Task 1
The Global Survey of Scientists

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Task 1 Research Questions

- To better understand scientists'…
  - Development of interest in science
  - Experiences in education and careers
  - Work-life balance
  - Family support
  - Demographics
  - Access to resources needed to conduct science
  - Opportunities to contribute to the scientific enterprise

Task 1 Research Questions Include

- Experiences scientists may have in different geographic regions
- Experiences scientists may have in different disciplines
- Experiences scientists may have in countries with different levels of development
- Experiences scientists may have in different employment sectors

Drafting the questionnaire

- AIP created initial draft questionnaire
  - Based on the 2009 IUPAP Global Survey of Physics
- Three regional meetings
  - Colombia
  - Taiwan
  - South Africa
- Participants in each region
  - Reviewed specific questions to collect feedback on regional implications of wording and topics
  - Provided input on the full survey instrument to ensure that the questions worked for the region and all disciplines
  - Outlined a distribution plan

Translation

- Once the final questionnaire was approved, we used a professional translation service.
  - Ensure comparability across languages
  - Professional translators can be neutral about cultural differences
- We asked scientists to proofread final translations
  - Marie-Françoise Roy, French
  - Silvina Ponce Dawson, Spanish
  - Saeko Hayashi, Japanese
  - Mina Betach and Schehrazad Selmane, Arabic
  - AIP staff members for Russian and Simplified Chinese

Survey

- Launched on 1 May 2018

Global Survey of Scientists

Welcome to the Global Survey of Scientists. To take the survey in English, click here.

Bienvenue dans l'enquête mondiale destinée aux scientifiques. Pour répondre aux questions de l'enquête en français, veuillez cliquer ici.

欢迎参加全球科学工作者调查。要使用中文参加本调查，请单击此处.

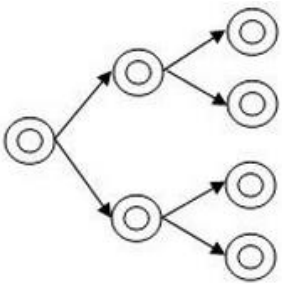
科学者向けグローバルアンケートにようこそ。日本語のアンケートに回答するには、ここをクリックします.

Приветствуем Вас в Глобальном опросе ученых. Чтобы пройти опрос на русском языке, нажмите здесь.

Bienvenido/a a la Encuesta mundial de científicos y científicas. Para hacer la encuesta en español, haga clic aquí.

مرحبًا بك في الاستبيان العالمي للعلماء.للمشاركة في الاستبيان باللغة العربية، انقر هنا.

Snowball sampling



- Used when there is no list from which to draw a random sample
- The results are not representative of the entire population
- Inferences about the entire population are not appropriate

Respondents by Discipline

(NOTE:These are counts for career discipline included in the multivariate model; these respondents answered every question included in the model. Discipline counts for academic study differ.)

Discipline	Women	Men	Total
Astronomy	898	997	1,695
Biology	1,190	606	1,796
Chemistry	772	765	1,537
Computer Science	1,484	1,306	2,790
Math	1,645	2,071	3,716
Math – Applied	614	606	1,220
Physics	1,407	2,515	3,922
TOTAL	10,751	10,987	21,738

Does not include 8,527 respondents in History of Science, Other disciplines, and no discipline indicated.

Analysis Plan

- Bivariate
  - Interpretation is straightforward
    - Either the two variables are independent or they are not
  - Is easy to visualize
  - Can test for statistically significant differences between responses from men and from women

  - However, analysis could be confounded by additional factors
    - For example, the analysis might reveal “differences” between men and women that result from men and women being at different stages in their career

Analysis Plan (Part 2)

- Multivariate analysis
  - Can account for confounding factors
  - Can be harder to interpret
  - Can be hard to visualize
  - Can test for statistically significant responses among members of different categories for one variable
    - While holding all other variables constant

- We did both bivariate and multivariate

Analysis

- Analysis of men's and women's responses overall
- Bivariate analysis
  - Tables with two dimensions
    - Gender within discipline
    - Gender within geographic region
    - Gender within (grouped) level of development

Type I Error Risk

- With so many possible combinations, a number of "significant findings" will result even when there is no difference
  - Type I Error (Reject a true null hypothesis)
  - Bonferroni correction
    - In essence, use a lower cutoff for α
    - We use 0.002

Findings

- The only item we examined where there was not a statistically significant difference between the responses of men and women is the timing of when the respondent chose their field.
- In every other item we examined, we found gender differences after accounting for any confounding factors.
- Men and women do not have the same experiences.
- Women's experiences are consistently less positive than men's.

Logistic regression vs ordinal logistic regression

- When the dependent variable is binary (yes / no), logistic regression is the appropriate analysis tool.
  - The coefficients can be translated to odds ratios.
  - Odds ratios are a measure of the relative likelihood of saying yes.
- When the dependent variable is ordinal (level of agreement), the sign of the coefficient does indicate the direction of the relative likelihood (more or less likely).
  - Conversion to odds ratios depends on the level of the dependent variable and the number of steps of movement.

