

Physics Identity of Undergraduate Women



George Mason University Research Team

Jessica Rosenberg, PI
Associate Professor of Physics & Astronomy

Nancy Holincheck, co-PI
Assistant Professor of STEM Education

Ben Dreyfus, co-PI
*Instructional Professor of Physics &
Astronomy*

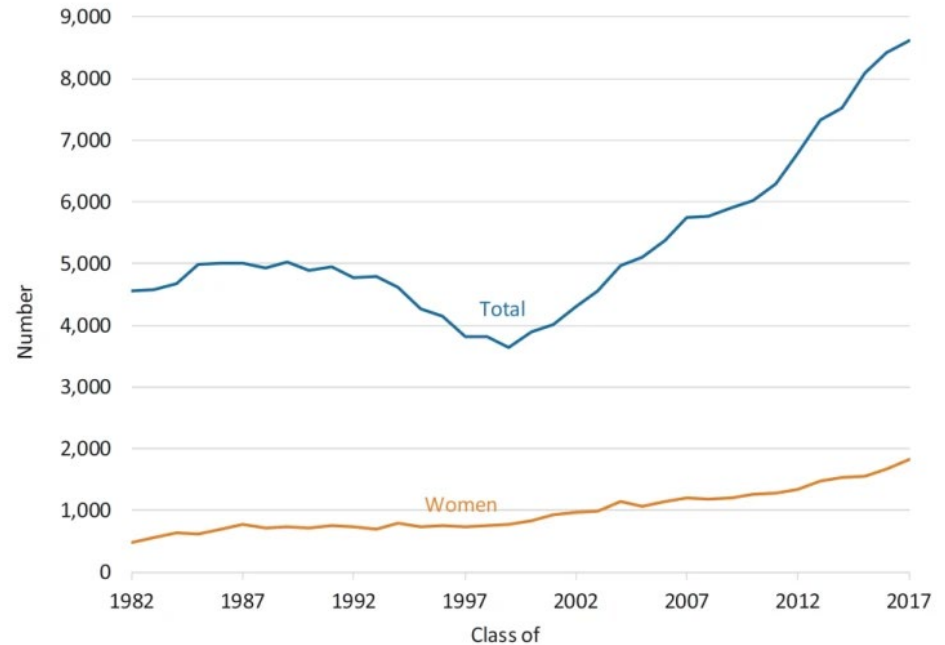
Laura M. Akesson
Graduate Research Assistant



Pion Project:

This project examines the role of mentorship, leadership, and career conceptualization in the development of **physics identity and belonging of undergraduate women in physics.**

Number of Bachelor's Degrees Earned in Physics, Classes 1982 through 2017



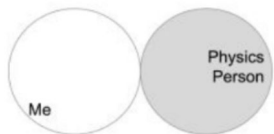
Source: AIP Statistical Research Center, Enrollments and Degrees Survey.



Abstract

Students with a strong science identity have a higher likelihood of choosing a science career and are more likely to demonstrate persistence in STEM courses and careers. Preliminary findings of an *ongoing* qualitative survey analysis of 120 undergraduate women in Physics will be presented. The following research questions are being investigated:

- How do undergraduate women explain their self-assessment of their own physics identity?
- What are undergraduate women's conceptions of what it means to be a physics person?



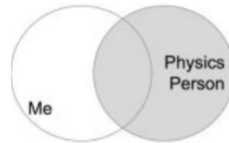
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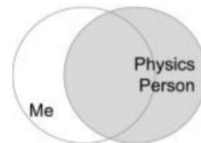
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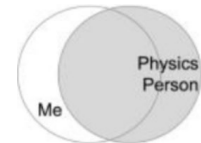
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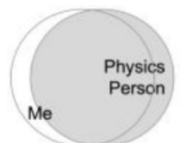
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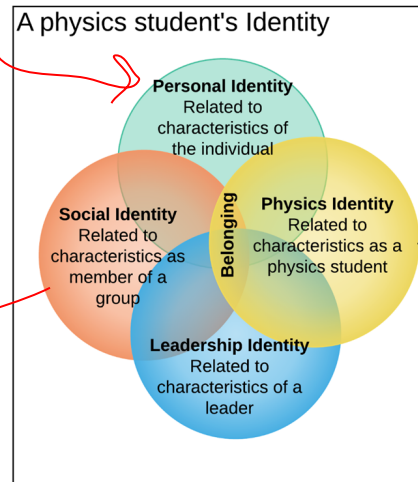


