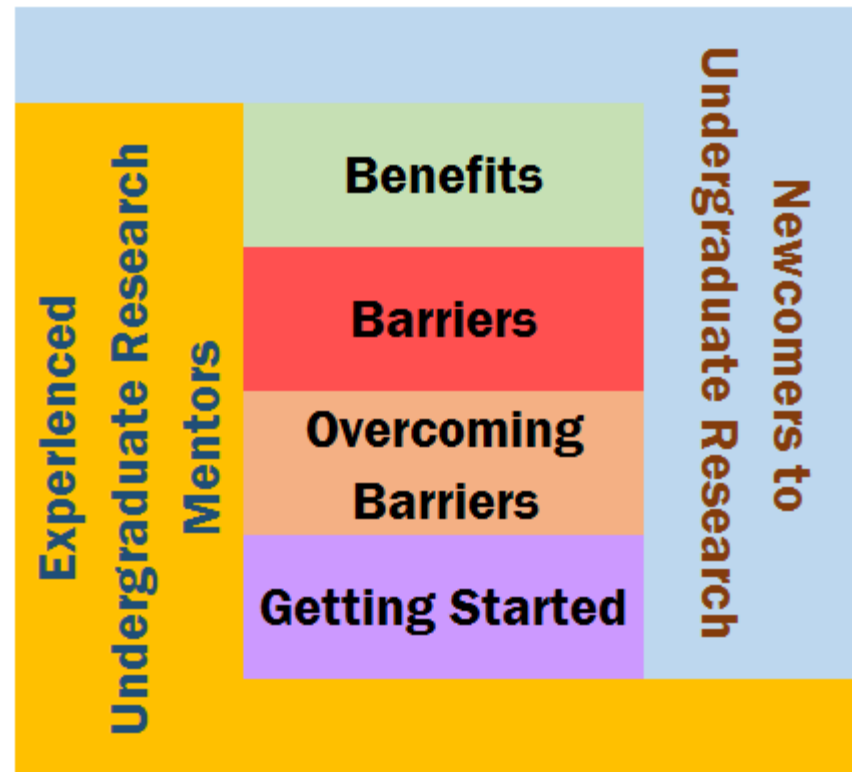# Mentoring Undergraduate Research Students

BENEFITS AND BARRIERS

Session Overview

Benefits – Faculty

1. Mentoring students outside the classroom can be highly enjoyable

2. Carefully chosen projects can help move your own research agenda forward; UR can be an excellent way to pilot new projects

3. May be beneficial toward tenure/promotion (good idea to discuss this with chair/administration as this is often campus specific)

4. A way to help handle "consulting" work (in particular for schools that do not have graduate students / consulting centers)

5. Keeps us sharp as practicing statisticians; engaged in the discipline.
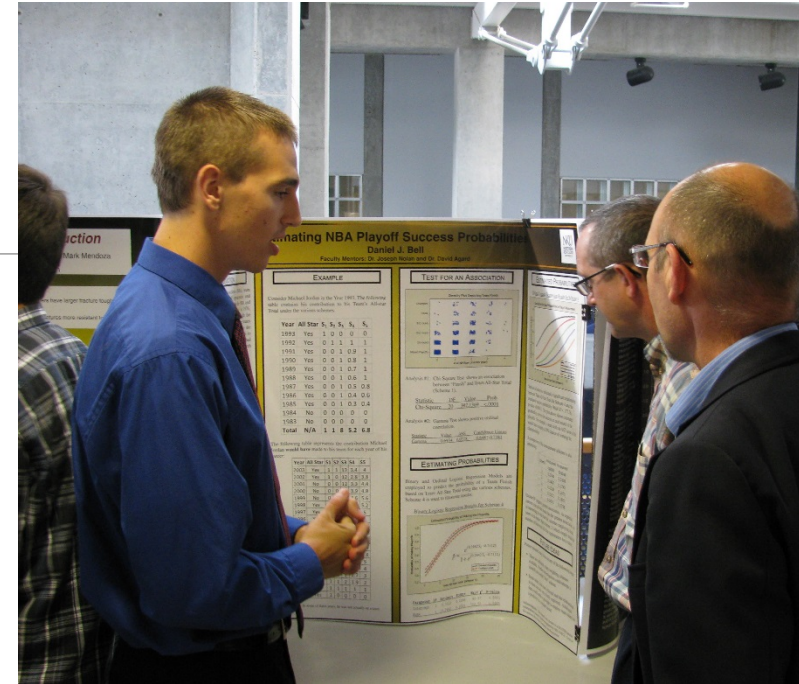
Benefits – Students

