Getting to Lake Wobegon

Department-Level Diversity of PhD Chemistry Graduates

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Overview of the study
Professional Preparation of Ph.D. Chemists

• How are departments, faculty & students responding to the changing context of graduate education, and to calls for reform around professional preparation?
• What changes to practice are underway?
• What is working—or not—about Ph.D. science education today?
• How do students develop career skills & make career choices in graduate school?
Chemists have high interest in non-academic careers

Sauermann & Roach, 2012
Chemistry employment is becoming less secure...

...and more risky
Our two-pronged approach

1. **“Mapping”: a broad survey of the landscape**
   What is current practice in chemistry Ph.D. education with respect to career preparation & decision-making?
   Loshbaugh et al. (2011). J Chem Ed
   Laursen & Weston (2014). This study

2. **In-depth case studies: a closer look**
   How do students, faculty, & other wise observers see the connection between graduate education, career preparation, & joining the discipline as a practitioner?
   Laursen et al. (2012). AERA conference paper
   Thiry et al. (2015). In review.
Status quo for chemistry

~2400 PhDs in chemistry awarded each year
  = 60% of PhDs in physical science
  = 7% of PhDs in S&E (~33,000)

5% to underrepresented minorities ("URM")
34% to women

*NSF SRS (2011 & 2006)*
Our study sample

IPEDS (Integrated Postsec Ed Data System, US DoEd) time series data on PhDs awarded in chemistry:

- Annual, all subfields
- 1987-2009 resolved by gender
- 1995-2009 resolved by race/ethnicity & citizenship


- Account for ~60% of all chem PhDs
- Practical cutoff: ~10 PhDs awarded/yr
Study variables

PhDs by institution (from IPEDS):

- Total # PhDs awarded
- % of PhDs by gender and by race
- % of PhDs to citizens and non-residents

Faculty by institution, by gender & race (from Nelson Diversity Surveys, 2007)

Testing trends in representation

Hierarchical Linear Modeling (HLM) tests linear trends:

• Appropriate for “nested” data. In our study, years are nested within institutions. Model accounts for dependency within institutions.

• Model tests growth over years:
  Is representation going up or down over years?

• Do other variables such as size of school predict rate of growth among schools, e.g.:
  Are growth rates higher at larger or smaller schools?
The proportion of women earning PhDs is increasing nationally…
...but women’s representation does not increase evenly across institutions

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Variation from the Mean: Representation of Women PhDs

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- LSU
- Average
- Harvard
The pool of potential applicants is growing… but PhDs to women trail growth in BS/MS degrees
What influences growth in % women PhDs?

- Departments that grant more degrees overall grant fewer to women (big depts are less gender-balanced)
- Overall growth in PhD grads correlates positively with growth in women grads (depts grow by adding women)
- No statistical relationship between %women PhDs & %women faculty
- Literature: critical mass, mentoring, collegial environment, interdisciplinary work
The number of minority PhDs is small
Percent URM students 1995 - 2009
Trends: Race & ethnicity

Student bodies are becoming more diverse ‘95-’09

✓ Proportion of US white students fell 11%
✓ Proportion of US Hispanics rose 1.4%
✓ Proportion of non-residents rose 11%

Larger departments have proportionately…

✓ more white students
✓ fewer Black & Hispanic students
✓ fewer non-resident students
Relationship to faculty composition

Departments with more white faculty have…

✓ more white students
✓ fewer Hispanic, Asian & non-resident students

Departments with more Black faculty have

✓ Proportionally more Black students
**URM representation does not increase evenly**

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Beating the pack: Graduation of URM PhDs

![Graph showing the graduation rate of URM PhDs over years, with lines for Purdue, Florida State, and Average.](image-url)
Diversity offers benefits and challenges

From our interviews
• Diversity of student bodies varies widely among depts
• Some depts actively & intentionally seek diversity
  – Know & track data; prepare diversity plans; define who is accountable (see Purdue, LSU examples)
• Successful strategies combine recruitment efforts with student support plans
• A climate of nurturing the whole person is a good retention tool

*Diversity has a snowball effect*
Departments that have built a critical mass find that recruitment & retention “take care of themselves”
What does it take to be “above average”? 

[Graphs showing trends in percent women and percent URM over years for different institutions.]
Resources

Purdue plan for broadening participation

U Michigan Rackham Grad School, “Recruiting for Diversity”

Washington GO-MAP recruiting best practices

*Diversity & the PhD*, Woodrow Wilson Foundation, 2005

StratEGIC

Strategictoolkit.org

Laursen & Weston (2014). J Chem Ed

http://www.colorado.edu/eer/research/grad.html