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STEM Identity: why it matters

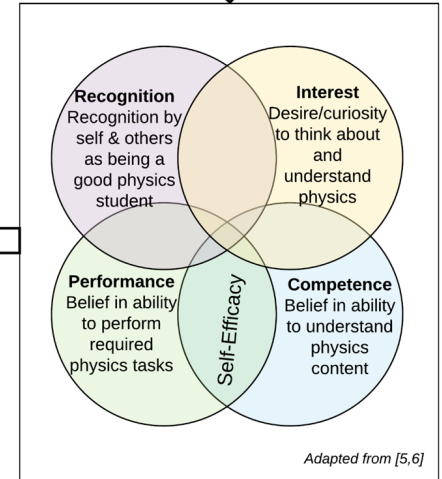
1. Motivation and persistence (Oyserman, 2015)
2. More likely to have positive beliefs about their competence (Perez, et. al. 2014)
3. Perceived costs (eg. time spent studying) more worthwhile
4. **For women:** high STEM identity provide a buffer against the experience of sexism (Kuchynka, et. al. 2017)

Psychology: A story that we create for ourselves (Pollman and Miller, 2010)



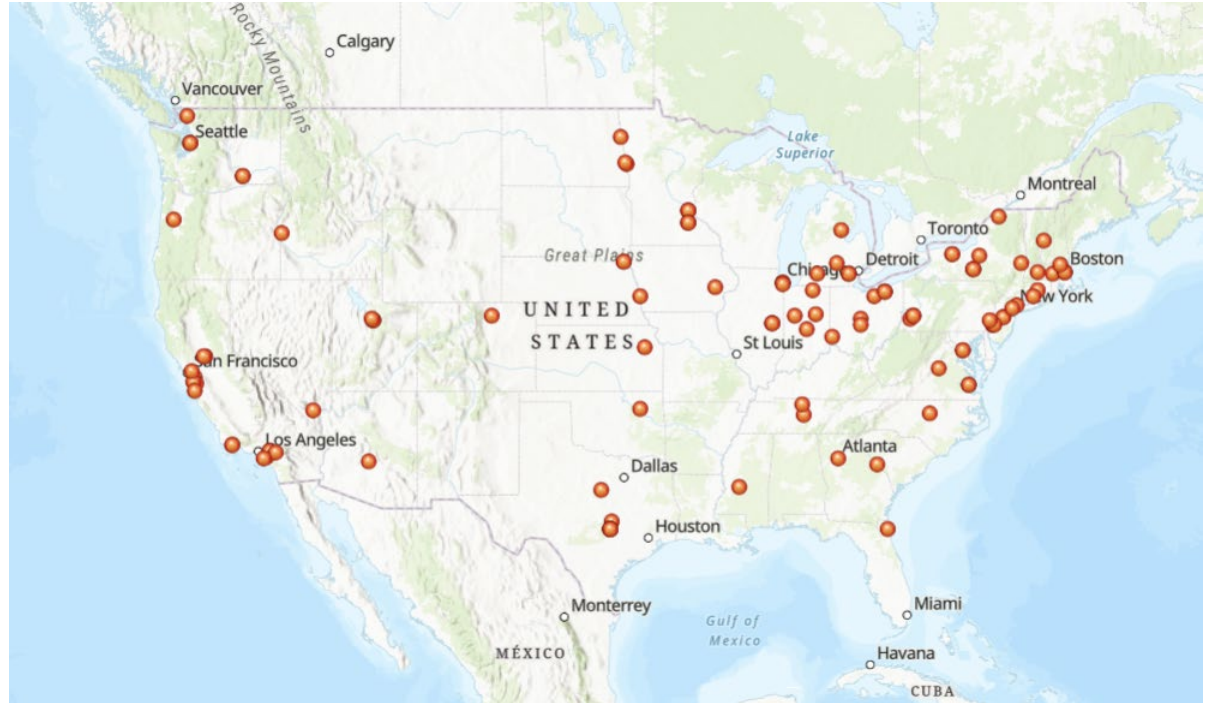
Sociology: Past, present, & future; ethnicities, races, religions, genders, sexual orientations, life histories, current realities. .people have multiple identities (Alsup 2006, Gee, 2000)

