

Successfully Mentoring Summer Undergraduate Researchers

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Mentoring Roles

- ***University Education Director and Pyrone Testbed Champion, NSF Engineering Research Center for Biorenewable Chemicals (CBiRC)***
- ***Education Co-Director, CenUSA bioenergy (Sustainable Production and Distribution of Bioenergy for the Central USA)***
- ***Co-Director, NSF REU Site for Sustainable Biomass Production and Processing (at ISU ABE)***

- ***The purpose of this talk is to teach key actions of effective mentors***



Why Mentor?

- **Selfish Reasons:**
 - Mentoring is a crucial skill for graduate students and post-docs
 - You will be mentoring in your next role as faculty members or industrial scientists and engineers
 - Thus...
 - **Having strong mentoring skills is transferable to industry or academia**
 - **And your mentoring experience strengthens your resume**

Why Mentor?

- **Idealistic Reasons:**
 - *Pay it forward*
 - Universities exist for two reasons: to **create new knowledge**, and to **build human capital**
 - Research internship programs address both of these core missions
 - Provide undergraduates the opportunity to participate in research
 - And in so doing to broaden their scientific and professional horizons
- **Successful research internships hinge on having great mentors in the labs!**

Mentor Expectations – Broad

- **Enjoy this opportunity to inspire a junior scientist/engineer**
- **Keep the safety of your mentee paramount**
- **Provide the environment needed for your mentee to thrive intellectually**

Mentor Expectations – Key Actions...

Key Action #1: Be Safe

- **Safety is paramount**
- **Ensure that you emphasize this to your mentee**
- **Never place your mentee in a position where they are doing something that is both outside their comfort zone and potentially hazardous**
- **Be safe yourself (set the tone for your mentee)**

Key Action #2: Be Prepared

- **Assess your mentee's abilities based on their academic background**
- **Based on this, develop a well-defined project with a realistic scope**
 - Provide some opportunities for student to contribute intellectually
- **Have the project defined several weeks before the start of the program**
 - Make sure the lab PI and other lab members are aware of the project

Realistic Scope...

- **This cannot be an MS or PhD project!**
- **Interns need clearly defined goals**
 - Not trivial ones, just clearly defined – e.g. “Determine the influence of broth magnesium concentration on growth rate of C8-producing strain of *E. coli*.”
- **Experiments where methods are well known**
- **Experiments where equipment is well characterized and materials are on-hand**

Key Action #2: Be Prepared

- **Ensure all equipment and supplies are on site the day the mentee arrives**
 - A 3-week wait for reagent might be OK in an MS or PhD, it can derail a summer internship
- **Have key documentation ready**
 - Lab techniques/protocols
 - Background reading

Key Action #3: Be There

- **Upon arrival**
 - Provide project details
 - Provide context
 - Provide a vision for how their work could contribute to the lab (i.e., inspire them)
 - Provide PPE and safety training if needed
 - Introduce them to the lab
 - Set expectations (best practices; responsible conduct of research)
 - Encourage questions

Key Action #3: Be There

- **During the program**
 - There is no hard and fast rule on mentee-mentor contact time, but these are not advanced graduate students – they can't be expected to go through orientation then work alone
 - Use review of weekly report as catalyst for discussions

Key Action #4: Be Positive

- **People respond to positive leadership**
- **On at least a weekly basis, provide positive feedback to your mentee on some aspect of their efforts**

Key Action #5: Be Proactive

- **Stay engaged in their project**
 - One approach is to develop the poster from early on
 - Weekly written reports or literature discussion sessions also possible
- **If things aren't going well, try to understand why?**
 - Is the scope of the project too large given the student's capabilities?
 - Don't be afraid to shift
 - Is the student not adhering to a regular work schedule and communicating with others in the lab?
 - Don't be afraid to reiterate the expectations



Key Action #6: Keep A Beginners Mind

- **Think about yourself at an earlier stage of your education**
- **Be *patient* with the questions you are asked**
 - Some of our deepest learning comes when we are challenged to explain concepts to a newcomer

What Might You Expect In Return?

