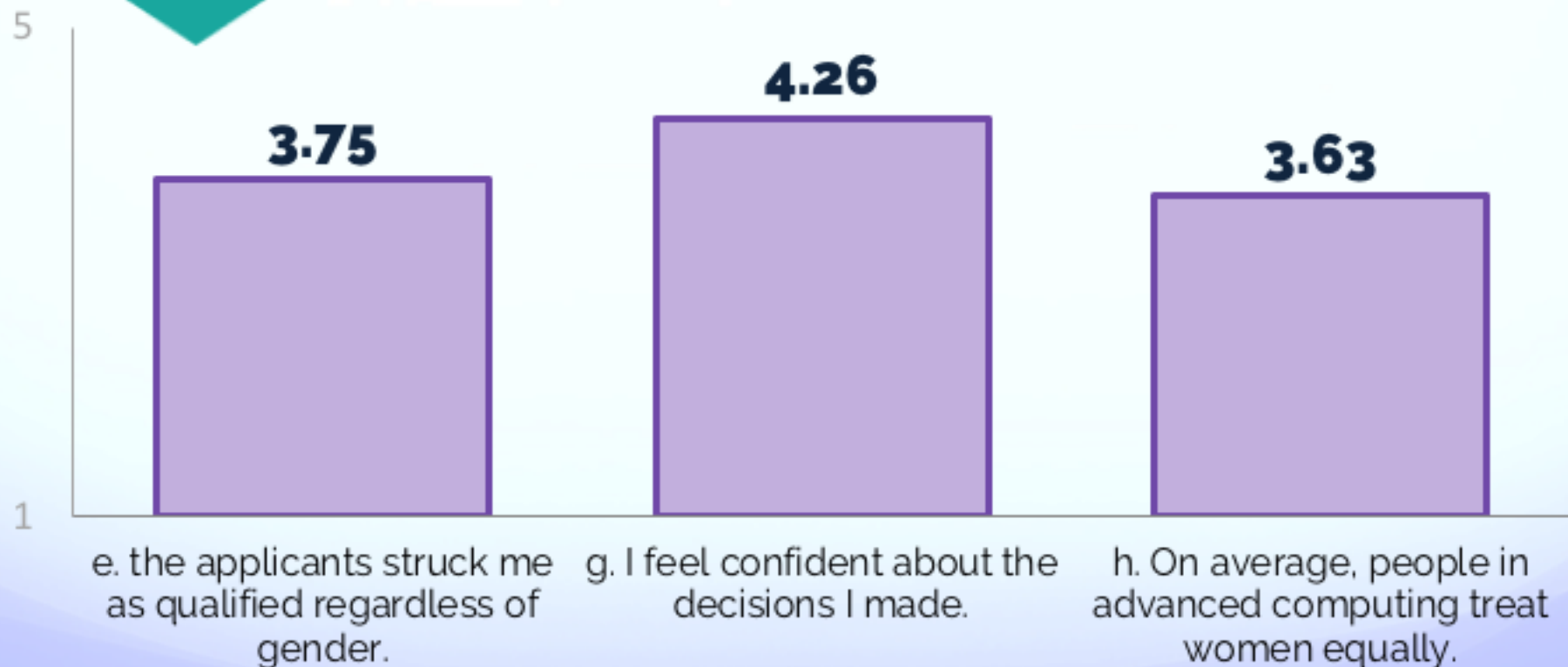
## Innovation

- Direct assessment of attendees found no significant gender difference.
- Reviewers (male and female) were asked to give feedback on the applications

"Unfortunately the pool of female applicants was a small and maximally qualified (i.e. selected) females did not appear to come up to the level of the maximally qualified males. I worry if the difference in preparation between males and females will be visible to the students at the event, and if so whether it will have a negative (reinforcing) effect on the minority position of the women in HPC."