Pion Inputs
LEADERSHIP, MENTORSHIP, and CAREER CONCEPTUALIZATION

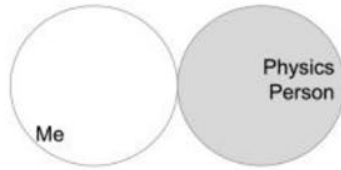


Conference(s) for Undergraduate Women in Physics

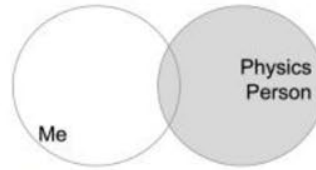
- Recruited survey participants from CUWiP attendees across US
 - n=120



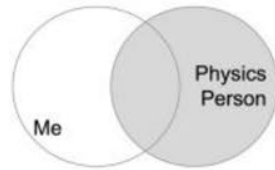
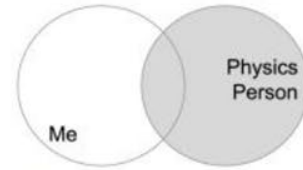
1. Which picture below best describes the current overlap of **the image you have of yourself** and your image of what a physics person is. Indicate the letter, and provide a sentence of two about why you answered this way.



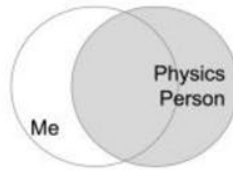
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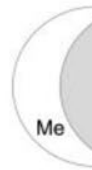
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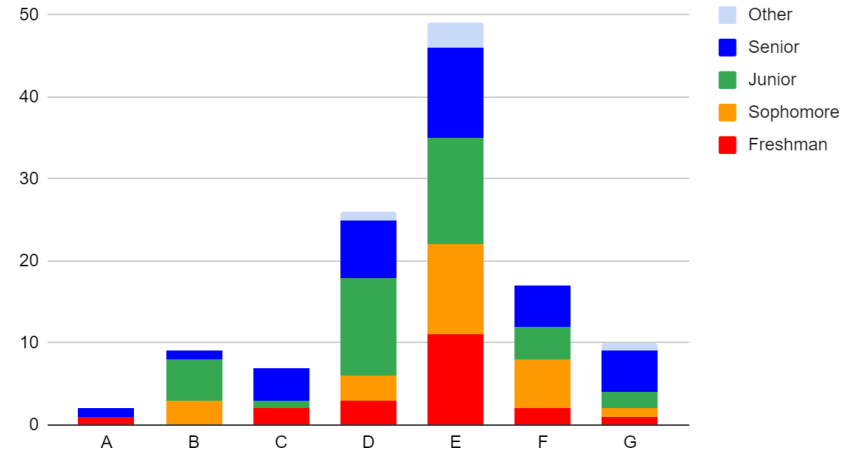