- **Some useful assistance in the lab**
- **Perhaps a new insight**
- **A protégé who embraces research because of you!**

“This REU has been one of the best times of my life. I am not the same person today I was in May... I became a researcher ... on your watch...”

Evidence?

- **First edition of podcast made April 2012**
 - The recommended *Key Actions* were based on my 18 years of faculty experience
 - Hosting over a dozen undergrad or pre-college mentees in my lab
 - Directing programs that have served more than 50 summer intern participants

Better Evidence?

- **In early 2013, we surveyed 116 students to test two hypotheses that underlay the 2012 presentation, namely:**
 - 1. Mentoring is the single most important predictor of internship success**
 - 2. The six aspects of mentoring identified are all highly relevant to overall mentoring success**

Methods

- **Participants received survey including questions related to the quality of experience and the behaviors of their mentors**
- **Linear regressions examined the correlation between overall quality of summer research internship experience and mentor behaviors**

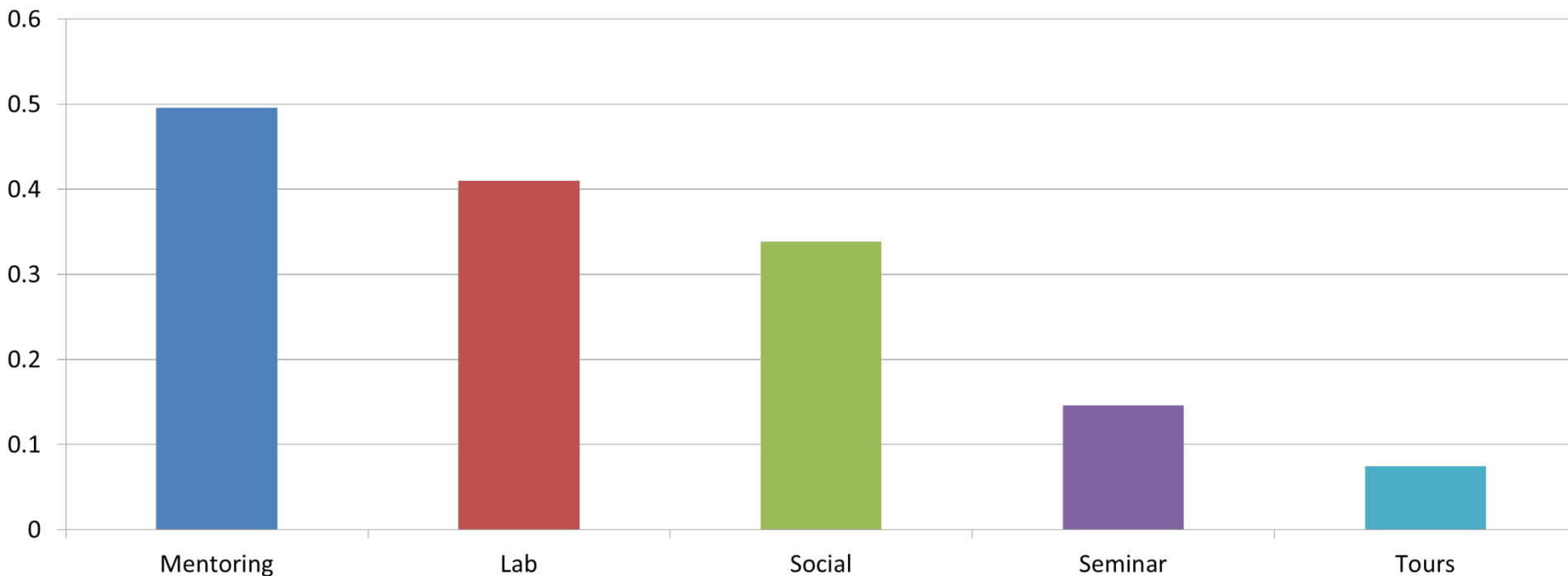
Results of Our Study...