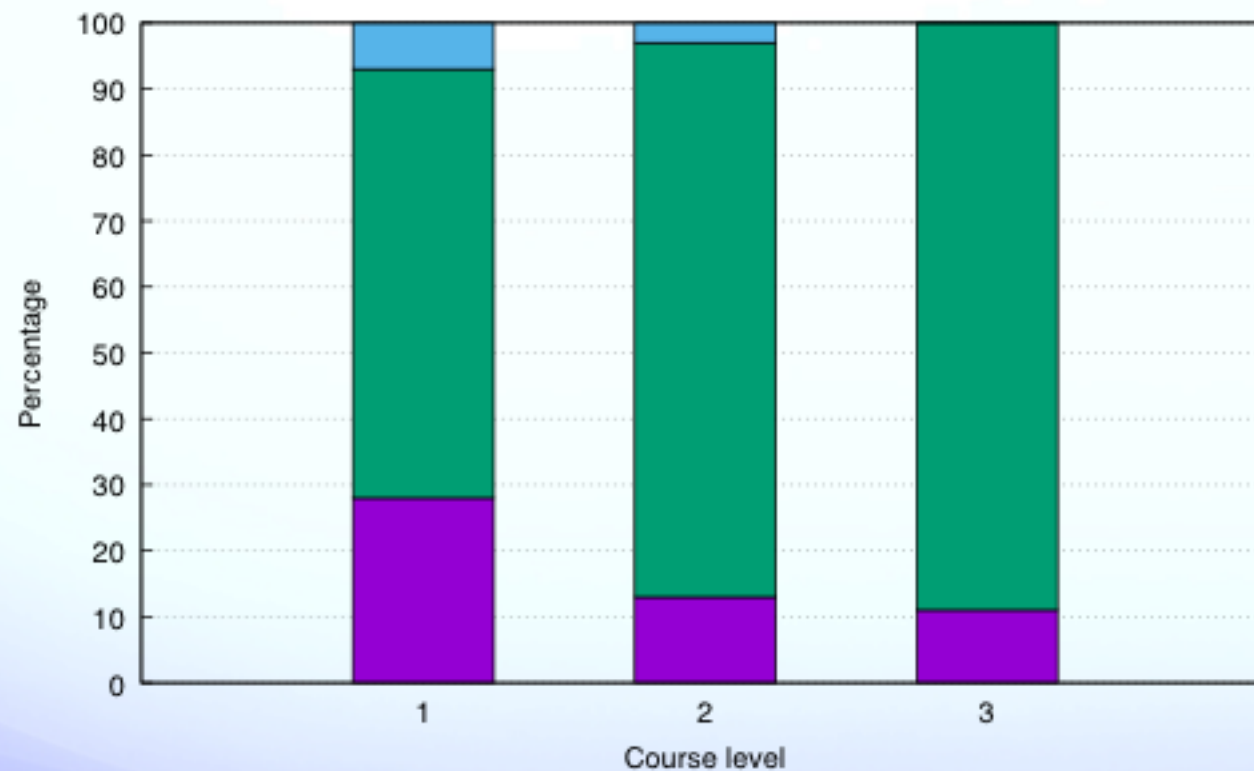
"I don't think we deliberately treat women differently, but I think it's very easy for us to implicitly assume that a decent female student will take a more applied path, while we force her male colleague to start programming."



## Innovation

- Reviews are now double-blind. Assessments are continuing to identify if there are real differences in the way applicants write their applications
- The pre-assessment no longer uses ratings such as 'novice' and 'expert' and instead asks for information on frequency of usage and awareness of concepts.

## Innovation: Training: improving participation in HPC training



- Percentage of attendees for level 1, 2, and 3 ARCHER training courses:
- Level 1: 28%
  - Level 2: 13%
  - Level 3: 11%

## Innovation:

### Training: provide training for women

#### Women in HPC Training:

- Provide training branded as 'Women in High Performance Computing'
- Led by female instructors with predominantly female demonstrators
- Consider training material content: do we use gendered analogies/metaphors/examples?

## Innovation:

### Training: provide training for women

"I think that a lot of the ladies attending were over qualified for this course. Many of them seemed to already have quite a lot of experience in HPC and were therefore beyond needing an introduction. "

"It was less intimidating signing up to this course knowing it would be mostly women"

