

Listening to Women in Physics Education

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Women and Physics

- My background: physics & physics education
- My interests: women and physics; women and physics education
- My research: various approaches to increasing participation of women in physics and physics education

What is the problem?

- There is an underrepresentation of women in physics.
- Women receive 21.5% of bachelor's degrees in physics.
- Women receive 19.6% of master's degrees in physics.
- Women receive 13.5% of doctoral degrees in physics.
- We need to be encouraging everyone to learn and understand science. Science/physics needs more women!

Two branches of physics

- Traditional Physics: nuclear physics, thermal physics, solid state, astrophysics, quantum physics
- Physics Education Research: how students learn physics, what misconceptions students have, what students believe about physics, what curriculum & instruction work best

Traditional Physics vs. Physics Education Research (PER)

- Seem to be more women in PER than in traditional physics
- A “census” of the PER community showed that this was true—about 40% of PERers are women (Ph.D.)
- What is it about PER that’s more welcoming to women?
- To answer, created survey for women in PER

Survey of women in PER

- Emailed to women in the field
- Experiences with UG & grad departments
- Role models & mentors
- Family background and support
- Impressions of physics & PER communities

Population Surveyed (so far):

● 18 women in Physics Education Research

● Current position:

- 6 graduate students
- 2 post doctoral associates
- 9 professors
- 1 other

● Current institution:

- 2 small state universities
- 14 large state universities (R1)
- 2 small private school

Results of Survey (demographic)

● Undergraduate Institution:

- 5 large state universities (RI)
- 9 small private universities
- 2 mid-sized universities
- 4 non-U.S. universities

● Graduate Institution:

- 19 large state universities (RI)
- 2 mid-sized universities
- 3 non-U.S. universities

Results (demographic cont.)

● When did participants choose physics?

● 1 during middle school

● 4 during high school

● 12 as undergraduates

● 1 after graduate school

● When did participants choose PER?

● 3 as undergraduates

● 3 between UG and grad

● 7 as graduate students

● 2 as post-doctoral associates

● 3 while teaching

Results (Gender Perceptions)

- Perceptions of gender ratio in physics?
 - “pretty low” “seems low” “low # of women”
 - “heavy on the boy side” “male domain” “male dominated”
 - estimated percentage of women between 10% & 50%
- Actual gender ratio in physics:
 - B.S. 21.5% earned by women
 - M.S. 19.6% earned by women
 - Ph.D. 13.5% earned by women

Gender Perceptions

- “There are clearly many more men than women. This has never been an issue for me. I think I actually kind of enjoy it.”
- “I think the percentage of women in physics is extremely low. I’m used to it and, in that sense, am comfortable. This does not mean I think it is right.”

Results (Gender Perceptions)

- Perceptions of gender ratio in PER?
 - estimated percentage of women between 30% & 50%
 - most thought more women than in traditional physics
- Actual gender ratio in PER:
 - ~40% of community is female

Impressions of the Physics Community

- Physics community viewed from unwelcoming to neutral
- “As a community I often don’t want to be a part of, due to their arrogance!”
- “Physics was a cold-hearted place, where people ate each other for sport.”

Being Female in Physics

- “I always felt a push that I was ‘smart’ and should do something ‘smart’ - physics, which interested me anyway, was probably the perfect choice from my parents’ viewpoint.”
- “I wanted to succeed in a field that not many go into because I wanted to prove to myself that I could do it.”
- “Growing up I heard from people that physics is hard and I knew that there were not many women in the field. I wanted to prove that I could do it. It was determination, prove that I am good as anybody else thing. A psychologist could have a field day exploring my psyche!”
- “This [independence] probably comes from the feeling of needing to prove I am capable (to the boys).”

Professional Meetings: American Association of Physics Teachers

- “It [AAPT] is a close, warm, fuzzy community.”
- “[Meetings] provide an opportunity to make professional contacts, talk shop...and get support from my peers....It is nice to go to meetings where I can talk to people who closely share my interests. I highly value this aspect of meetings.”
- “AAPT always inspires me and recharges my batteries.”
- “[AAPT provides the opportunity] to network and connect with others.”

Family Support

- “I can use my fiance as free test subject and can tell advisor when not available for wedding planning reasons.”
- “My family would have killed me had I not gone to college. The quote was something like ‘you’ve got too many brains not to go.’”
- “As my grandmother used to say to me, they can take everything away from you, but not what’s in your head.”
- “I was brought up as a boy - with boy’s toys as my father wanted to have a son. I didn’t have a doll until I was 11 years old...I think that playing with boys toys is extremely important. I am not sure what Barbies help to learn - I don’t want to sound rude though.”

Mentors & Role Models

- Many projects and programs include mentoring or bring in women as role model
- Literature often cites the benefits of role models and mentors (Adams, 1993; Moses, 1989)
- MentorNet, others claim success
- Little is actually known about the effectiveness of role models (Equity Equation, 1996).
- Although female students can be mentored by male scientists, research shows that women have more influence than men as mentors for female students.
- Physics has few female role models, PER was “founded” by a woman

Role Models

- Role models are not chosen for their position, but rather for their personality and characteristics.
- “I admire and respect different qualities in many people that I know and I try to use these characteristics to shape my life, professionally and personally.”
- “...the part I model is not necessarily the career path but the approach to work they took.”

Mentors

- Mentoring is a positive experience.
- “invaluable”, “terrific”, “rewarding”
- Mentors offer guidance, advice, support.
- “People have always looked out for me, and provided advice and guidance. I guess its is a personality trait. I listen and value their advice, but don’t necessarily use everything they say.”
- “I wanted to work with someone who had sufficient experience and wisdom to guide me, yet give me some freedom, and respect my opinions/previous experiences.”

Other Quotes

- “I think it is more to my advantage to be female, even though decisions in the world may not be fair or conducted in an even-handed way. I think the whole package that I am makes me better able to have overcome, coped and learned what I have learned and continue to learn in my life.”
- “I don’t trust girls. I had several experiences throughout my childhood and teenage years that showed me that females were not to be trusted not to turn on you or abandon you.”

Preliminary Conclusions

- Participants are mostly comfortable with the small number of women in physics.
- Professional meetings are very important.
- Family helps more than hinders.
- Mentors offer support and guidance; role models exhibit characteristics to aspire to.

Implications for Instruction

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- Community is important!
 - What Works for Women in Undergraduate Physics? Whitten et. al. Physics Today, Sept 2003, 56(9) p.46
 - What Works? Whitten et. al.(2003) J. of Women & Minorities in Science and Engineering 9(3&4) 239-258.
- Develop a sense of community in the classroom: promote study groups, small group and large group interactions, know names, peer grading, peer instruction,
- Bring students to local & national conferences or create classroom conference

Implications

- Teachers need to be aware of outside influences such as family
- Mentoring can be valuable for majors and non-majors; advising and mentoring through teaching?
- Female role models aren't as important as good role models; teachers regardless of gender should try to serve as good role models for personal characteristics rather than just by being a good science teacher