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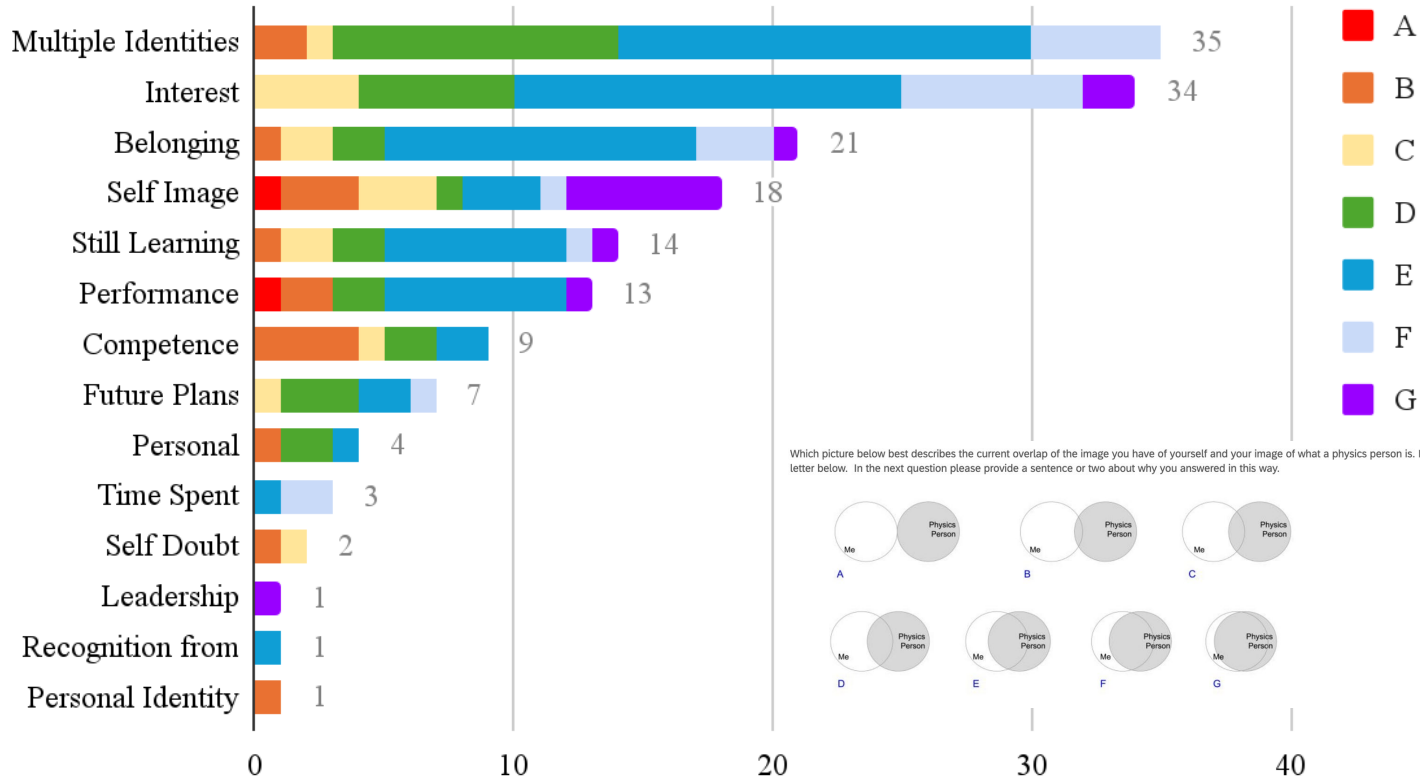


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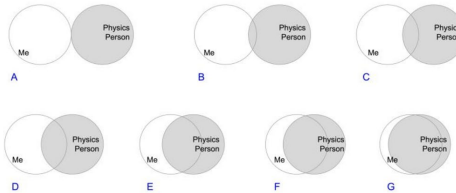
Identity letter by grade



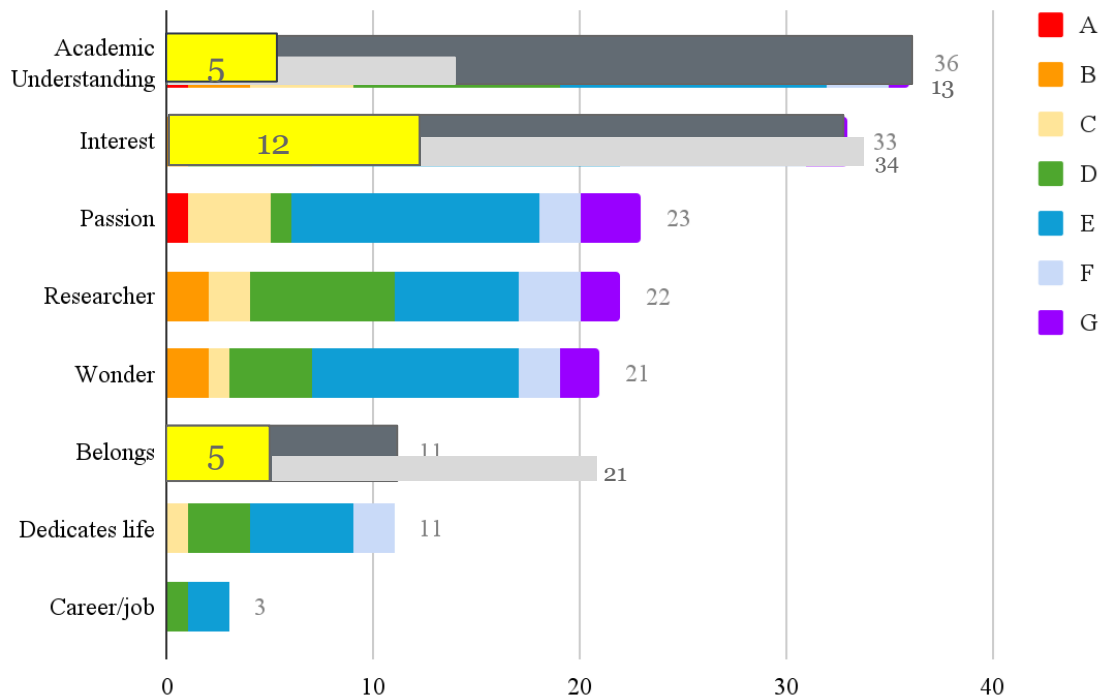
Factors (coded) explaining response to self-assessed overlap



