What Works for Women in Undergraduate Physics?

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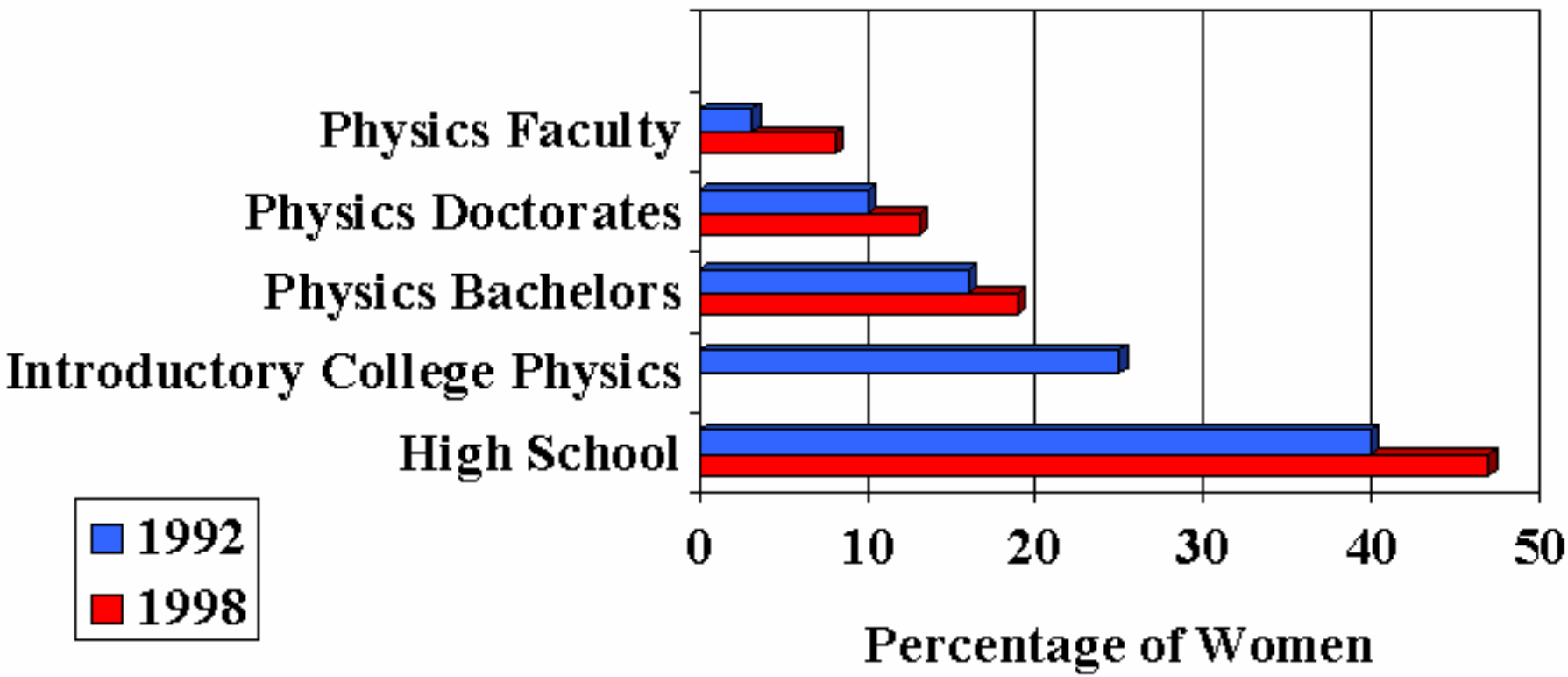
Outline