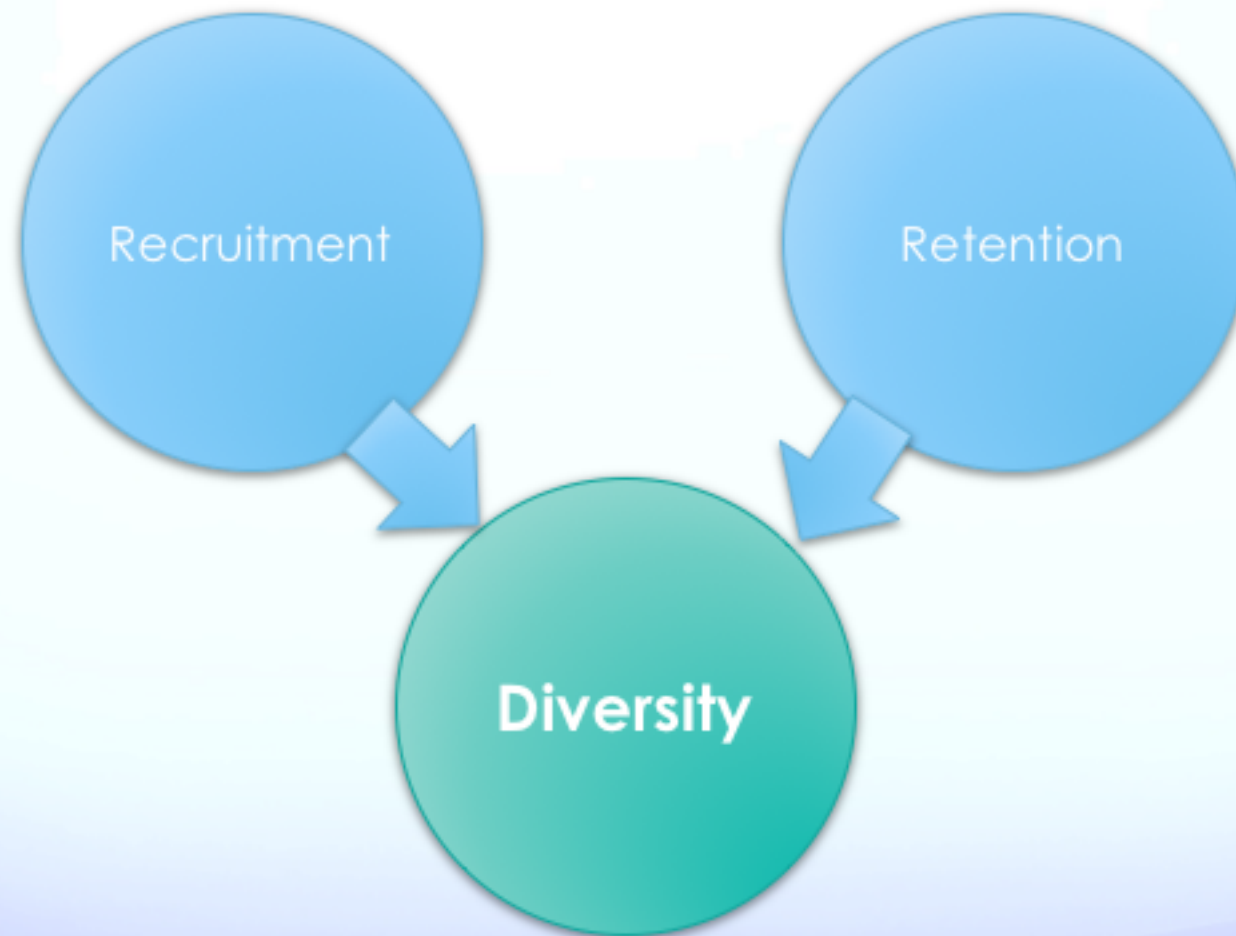
"I really appreciate that this course was for women. It allowed us to interact in a more relaxed environment. "

"The fact that it was aimed at women meant that there was a less pressured and competitive environment. I felt less embarrassed to be stuck or confused, as everyone was so kind. "

BUT:

"The experience that they had was intimidating and at times I felt that people were talking shop and using jargon that I didn't understand so I felt left out of some of the conversations happening during breaks."