Which picture below best describes the current overlap of the image you have of yourself and your image of what a physics person is. Indicate the letter below. In the next question please provide a sentence or two about why you answered in this way.



2. What does it mean to be a physics person?



Gap between
undergraduate
women's actual
identities and
designated identities

designated identities

gap

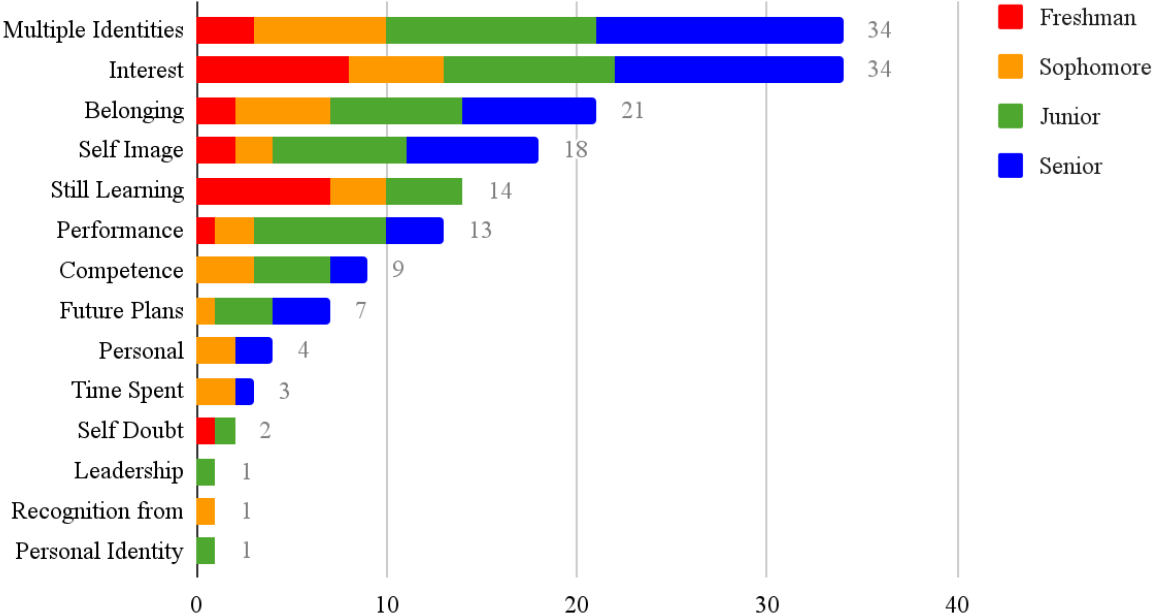
actual identities

⇒ Persistence
Belonging

(McDonald et. al. (2019))

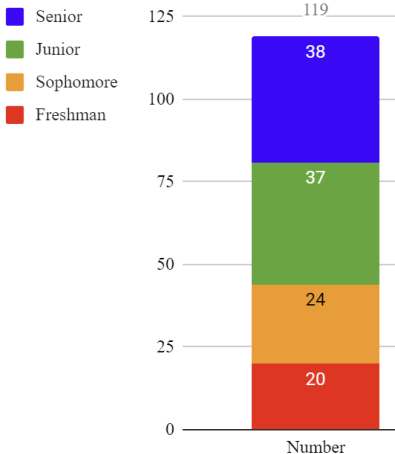
Identity development over time (undergrad women)