1. Participation can foster a sense of belonging within the field

2. Students see course material "in real life" and build close relationship with faculty

3. Summer stipends can help support students in completing their degree.

4. All of this can impact retention

5. Projects can result in direct connections to employers; even if not good preparation for career/grad school; employers like to see UR on resumes.
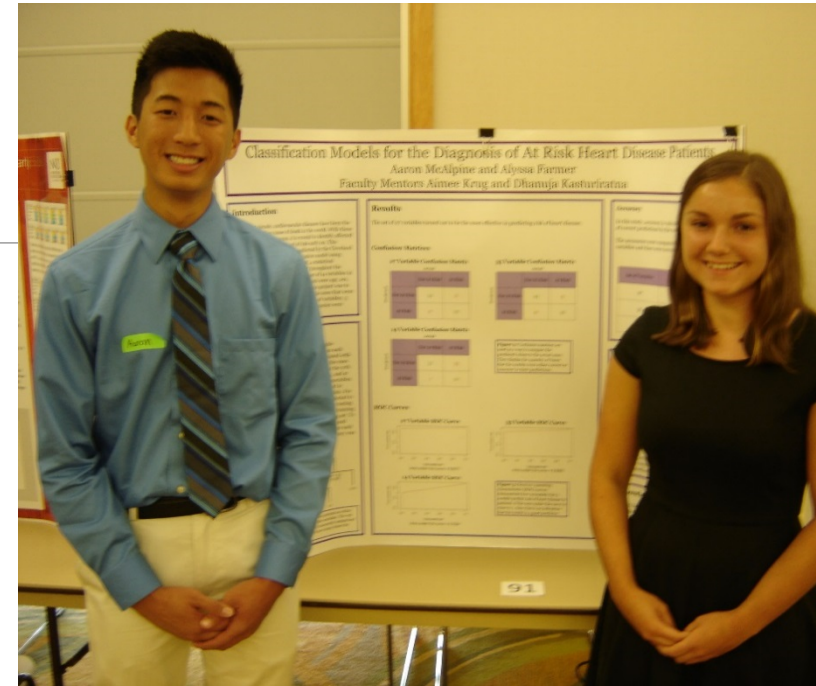
Retention of NKU UR-STEM Participants vs. STEM Comparison Group
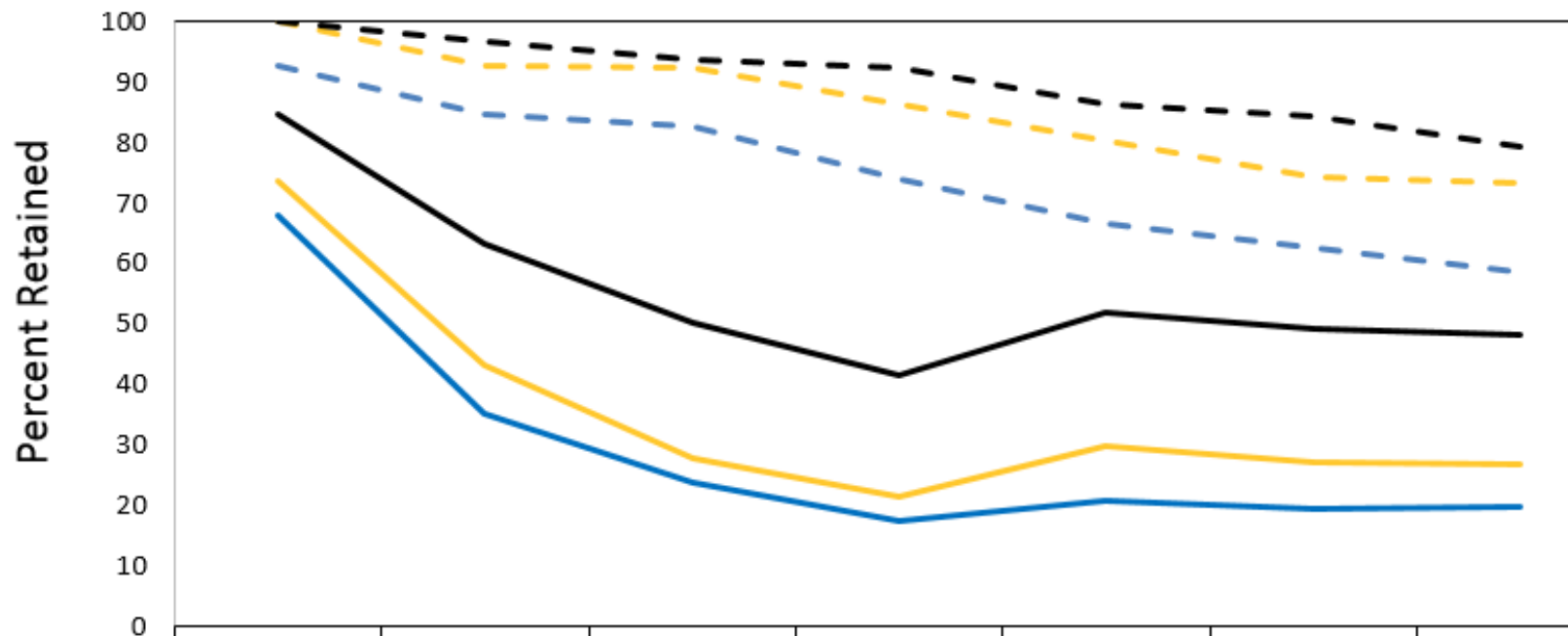
	1st Spring	2nd Fall	2nd Spring	3rd Fall	3rd Spring	4th Fall	4th Spring
UR-STEM (Retained Major)	92.9	84.7	82.7	74.1	66.7	62.7	58.8
UR-STEM (Retained STEM)	100.0	92.9	92.6	86.4	80.4	74.5	73.5
UR-STEM (Retained NKU)	100.0	96.9	93.8	92.6	86.3	84.3	79.4
Comparison (Retained Major)	68.0	35.2	24.0	17.6	20.8	19.5	20.0
Comparison (Retained STEM)	73.6	43.2	28.0	21.6	29.9	27.3	26.7
Comparison (Retained NKU)	84.8	63.2	50.4	41.6	51.9	49.4	48.3

