

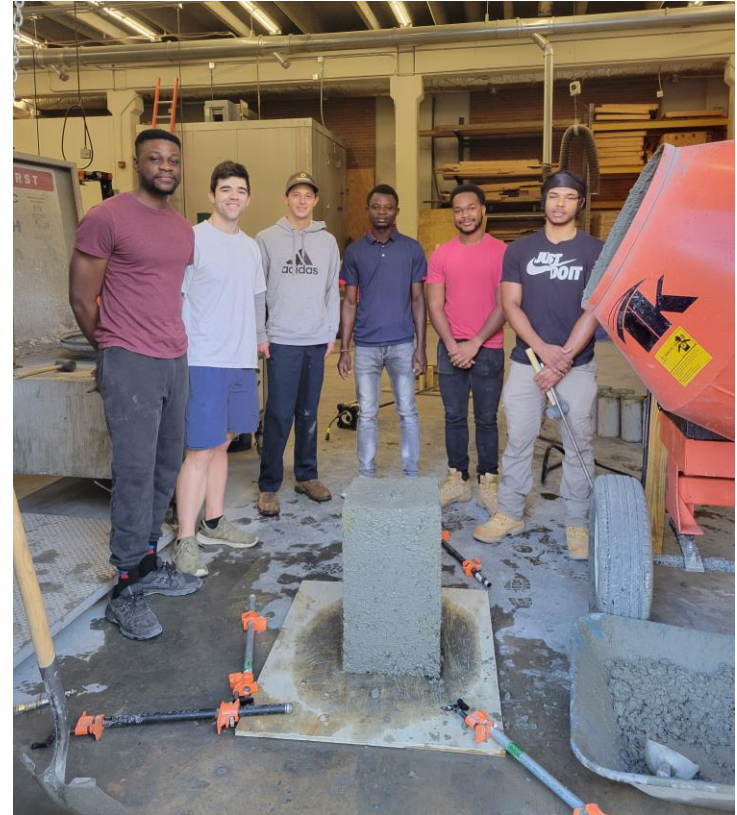
Incorporating Undergraduates into Research with Meaningful Outcomes

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American Concrete Institute
Spring 2024 Convention

Best Practices for Incorporating Research
into Concrete Education

New Orleans, LA March 25, 2024



Learning Objectives Discussed

1. Identify various ways to incorporate research into concrete education.
2. Identify innovative approaches used to incorporate undergraduate research into national-level research proposals.
3. Identify meaningful ways of incorporating undergraduate students into graduate research projects.



I would not have made it to this point in my research career without the contributions of over 40 undergraduate research assistants.

Need for Undergraduate Research Assistants

- Laboratory-based concrete research is labor intensive
- Undergraduates fill an important need in preparing materials, batching concrete, and testing
 - And data analysis, report writing, paper writing...
- Undergraduate assistants are an increasingly cost-effective means of achieving research objectives
- Training undergraduate research assistants leads to (some) graduate research assistants
- Essential to queue and retention/translation of knowledge and practice, particularly in the laboratory



Benefits of Use of Undergraduate Research Assistants

- Work gets done
- Undergraduates are able to train new graduate students in the policies, procedures, practices of the laboratory
- They can provide a source of **continuity** between projects/graduate students
- They act as ambassadors and recruit other undergraduates to serve as assistants, or to enter graduate school



Translating Undergraduate Research Experience into a Head Start on Graduate Research

- 10 of my 40 undergraduate research assistants chose to stay for a MS degree
- MS project needs to be a good fit, but many students gain confidence as an undergraduate research assistant
- Early entry MS programs allow for a “head start” on research for undergraduates willing to commit
- This approach is very helpful for ensuring a smooth start to new projects



Recruitment Approaches

- Get them involved early
 - Even freshmen can become outstanding research assistants
- Recruit from classes
- Have effective undergraduate research assistants recruit their friends
 - Would you want this student on your group project team?
 - Would you want this person to work for you?
- Office of Undergraduate Research (OUR)



Undergraduate Research Assistant Opportunity Summer 2024

Are you a geology major who will be on (or near) campus this summer?
Interested in learning about engineering applications related to geology?