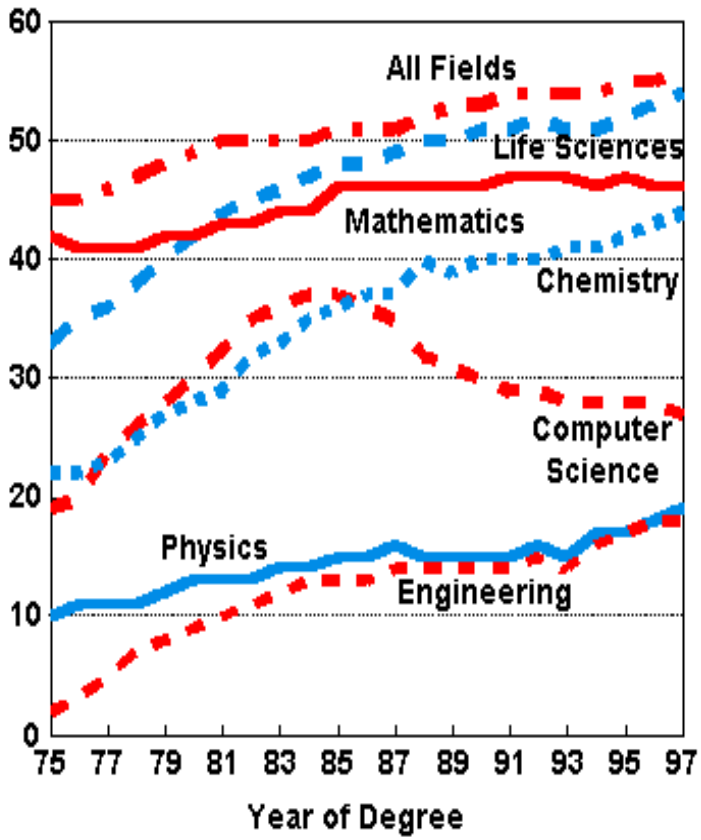
1. Why so few women in physics?
2. This project
3. Results
   a. Creating a strong fabric of departmental culture
   b. More is not necessarily better
   c. What HBCU’s are doing right
4. Conclusions

The "Leaky Pipeline"
Women opt out of physics at every step up the academic ladder.



Physics is the "coldest" science for women

Percent of Bachelor's Degrees Earned by Women



This Project

- We visited 9 undergraduate only physics departments
- 5 successful, 4 typical, 2 HBCUs
- Team: 3 women physicists, one a recent BA recipient
- Interviewed with male and female faculty, male and female majors, department chair, dean, lab staff
- Toured department to see facilities and use of space
- Observed classes and labs

Teaching and Curriculum

- Most curriculum and pedagogy traditional
- Female faculty tend to be more innovative
- Student-faculty research is important

Teaching and Curriculum

The traditional Introductory course does not receive high student reviews

Yeah, but how many times can you sit there and solve problems like 'how fast is the block sliding down the incline?' (laughter) . . . If you took physics in high school it was a lot of the same stuff. (Male student)

Teaching and Curriculum

"Cookbook" labs are less popular than open-ended project oriented labs, even when projects are more time-consuming

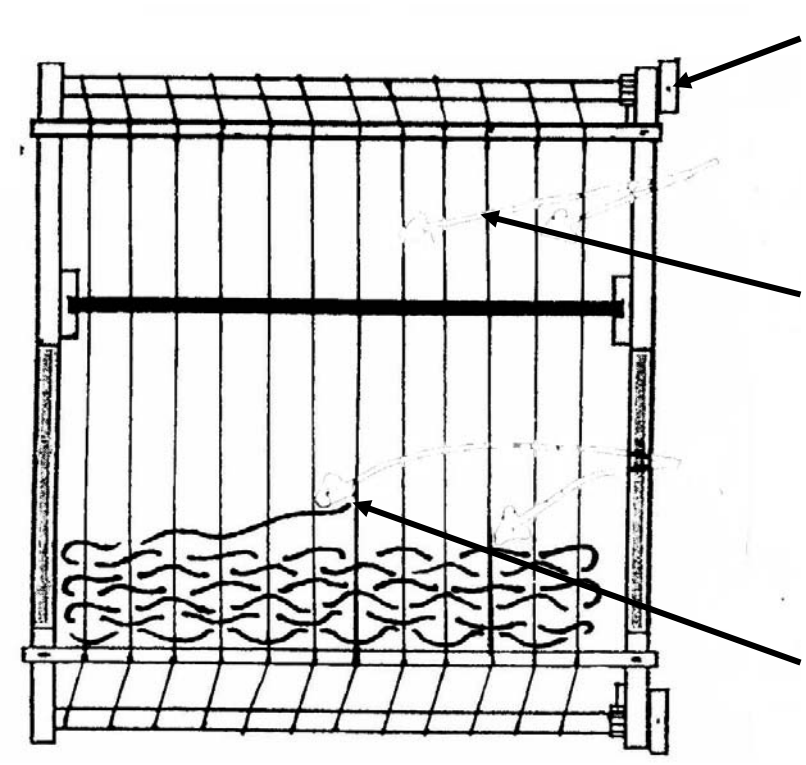
In a lot of experiments it's just turning a dial or something like that. I wanted more hands on.. . . .Most of the labs are already set up. The only lab I really liked was the radio because you had to do it on your own. He gave you the key and you had to go to your room and figure it out. (Male student)

Teaching and Curriculum

Some students are recruited through innovative non-major classes.