# The Opportunity: what else can we do?





# Benchmark

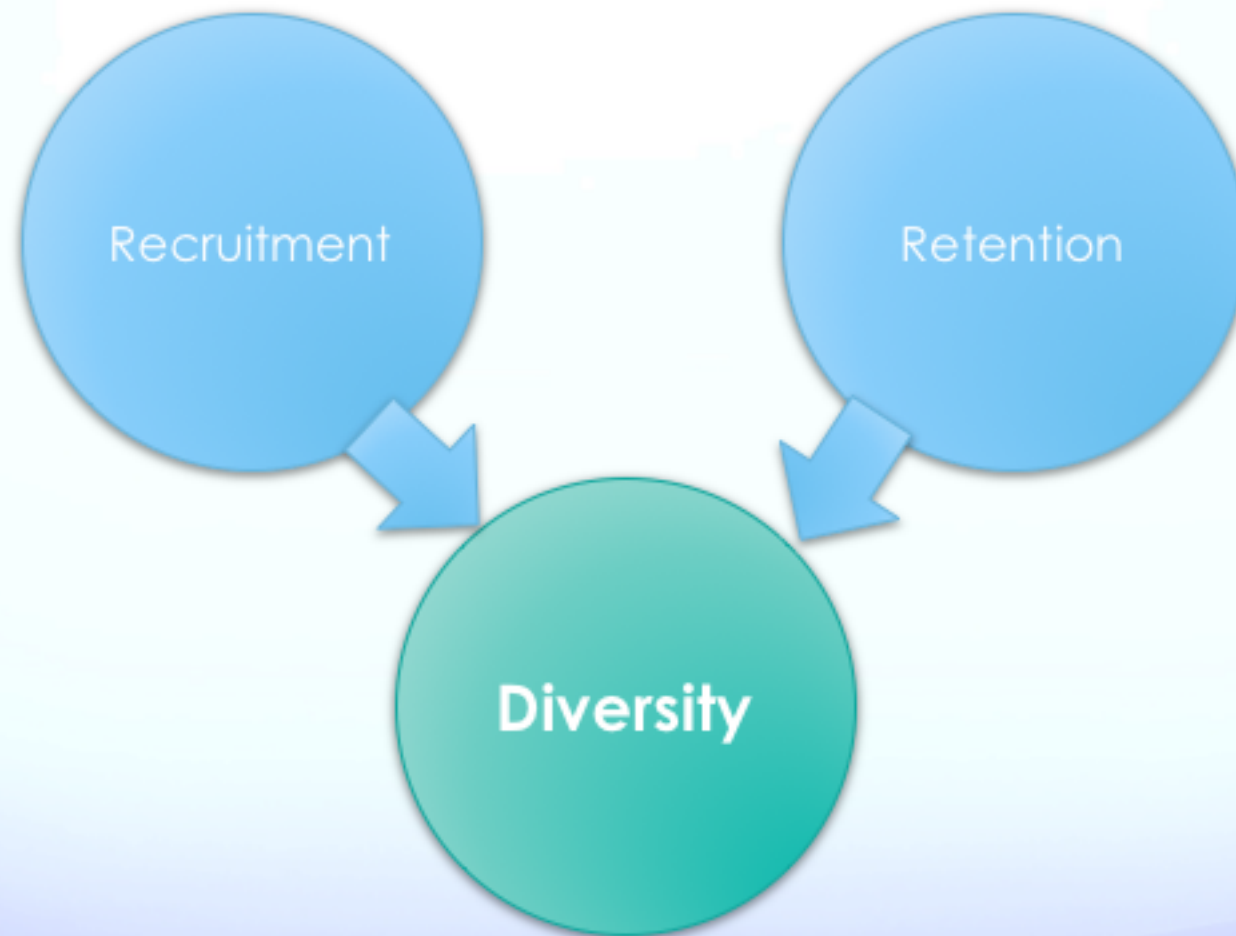
- Do's and Don'ts:
  - Do ask your colleagues: let them self-declare their gender.
  - Don't assume
  - Do offer an 'opt-out'.
  - Do share numbers and percentages.
  - Don't share data that is not anonymised, or for groups <5 people.
- What to measure:
  - Gender of your HPC users/colleagues
  - How engaged users are with HPC. How many CPU hours do they use? Who is inactive/active?
  - Who are they (e.g. PIs/Co-Is/researchers, students)?
  - Publication rates

## What you can do

- Training on:
  - Imposter syndrome
  - Unconscious bias
  - Stereotype threat
- Provide mentorship and sponsorship
- Look at your family-friendly working policies
- Attend WHPC events (see [www.womeninhpc.org/events](http://www.womeninhpc.org/events))
- Run your own events aimed at encouraging women
  - Mentoring networks
  - Hold social events for women to meet each other
  - Invite more female keynote presenters
  - Look at how you run your conferences and events



## Diversity: the conclusion





# Contributors

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