Dr. Tara Cavalline in Engineering Technology and Construction Management is seeking undergraduate research assistants for Summer 2024. Student(s) will work on several ongoing research projects focusing on concrete materials for highway pavements/structures and airfield pavements. Research projects are sponsored by the North Carolina Department of Transportation, the Federal Aviation Administration, and private funding entities. Our research team includes several graduate students and undergraduate students, as well as several faculty members from Engineering Technology and Construction Management and Civil and Environmental Engineering.

Job duties include:

- Obtaining aggregates from quarries and preparing blends for use in concrete mixtures
- Preparing materials for batching in concrete mixtures
- Batching concrete mixtures and preparing test specimens
- Performing tests on fresh and hardened concrete
- Analysis of data
- Developing test apparatus for new concrete tests
- Fieldwork to support concrete testing at on-site locations
- Laboratory improvements, upkeep, and cleaning

Preferred qualifications:

- Willing to work in a laboratory and/or field (jobsite) setting - shoveling and lifting is part of the laboratory work
- OK with getting a little messy while preparing materials, batching, and testing concrete
- Positive attitude, motivated, reliable, and curious
- Good communication skills

Students taking summer courses are eligible to work up to 20 hours per week while enrolled in courses. Students not taking summer courses can work up to 40 hours per week. Pay will be based upon UNC Charlotte's approved undergraduate research assistant salary scale, which considers academic year (freshman, sophomore, junior, senior).

Please email Tara Cavalline at tcavalline@charlotte.edu if interested, and attach resume and expected availability (e.g. Summer session 1, 2, or both)



When in trouble...


- Think outside the box
- I recruit from related fields
- Geology has been particularly fruitful
- Remember that training needs may be greater
- Might spend more time explaining “why are we doing this?”

Key Items for Training

- Safety
- Technical training
- Data recording practices and security

- Partner them with other undergraduates and/or graduate students
 - I pay undergraduates to “tag along” for any activities they are not familiar with
 - This is an investment
- Speaking up
 - When something is not going well
 - When something didn’t turn out correctly
- Concrete research vs. class schedule...

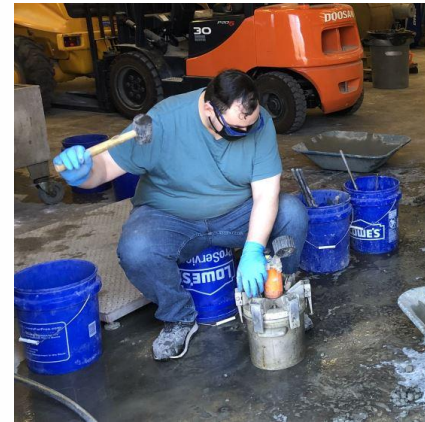
Mentoring

- Model the behavior you'd like to see from the undergraduates
- Attention to detail
- Time management
- Sense of urgency
- “This test matters. This data matters. What you do matters.” 
- Making mistakes
 - Ask questions, speak up, fess up
 - It's (usually) ok to repeat a test or re-do something
 - It's not ok to knowingly have “bad data” or otherwise induce error, variability, etc.
- Graduate student buy-in
 - Positive practices and good attitudes/habits of graduate students set an example for undergraduates
 - Alternatively, poor practices and not-so-good attitudes/habits of graduate students can rub off on undergraduates



Quality Assurance and Control

- Emphasize importance of the work
- Asking questions – not only is it OK, but it is essential
- Data management and security
 - Graduates student(s) also need to be on board and drive this
- Ensure single-point responsibility
- Consistency in performing tests – same student runs same test(s) for a project



Engagement in All Phases of Research

- Provide the proposal/contract document for the project(s) they will be working on
- It's never too soon to understand how work gets awarded and contracted
- Material preparation is always a good start
 - Batching, weighing, sieving, etc.
- Shadow graduate students and other experienced undergraduates in testing
- Cross-training helps prevent shortages in help
- Literature review
- Data analysis
- Preparation of final report
- Preparation of papers – especially when MS students disappear