[Physics course for education majors] was a lot more examples and demos and real life situations—a lot less math. Things that anyone would be interested in knowing, like Bernoulli's principle is when the shower curtain comes in on you and sticks to you. . . . General stuff that makes physics fun, especially for people who don't like math. (Female student)

Strong Departmental Fabric



Loom—Institutional Support Structure

Warp—Faculty provide continuity and structure

Weft—Students create community

LOOM
Faculty work together as a team

Successful departments have diverse faculty who respect each other's (different) strengths and work together

We have different styles and we are all unique, but we know how to work together to get things done. (Male Department Chair)

LOOM—Women Faculty are not essential but they ARE important

- Male faculty can successfully mentor women students—3 of our 5 successful departments had all male faculty.

It would be nice to see some really good female professors who are supportive of females going through the science program, just to know that you can get somewhere. (Female student)

- Elizabeth Tidball (1986) found a strong correlation between the presence of adult female role models and the aspirations of women students.

I could look upon her as a role model and relate more.. The male faculty are sort of role models for me, but it's not exactly the same. (Female student)

LOOM
The Difficulty of Hiring Women

When our number one candidate comes out to be a woman and we offer her the job, that she'd take it. That's happened twice, in the last few searches. (Department chair)

- Department chairs and deans seem totally unaware of any connection between institutional policies and the difficulty of hiring women faculty.

- *The woman who was here who left was very good. . . . I think her spouse could not find anything to do. (Department chair)*

- The expense of family-friendly policies must be weighed against the expense (in money and faculty morale) of failed searches and startup money for faculty who leave in a couple of years.