When we show results …

- For binary variables, we report the odds ratio.
- For ordinal variables, we report the direction of the likelihood.

Multivariate analyses

- All results for the comparisons of men's and women's experiences assume all other variables are the same.
  - Same age
  - Same discipline
  - Same employment sector
  - Same geographic region
  - Same level of development
- That means that the different experiences **cannot** be attributed to age, discipline, employment sector, geographic region, or level of development.

Examining the Gender Gap

Timing of choosing primary field of study

- **"When did you choose your primary field of study?"**
  - No statistically significant difference between men's and women's responses.

Doctoral program experiences

- "How would you rate the quality of your doctoral program?"
  - Men respondents rated the quality of their doctoral program higher than women respondents.

Doctoral program experiences

- "How would you rate the quality of your doctoral program?"
  - Men respondents rated the quality of their doctoral program higher than women respondents.
- "In my doctoral experience, I had support from my advisor or supervisor."
  - Men respondents were more likely to agree than women respondents.

Interruptions in doctoral studies

- "Have there been any significant interruptions in your doctoral studies?"
  - Women respondents were 1.6 times more likely to say yes.

Current workplace experiences

- "At my current job, my employer treats everyone fairly."
  - Men respondents were more likely to agree

Current workplace experiences

- "At my current job, my employer treats everyone fairly."
  - Men respondents were more likely to agree
- "My co-workers are respectful of everyone."
  - Men respondents were more likely to agree.

Career progress

- "Compared to colleagues who completed their final degrees at the same time as you, how quickly have you progressed in your career?"
  - Men respondents were more likely than women respondents to indicate a faster progression.

Career progress

- "Compared to colleagues who completed their final degrees at the same time as you, how quickly have you progressed in your career?"
  - Men respondents were more likely than women respondents to indicate a faster progression.
- "Compared to your colleagues in your workplace with similar qualifications as yours, do you think your salary / pay is … higher / similar / lower?"
  - Men respondents were more likely than women respondents to say higher

Career-advancing opportunities

- “Have you given a talk at a conference as an invited speaker?”
  - Men respondents were 1.2 times more likely than women respondents to say yes.

Discrimination

- "I have never experienced discrimination."
  - **Men** respondents were **4.8 times more likely** than women respondents to indicate they had **never experienced discrimination**.

Career influence on personal life

- **"Has your career influenced your decisions about children, marriage, or a similar long-term partnership?"**
  - **Women** respondents were **1.6 times more likely** than men respondents to **say yes**.

Becoming a parent

- "My career or rate of promotion slowed significantly when I became a parent."
  - **Women** respondents were **3.3 times more likely** than **men** respondents to indicate their **career** or **rate of promotion slowed significantly** after becoming a parent.

Becoming a parent

- "My career or rate of promotion slowed significantly when I became a parent."
  - **Women** respondents were **3.3 times more likely** than **men** respondents to indicate their **career** or **rate of promotion slowed significantly** after becoming a parent.
- **"My work or career did not change significantly when I became a parent."**
  - **Men** respondents were **3.0 times more likely** than women respondents to **say yes**.

Encountering sexual harassment

- "I have encountered sexual harassment at school or work."
  - **Women** respondents were **14.4 times more likely** than **men** respondents to say **yes**.

Dual Careers

- "Is your partner or spouse employed in your field?"
  - **Women** respondents were **3.4 times more likely** than **men** respondents to say **yes.**

What about discipline, geographic region, level of development, and employment sector?

- We found strong evidence to indicate that the **gender gap persists across all disciplines**.
- We found strong evidence to indicate that the **gender gap persists across all geographic regions**.
- We found strong evidence to indicate that the **gender gap persists across all levels of development**.
- We found strong evidence to indicate that the **gender gap persists across all employment sectors**.

Potential areas to examine

- Multivariate analyses allow us to examine factors beyond gender.
- Thus, the analyses can highlight disciplines, geographic regions, or employment sectors with more desirable outcomes.
  - That is, desirable outcomes with *all other variables held constant*.
- In addition, we can assess the impact of a country's Human Development Index on desirable outcomes.
- Perhaps we can discover areas where we can learn lessons about achieving more desirable outcomes.

Doctoral studies

- Respondents who had **studied in math** programs were **more likely** to rate their **program quality higher**.
- Respondents who had **studied in math** programs were **more likely** to have a **positive relationship** with their **advisor**
- Can we learn lessons about best practices in doctoral programs by examining math programs?

Doctoral studies

- Respondents who had **studied in Northern America** were **more likely** to rate their **program quality higher**.
- Respondents who had **studied in Northern America** and **in Oceania** were **more likely** to have a **positive relationship** with their **advisor**
- Can we learn lessons about best practices in doctoral programs by examining programs in these areas?