Benefits – Institutional

1. Attractive to students (increase enrollment and retention); **Beneficial effect on minority students and first-generation college students**

2. Strong UR program can be leveraged toward grants, external funding

3. Projects can often support faculty from "client" disciplines

4. Best pedagogical practice; leads to increased fulfillment of student learning outcomes
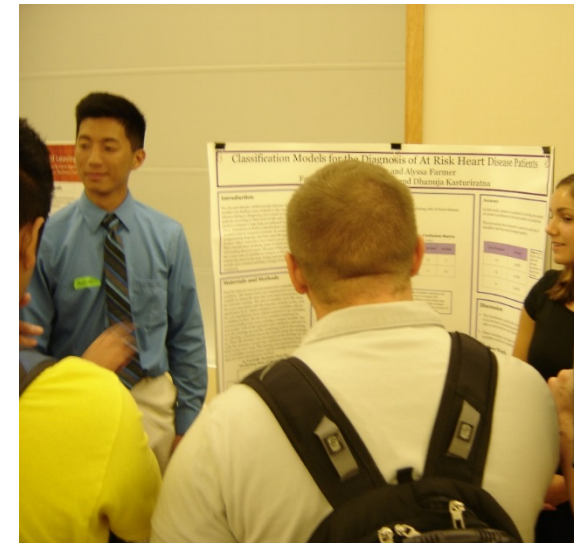
Audience Participation Questions

- Are student benefits alone sufficient to warrant your participation in mentoring undergraduate research?

- Does your college or university provide any sort of direct incentive for you to mentor UR?

- Which of the following do you see as significant barriers to your participation as an UR mentor?