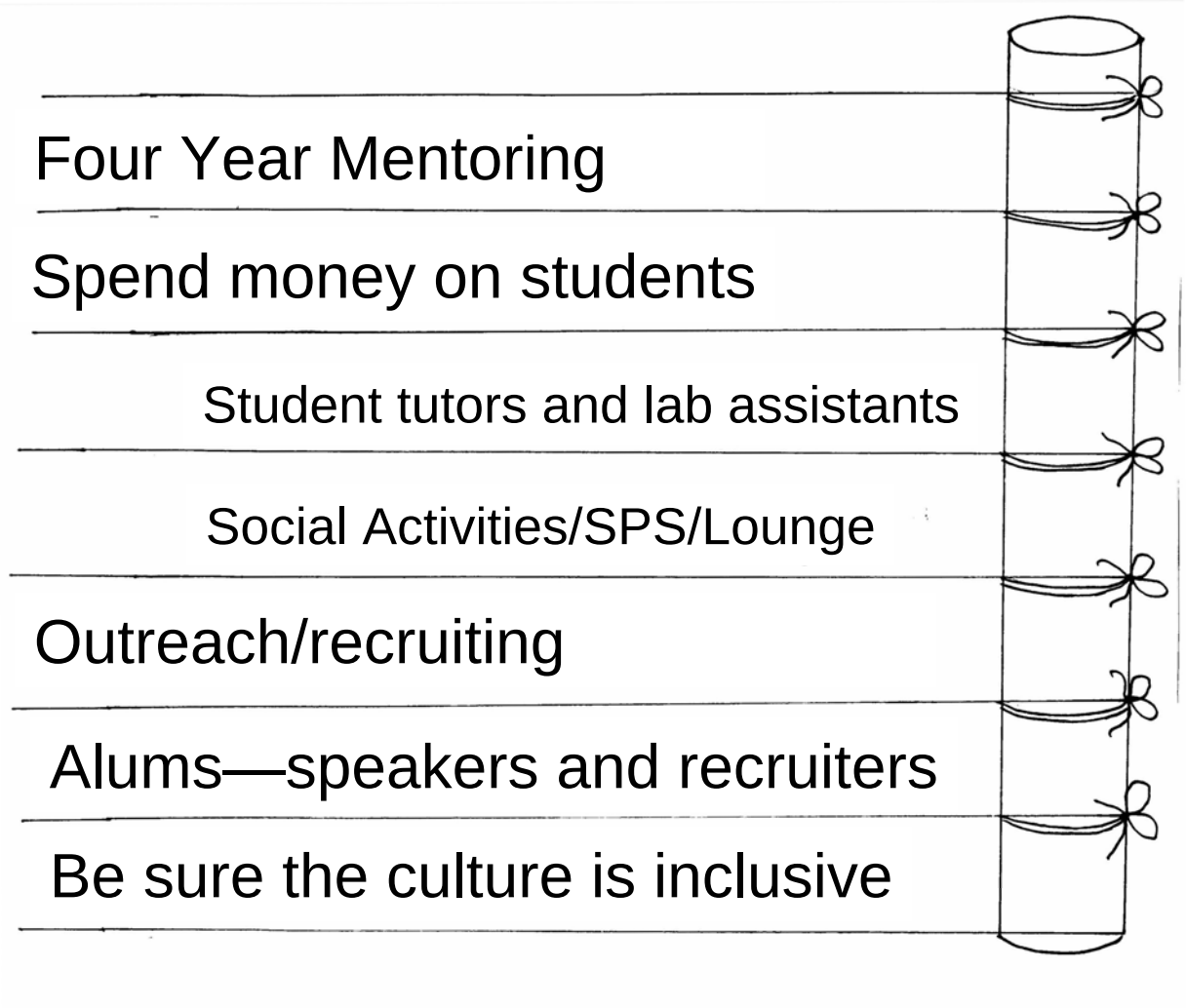
LOOM
Career-Family Conflicts

Rosser and Lane (2002) interviewed female recipients of NSF research grants about barriers to their career advancement. Conflicts between family and career came up more than twice as often as any other issue.

LOOM
Family Friendly Policies

- Help for academic couples (the two-body problem
  - 68% of female physicists are married to other scientists vs 17% of male physicists
- Family leave and slowing tenure clock
  - Broadly defined for different families at different stages of life
  - Must be carefully monitored to be sure faculty aren’t punished for taking leave
- Childcare
- Family-friendly atmosphere