Doctoral studies

- The **higher** a nation's score on the **Human Development Index**, the **lower** the rating of **program quality**.
- The **higher** a nation's score on the **Human Development Index**, the **lower** the rating of the **advisor relationship**.
- Are these perceptions driven by higher expectations?
- Are these realities?

Respectful co-workers

- Respondents employed in **industry**, **NGOs**, **primary/secondary schools**, and who were **self employed** were **more likely** to **agree** that their coworkers treated them with respect than those who work in academic institutes, universities, colleges, or government entities.
- Can we look for commonalities among these sectors that we can apply at academic institutes, universities, colleges, and government entities?

Respectful co-workers

- Respondents working in **Northern Europe** were **more likely** to **agree** that their coworkers treated them with respect than those working in other parts of the world.
- The **higher** the **Human Development Index**, the **more likely** the respondent was to **report having respectful co-workers**.
- Are these realities or perceptions?
- What lessons can we learn?

Discrimination

- Respondents with disciplinary backgrounds in **math** and **physics** were more likely to have **never experienced discrimination** than those in other disciplines.
- Can we learn best practices about addressing discrimination by examining interactions in these disciplines or in workplaces that employ a high proportion of mathematicians and physicists?

Discrimination

- The **higher** the **Human Development Index**, the **more likely** respondents were to report **never experiencing discrimination**.
- Respondents in **Northern America**, **Northern Europe**, and **Oceania** were **less likely** to report **never experiencing discrimination**.
- Is this a perception or a reality?
- What lessons can we learn?

Career influencing personal life

- Respondents working in **industry** and at **primary/secondary schools** were **less likely** than respondents working in all other settings **to say** that their **career influenced decisions** about their **personal lives.**
- Respondents working in the **government** and **industry** sectors were **more likely** to say their **rate of promotion had not changed** after becoming a **parent**.
- Does industry have lessons to offer regarding work-life balance?

Career influencing personal life

- Respondents working in **Northern America** and **South America** were **more likely** than respondents working in all other settings **to say** that their **career influenced decisions** about their **personal lives.**
- Respondents working in **Africa**, **Carib / Central America**, **East / SE Asia**, **Northern America**, **Western Asia** and **Western Europe** were **less likely** to say their **rate of promotion slowed** after becoming a **parent**.
- This suggests regional differences in the work-life balance.

Career influencing personal life

- There were **no statistically significant differences** among respondents by **Human Development Index** and **career influencing decisions** about **personal lives.**
- There were **no statistically significant differences** among respondents by **Human Development Index** and **a change in one's rate of promotion after having children.**

The Gender Gap in Science

- Based on responses provided by about 30,000 scientists* from 159 unique countries, the evidence indicates that women's experiences in science are less positive than men's experiences.
- This gender gap persists after accounting for
  - Age (as a proxy for career stage)
  - Discipline
  - Employment sector
  - Geographic region
  - Level of development

* There were 32,346 responses to the first question. Our analyses include only the subset of respondents that provided responses to each of the questions used in the analysis.

Thank you!

Questions?

Comments

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Multivariate regression results:
How would you rate the quality of your doctoral program?

A higher number is a better rating

So, a positive coefficient means this group rates it higher relative to others in its group.

Variable	Coefficient	p-value	
Male	**0.226**	**0.000**	**Female**
Age	**0.013**	**0.000**	Continuous
Dsc HPS	-0.239	0.116	
DscBio	**-0.233**	**0.000**	
DscPhys	-0.151	0.004	
DscCST	-0.148	0.028	**Astronomy**
DscOther	-0.096	0.092	
DscChem	-0.069	0.284	
DscApplMath	0.138	0.039	
DscMath	**0.263**	**0.000**	
RE_SEAsia	**-1.235**	**0.000**	
RCent_SthAsia	**-0.968**	**0.000**	
REastEuro	**-0.648**	**0.000**	
RSouthEuro	**-0.606**	**0.000**	**WestEuro**
Rafrica	**-0.507**	**0.000**	
RWestAsia	-0.081	0.578	
RSouthAm	0.062	0.393	
RCaribCentAm	0.101	0.491	
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RNthnAm	**0.700**	**0.000**	
HDIscore	**-1.999**	**0.000**	Continuous

Multivariate regression results:
How would you rate the quality of your doctoral program?

The coefficient for Male is significant (p<0.001) and positive → men rate doctoral programs higher than women, all other variables held constant

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Multivariate regression results: How would you rate the quality of your doctoral program?

Here we compare all other disciplines to Astronomy

The coefficient for Bio is significant ($p<0.001$) and negative → students in biology rate their program quality lower, all other variables held constant

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The coefficient for Math is significant (p<0.001) and positive → students in math rate their program quality higher, all other variables held constant

Continuous

Multivariate regression results:
How would you rate the quality of your doctoral program?

The coefficient for HDIscore is negative and significant → the higher the Human Development Index, the lower the program quality rating by respondents, all other variables held constant

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