Audience CQ&A

What comments or questions do you have about the benefits to UR, as relates either to our presentation or to your own experience?
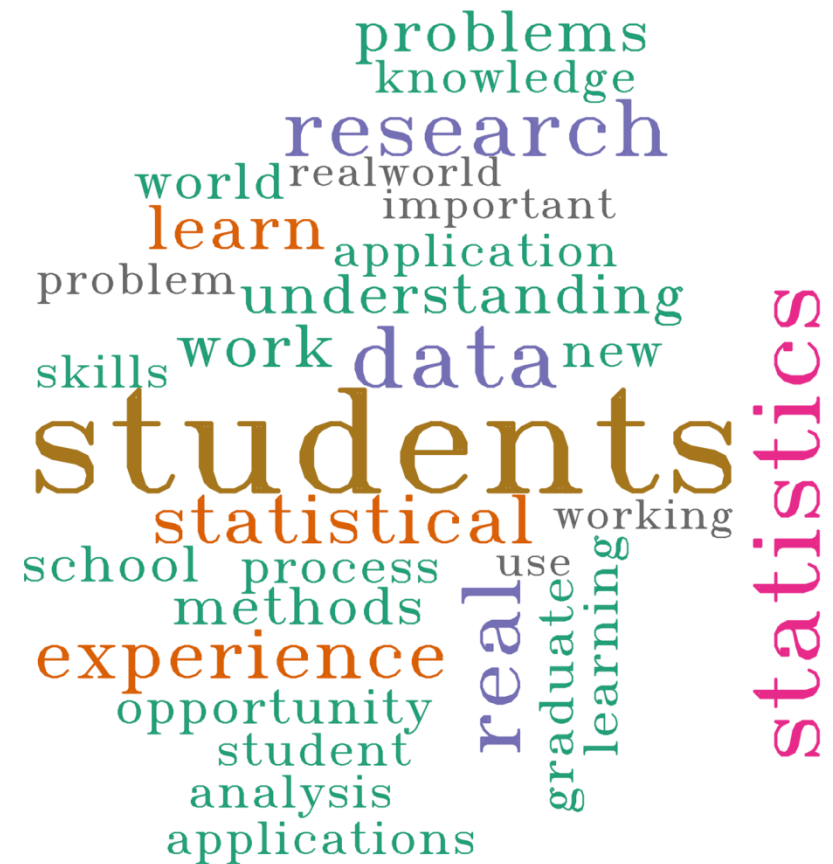
Barriers – Faculty

1. **The Tenure Catch-22:** How to weigh the value placed on supervising undergraduate research versus maximizing research output? The two objectives may seem to lie in direct opposition to one another.

2. **Funding:** Where does one find support for themselves and their students?

3. **TIME(!!!):** It takes time to train students. Many qualified students are upper class students, and thus close to graduation (leads to perpetual training and incomplete projects). How can you engage in mentorship of undergraduate research, and remain sufficiently productive?

Barriers – Students

1. **Funding:** Where to find funding? Student compensation may not include items like housing and meals, making other opportunities more lucrative.

2. **"Access":** Self-doubt can prevent students from applying, instead favoring more traditional jobs/internships. How to find (be aware of) appropriate opportunities? Some students (first-gen, say) may not see value in undergraduate research opportunities. Limited number of opportunities may keep capable students out, e.g., international students face a competitive market.

Barriers – Institutional

1. **Institutional Values:** Institutions may be looking for faculty research to make "maximal impact". This may not be compatible with undergraduate research.

2. **Maintaining uniformity:** Hard to set campus-wide standards and expectations since research varies widely by department, and value placed on undergraduate research may vary widely by department.

3. **Funding:** Even if research with undergraduates is valued, it is expensive to adequately compensate faculty and students.

Audience Participation Questions

1. Have you ever chosen not to undertake mentorship of an undergraduate research student because of one of the aforementioned barriers (tenure catch-22, funding, time)?

2. Have you ever had a conversation with your department, or administration, about these barriers to mentorship of undergraduate research?

3. Do you believe that the benefits of mentoring undergraduate research students outweigh these barriers?
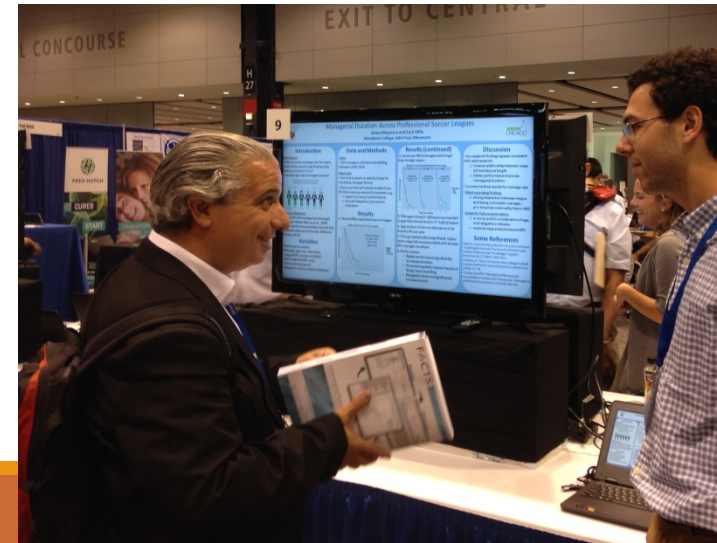
Audience CQ&A

What comments or questions do you have about the barriers to UR, as relates either to our presentation or to your own experience?