- **A total of 76 responses were received**
 - **65.5% response rate**

Mentoring is Critical!

- Of all five primary aspects of program, mentoring correlated most strongly with student ratings of overall program experience

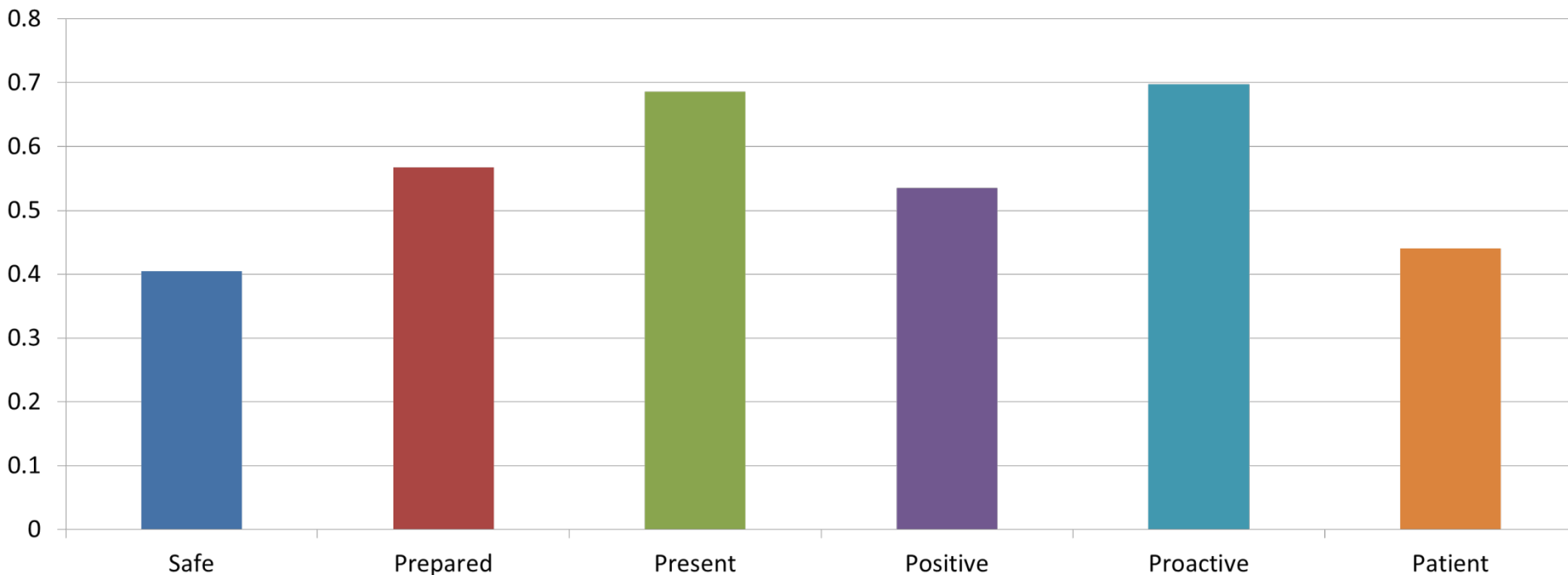
Figure 1
Correlation Coefficients (r^2) of Overall Program Experience with
Primary Aspects of Program



These Six Actions are Key!

- Each were correlated with the mentoring experience score at $r > 0.64$

Figure 2
Correlation Coefficients (r^2) of Mentoring Experience with
Mentor Behaviors



Summary

- **Be Safe**
- **Be Prepared**
- **Be There**
- **Be Positive**
- **Be Proactive**
- **Keep A Beginners Mind**

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Thank You!