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

Thursday, October 21, 2010
Results of Survey (demographic)

Undergraduate Institution:
- 5 large state universities (R1)
- 9 small private universities
- 2 mid-sized universities
- 4 non-U.S. universities

Graduate Institution:
- 19 large state universities (R1)
- 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

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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).”
“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 models.

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.”

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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!


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.