Overcoming barriers – faculty

Issue #1. How do you find the time for this?

- Ideal – buyout; release time; reduced departmental/institutional responsibilities

- Synergies with research projects – research agenda's and undergraduates

- Synergies with existing responsibilities – teaching; consulting

- Growing a program – upper vs. lower classmen; strategic choices; 2+ students in groups

- Consistently taking a creative problem solving approach and positive attitude to looking at how to be more efficient/time management

Overcoming barriers – faculty

Issue #2. Getting recognized

◦ Isostat; Chairs, deans and provosts; USPROC; Publish!; Grants

Issue #3. Where do you find funding?

◦ External: NSF REU; ASA REU; NSF-RUI, NIH-R15; REU supplements

◦ Internal: seed money – most schools have programs

◦ Foundations/scholarships

◦ Industry partnerships

◦ Kickstarter like models

Overcoming barriers – faculty

Issue #4. Creating a culture of UR

- Build on in-course experiences
- Partner with bigger PIs/institutions
- Highlight student work with peers and students

Overcoming barriers – students

Funding

◦ Investment in future; competitive for getting grad school paid

Access

◦ Start in classes; promote student work; changing culture to excitement about being in on 'discovery'

Overcoming barriers – institutional

Impact

◦ For many faculty (especially at PUIs) this is missional work; It's not either/or, it's both/and

Uniformity

◦ Differences in scholarship and research between disciplines

◦ Worry more about dean/chair than provost

Funding

◦ Donors; students are (relatively) cheap labor vs. faculty

Concluding tips and tricks

Sustainable and Synergistic

◦ Shotgunning

◦ Learn to sell

◦ Plan ahead! 3-5 YEARS (not months!)

◦ Momentum and persistence

◦ Avoiding the two 'big mistakes' – Entitlement and not getting started

◦ Creative funding – small; cost-share; etc.

Audience Participation Questions

Which of the following would work at your institution?

- Creating a research course

- Aligning student projects with your research

- Developing partnerships with industry and/or other colleges

Audience CQ&A

Do you have a strategy for overcoming some of these barriers that you would like to share?

What comments or questions do you have about some of the solutions we have proposed?

Logistics – Project Development

Where should I find undergraduate research projects?

- Computational pieces of your own research.

- Other faculty on-campus and local organizations.

Where can I find funding?

- Determine what internal sources are available.

- National grants.

- Preparation for Industrial Careers in Mathematical Sciences Program.

- Consider Kickstarter type fundraising initiatives and industry partnerships.

Logistics-Time

How can I fit undergraduate research into my work load?

- Create research/capstone courses.

- Advocate for a course reduction.

- Conduct a project over the summer.

- Develop projects that benefit your research.

Logistics – Selecting Participants

How do I make students aware of this opportunity?

- Advertise in your classes.

- Give a departmental seminar.

How do I select students?

- Consider factors beyond GPA, such as, motivation and inter-personal skills.

- Recruiting underclassmen allows for a longer term research project.

Logistics – Mentoring the Project

What should I consider to ensure a productive experience?

- Provide a lot of structure and hold frequent meetings.

  ◦ Assign weekly tasks.

  ◦ Require students to write every week.

- Consider using a version control system like git/github.

- Be encouraging and allow students to be creative.

- At the end of the project, give students the opportunity to evaluate the experience.

Logistics – Disseminating the Work

Where can the students present?
- On-campus research day
- Local, undergraduate conferences
- USPROC Competition
  - Research side for capstones / research projects
  - Class project if the project was done as part of a class
- National conferences
  - Electronic Undergraduate Statistics Research Conference
  - National Conferences on Undergraduate Research (www.cur.org)
  - Nebraska Conference for Women in Mathematics

Logistics – Distributing the Work

Should I try to publish my work with students?

- If possible, and try to involve the students in the writing.

Are there undergraduate journals?

- American Journal of Undergraduate Research (www.ajuronline.org/)

- Involve, a Journal of Mathematics (msp.org/involve/)

- SIAM Undergraduate Research Online (www.siam.org/students/siuro)

- The Rose-Hulman Undergraduate Math Journal (www.rose-hulman.edu/mathjournal/)

Audience CQ&A

What other comments or questions would you like to bring up, as relates either to our presentation or to your own experience?

Thank You!!!!