Pipelines, Watersheds and Other H_20 Distribution Systems

- ☑ Attraction *and* retention
- ☑ Farm systems vs. free agents

Supporting Students as Learners and as People

> *"In addition to academic skill and personal desire, being successful in the mathematical sciences takes 20 percent nature, 60 percent nurture, and 100 percent determination."*
>
> —Trachette Jackson
> Professor of Mathematics
> University of Michigan

- ☑ Communicate an expectation of success, rather than one of failure;
- ☑ Select first-year course instructors carefully;
- ☑ Modify program requirements to correspond to educational objectives;
- ☑ Allow students more time to master the basics before beginning advanced courses.

Promoting Diversity at the Graduate Level in Mathematics
Mathematical Sciences Research Institute
Berkeley, CA 2008
National Science Foundation, National Security Agency, & Andrew W. Mellon Foundation
http://library.msri.org/msri/DiversGradMath.pdf

"Concern" vs "Challenge" (or even "Opportunity")

- ☑ Heterogeneity of knowledge/skill sets
- ☑ How many students would you trust to do a data analysis?
- ☑ Can you teach data analysis/science without engaging in data analysis/science?
- ☑ Mathematics teaching is not so ubiquitously wonderful

How to Move Forward

- ☑ Learn from people/programs who have been there before… but don't be constrained by those viewpoints
- ☑ Flexible cross-disciplinarity
  - ➡ "outstanding senior undergraduate, a young woman majoring in computer science…not occurred to her that statistics might be a good option, and, from the standpoint of admission to a graduate program in statistics, she presented logistic complications; it was not clear exactly what she would study, or how many years it would take to complete her degree. We must make room for students like this and recruit them." – Brown & Kass
- ☑ Just-in-time learning (introduce mathematics as needed, not as pre-requisites)
- ☑ Cooperative learning
- ☑ Select/create first-year courses carefully (Introductory psychology model)
- ☑ Co-teaching (within and across institutions)
- ☑ Partnerships with community colleges and high schools

"Skate to where the puck will be, not to where it has been."

—Walter Gretzky

"So where have things gone wrong? We believe that the primary source of the current difficulties is an anachronistic, yet pervasive conception of statistics."

Course/Program Design

- ☑ Existing courses/programs vs. "new" program
- ☑ Content-focused vs. outcome-focused
- ☑ Topic-based vs. project-based
- ☑ Individual vs. team approach

Focus on statistical (computational) thinking

➡ Primary goal at all levels of statistical (data science) training

➡ "Currently, statistical thinking is internalized as a byproduct of extensive statistical training. Elevating it to an overarching goal allows curricula to be assessed according to the way in which statistical thinking is engendered."

What is Statistics?
Emery N. Brown & Robert E. Kass
The American Statistician, 2009