WARP—Faculty create structure and continuity

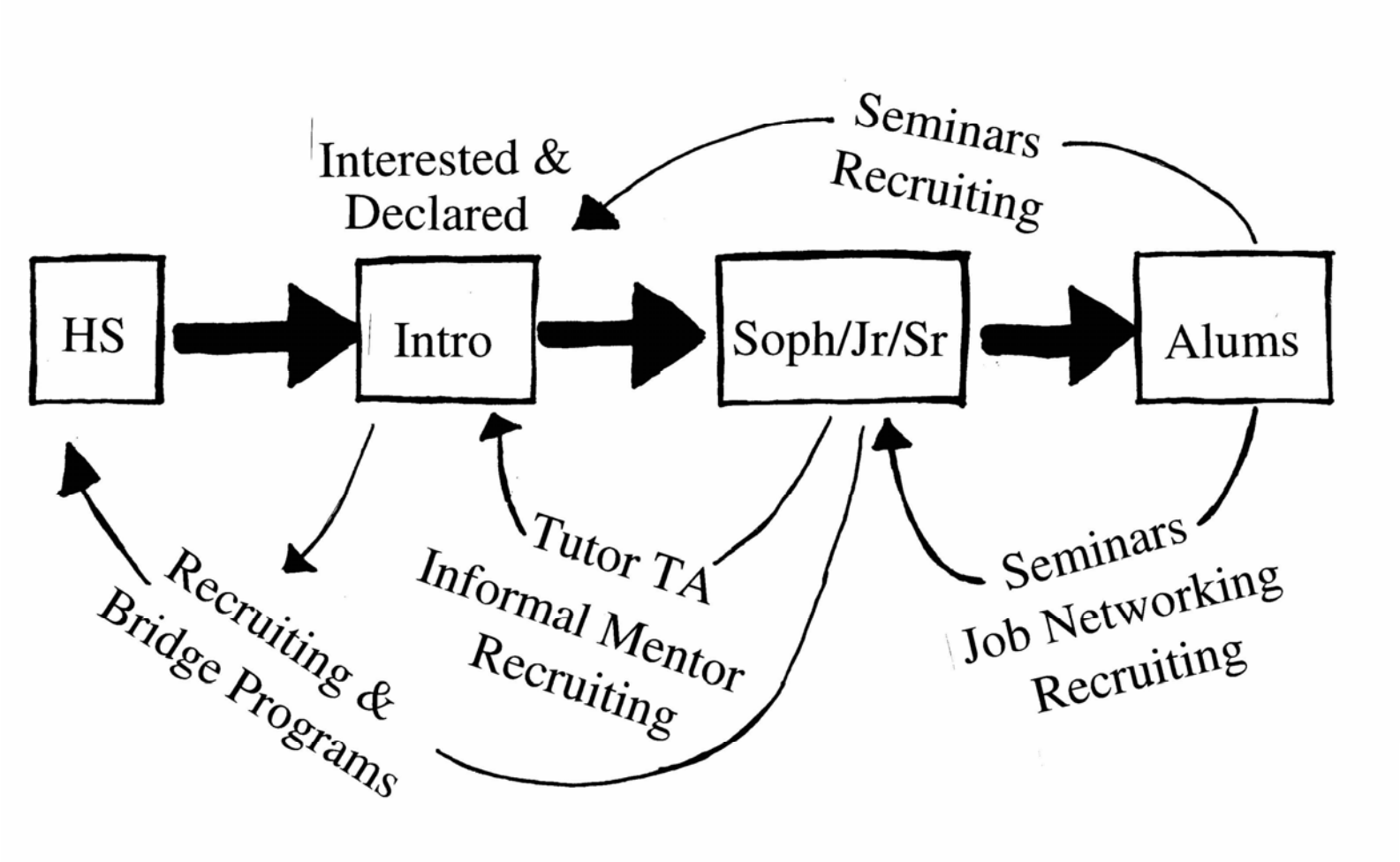


WARP—Four year Mentoring

As a freshman coming in and not having a lot of experience with the department, I wish they would do something to make the individual professors seem more approachable (Female student)

[Male professor] does that more so than anybody else. The way he does it is that he passes out index cards in the first class and asks them to indicate their interests. Then once he has identified those who say they have an interest in physics, then I think he makes the extra effort to get them involved in SPS, going on field trips and buying into the department and so on. (Male Department Chair)

WEFT—Students create culture and community



WEFT
What students can do

- Treat other students as partners, not competitors.
- Be inclusive, don’t encourage or participate in sexist or racist “jokes.”
- Plan physics-related activities (e.g. trips to research laboratories). Ask faculty for logistic and monetary support.
- Organize an SPS chapter or Physics Club.
- Get to know younger students. Be sure potential majors in introductory physics are included in activities.
- Plan outreach activities, e.g. to local schools.
- Contact alums for advice about postgraduate plans. Ask faculty to recommend appropriate people.

Historically Black Institutions

- Extraordinarily productive of women scientists—75% of African-American women scientists have bachelors from HBCU (Leggon and Pearson, 1997)
- 8 of AIP's 20 successful schools are HBCU's
- family atmosphere—mutual respect

Yes, (the faculty and staff)-try to help young Black people at this school . . . it affects the community—it all comes back, you know. We help the community by being educated. (Male student at an HBCU)

- African-American culture supports extended "it takes a village" model of child rearing

You have to understand that [family] is a cultural term for us as a people. I guess the closest is the African idea that it takes a whole village to raise a child. (Female provost)

Historically Black Institutions

- HBCU's are dedicated to success of each student—female and male

  [A good faculty member is one who will] cover the content and go the extra mile and give the student the assistance, but they have to hold the student to the standard. They don't lower the standards because the student has a deficiency. Physics is physics wherever you are. (Female Dean)
- particularly successful at using students in recruiting efforts
- alternative paths into major
- minimal resources

How does this apply to research universities?

- Pay attention to undergraduates—that's where graduate students come from
- First year is important—chose good teachers and friendly, accessible people to teach intro course for majors
- Have some seminars at undergraduate level
- Work to warm up department culture with informal student-faculty activities
- Monitor department culture to be sure it is inclusive
- Be sure women students feel safe in the department at night

What about graduate programs?

- Department climate is important for women graduate students
- Presence of women faculty is important
- Family-friendly policies are important for women faculty
- First year is critical for graduate students
  - Good teaching and advising
  - Orientation and social activities
- Support of Department Chair is critical
- Department safety must be monitored
- Consider a CSWP site visit (www.aps.org/educ/cswp/visits/index.html

Conclusions

- Note that most of these suggestions do not target women.
- Department culture that is inclusive of women students and potential majors in introductory courses is critical
- Male faculty *can* successfully mentor women students.
- Female faculty provide important role models.
- Family friendly policies could be important for recruiting.
- Student-faculty interactions must respect appropriate boundaries.
- HBCU's are models of strong student-oriented departments.