Retaining Undergraduate Research Assistants

- Concrete-related research can be a tough job
- Physically demanding, time sensitive
- Field work and travel
- Everything is messy and heavy

- Cultivate a team environment
- Graduate students need to respect undergraduates
- Be courteous of their time demands

- Undergraduate students need to understand the time sensitivity/importance of the graduate students' work
- Finding a good fit is important



Best Practices for Mentoring URAs (from OUR)

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Best Practices for Mentoring URAs (from OUR)

- Prepare the student for more than the assigned research project(s) by including the student in allied functions/responsibilities/social activities within the discipline. Seminars, professional society meetings. Introduce the student to colleagues. Treat them like new graduate students/career employees.
- Show them what you do (from grant writing to editing of journal proofs). By all means tell them why you love your work! Be a role model for the next generation of scholars.
- Define a contractual agreement that includes time requirements, expectations of performance in a timely way, expected fate of the work.
- Be sure the research assignments are realistic and developmentally appropriate when considering the past coursework and experience of the student. The student may become frustrated and quit for the wrong reason.

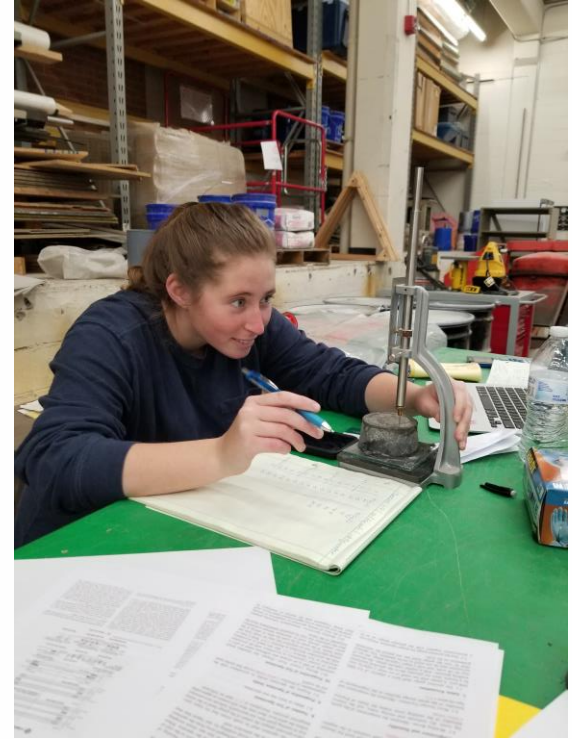
Best Practices for Mentoring URAs (from OUR)

- Graduate students can make excellent mentors and the experience they get while doing so prepares them for mentor roles following their graduation.
- Faculty retain the key responsibility in establishing the role the graduate student will have with the student and that sufficient oversight is made to assure a beneficial partnership between the undergraduate and the graduate student.



Best Practices for Mentoring URAs (from OUR)

- Build respect through praise of good work and constructive suggestions for improvement.
- Meet on a neutral playing field from time to time, i.e., not always in your office/lab.
- Have weekly progress meetings, as short as 10 minutes or longer as needed. Be a good listener and share your own discoveries, frequently. Establish realistic deadlines for units of work.
- Write letters of recommendation for employment, scholarships, national fellowship competitions, and admission to advanced degree programs.
- Keep in touch when it's all over.



Conclusions

I owe many, many thanks to the undergraduates that have worked for my/our research team

- Undergraduates can serve in many capacities
- Be mindful of early stage assignments, but encourage them to grow into tasks with increasingly more rigor and responsibility.
- Make sure that you, your graduate students, and your undergraduates have a good quality assurance / quality control plan
- Undergraduates that have a good experience make some of the best great graduate hires
- Even if they don't stay on for graduate school, research experience provides skills useful in the workplace