Factors (coded) explaining response to self-assessed overlap by grade

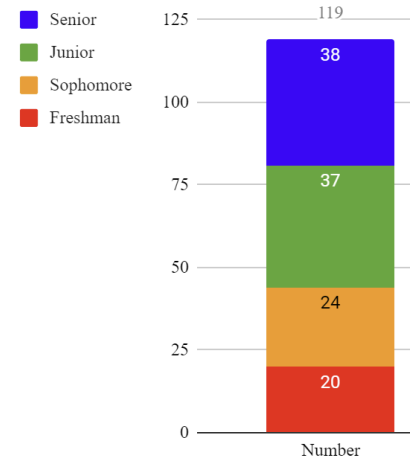
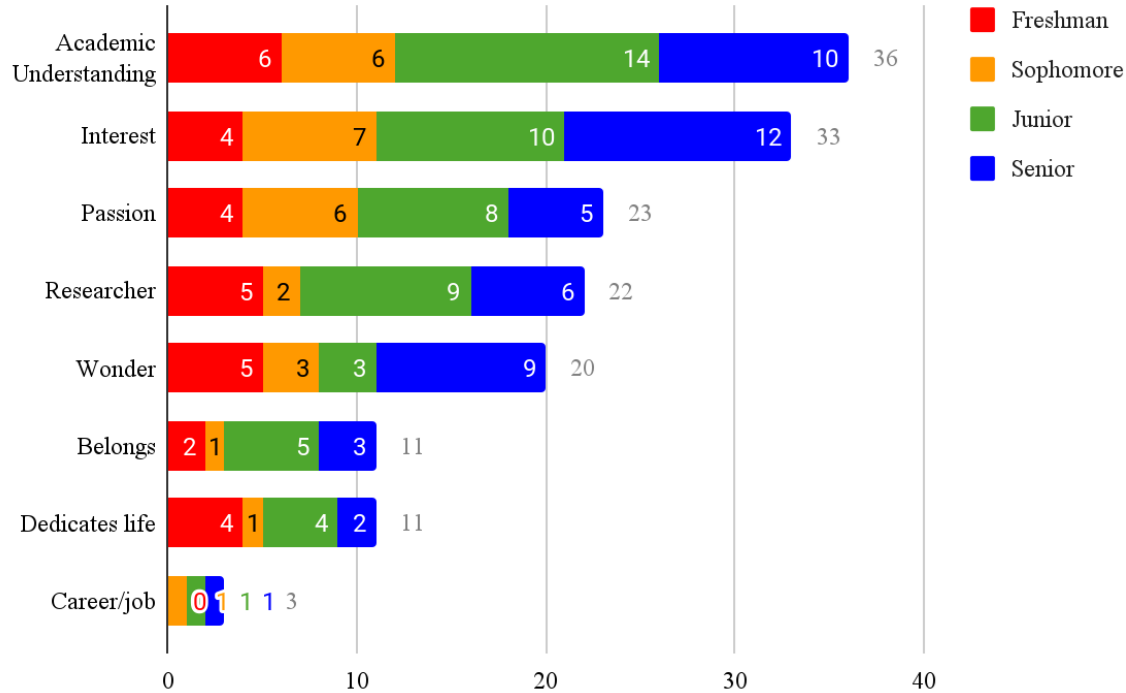


Q: Is belonging a senior thing? (Hazari says yes). This data says not for these women.

Q: Were competence and performance more of a freshman thing? (Alqvist et. al.) Again, this data says not for these women.



Physicist definition over time (undergrad women)



Future plans? Leadership?

Quantitative (χ^2) analysis revealed no statistically significant results comparing Physics Identity (A-G responses) with:

- Future plans: 86 (71%) responded “Graduate School (STEM)”
- Leadership: numbers too low
- Self-Identity was correlated with coded explanations for question 1 (calibration was correct!)

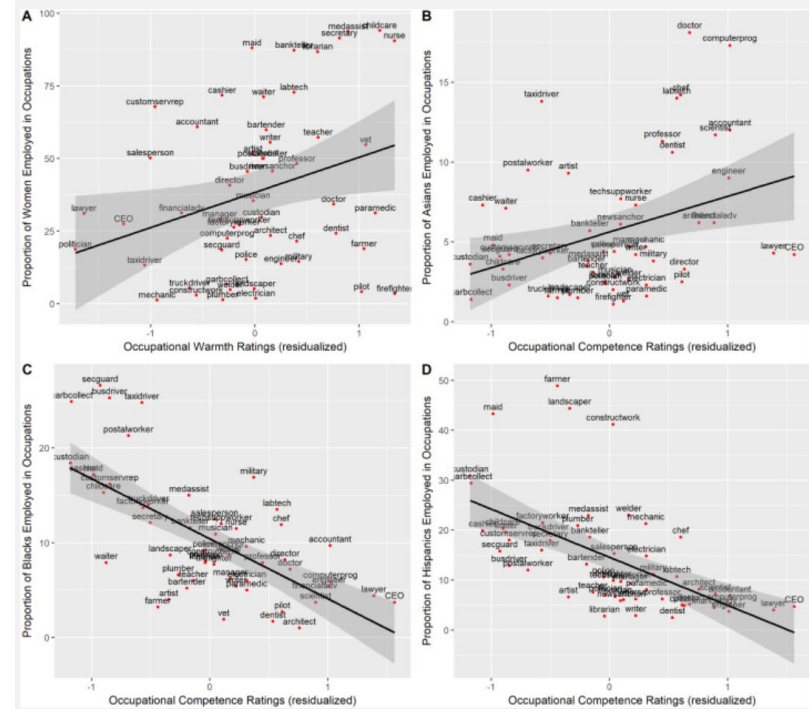
Qualitative analysis of 31 corresponding interviews ongoing/forthcoming

Discussion: Stereotype Content Model

Table 7.1 Four types of out-group, combinations of status and competition, and corresponding forms of prejudice as a function of perceived warmth and competence

		<i>Competence</i>	
		<i>Low</i>	<i>High</i>
<i>Warmth</i>			
High	Paternalistic prejudice Low status, not competitive Pity, sympathy (e.g., elderly people, disabled people, housewives)	Admiration High status, not competitive Pride, admiration (e.g., in-group, close allies)	
Low	Contemptuous prejudice Low status, competitive Contempt, disgust, anger, resentment (e.g. welfare recipients, poor people)	Envious prejudice High status, competitive Envy, jealousy (e.g. Asians, Jews, rich people, feminists)	

Fiske, 2002.



He, J. et. al. (2019)

Discussion (cont.)

Table 3. Resulting Goal-Endorsement Factors: Agentic and Communal Goals

Agentic goals ($\alpha = .87$)	Communal goals ($\alpha = .84$)
Power	Helping others
Recognition	Serving humanity
Achievement	Serving community
Mastery	Working with people
Self-promotion	Connection with others
Independence	Attending to others
Individualism	Caring for others
Status	Intimacy
Focus on the self	Spiritual rewards
Success	
Financial rewards	
Self-direction	
Demonstrating skill or competence	
Competition	

Note: A factor analysis of goal-endorsement items supported two distinct factors: agentic goals and communal goals. Cronbach's alphas indicate high internal consistency within each scale.

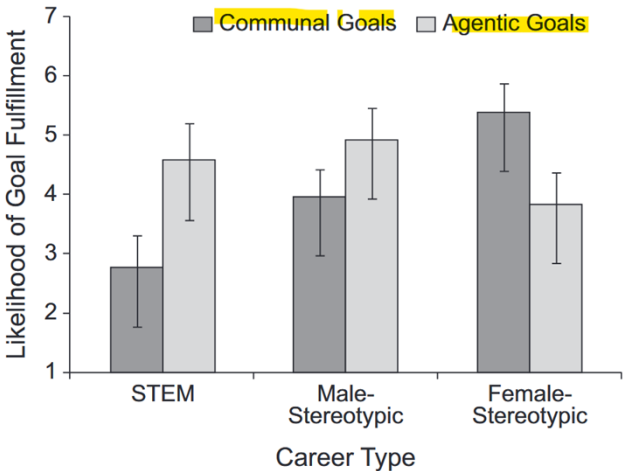


Fig. 1. Participants' mean ratings of the likelihood that communal and agentic goals would be fulfilled by science, technology, engineering, and mathematics (STEM) careers; male-stereotypic careers; and female-stereotypic careers. Error bars reflect standard deviations.

For URMs: Connections between interests in STEM and their racial/ethnic backgrounds and communities

For women: communal goals of greater importance. (Diekman et. al. 2010)

Conclusions

- Physics identity for undergraduate women is complex
 - Data from self-selected CUWiP attendees (perhaps lessening the Physics identity)
- Omissions should not be taken as non-factors; interviews may shed more light here
- Psychological and Sociological frameworks may be useful
- K-12 plays a significant role
- For women and other URM in physics, ***community in Physics*** needs to be examined.
 - How can this be addressed by
 - explicit norm-setting (culture establishment)
 - curriculum and instruction?

