

REU Site: Undergraduate Research in Smart Environments: Year 4 Evaluation Report
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The UNCC CISE REU a la Carte pre and post program surveys were used to assess the impact the 2018 program had on students’ (1) research skills and (2) attitude toward graduate school. The survey was also used to assess students’ (3) satisfaction with their mentoring experience and (4) overall satisfaction with the REU experience. We administered our own pre and post program mentoring survey which measures our mentors’ ability to (5) provide an authentic research experience to the students, (6) improve students’ research skills, and (7) advise undergraduate students. Finally, using follow-up communications with the REU students and faculty mentors, we will assess the students’ eventual (8) publication of research, and (9) enrollment in graduate school.

In 2018, 11 students participated in the WSU REU program. Nine students began the Pre-REU Survey, but only seven students completed the pre-REU survey and 3 to the post- REU survey, and not all responded to each question. The project team intends to follow up with students in 2019 to see if the 2018 cohort: (a) finished their BS degrees, (b) had any publications/ presentations related to their REU experiences, and (c) pursued graduate degrees.

SUMMARY OF STUDENT RESULTS 2015-2018

TABLE 1. Summary of student results 2015-2018.

| Indicator | | Results 2015-2018 |
|-----------|---|---|
| 1. | Retention in undergraduate science & engineering programs | <ul style="list-style-type: none"> • 2018: Data will be collected in 2019 • 2017: (N=6 respondents out of 10): by 2018, 5 were still in their BS programs. • 2016: (N = 10 respondents out of 11): by 2017, 9 completed their BS degrees; 1 participated in student mentoring. • 2015 (N= 6 respondents out of 10): by 2016, 5 completed their BS degrees, with 1 ongoing. |
| 2. | Publications and presentations involving REU participants | <ul style="list-style-type: none"> • 2018: no papers during the REU; follow up will take place in 2019 • 2017: 1 conference proceedings paper during the REU. 4 conference papers were published over the 2017-2018 academic year. • 2016: (N = 10 respondents out of 11): by 2017, 3 conference proceedings papers, 1 poster, and 1 senior design project • 2015 (N= 6 respondents out of 10): by 2016, 1 conference proceedings paper |

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| 3. | Percentage of students that go on to graduate school | <ul style="list-style-type: none"> • 2018 (Pre-REU: N = 9; Post-REU = 3): <u>Pre-REU</u>: 1 student indicated Strongly Agree; 3 Somewhat Agree; 4 Neutral; 1 Somewhat Disagree; <u>Post-REU</u>: 1 student indicated Strongly Agree; 2 Strongly Disagree 1 Disagree. Post –REU: 1 Somewhat Agree; 2 Strongly Disagree. • 2017 (N= 6 out of 10 respondents): one student entered graduate school fall 2018; all other respondents intended to pursue a graduate degree. (Pre-REU: N= 9; Post-REU=7): Pre-REU: 4 Strongly Agree they plan to go to graduate school; 3 Somewhat Agree; 2 Neutral. Post-REU: 4 students indicated Strongly Agree they plan to apply to graduate school; 1 Somewhat Agree; 1 Neutral; 1 Somewhat Disagree. • 2016 (N= 9 respondents out of 11): 5 students entered graduate school; 2 plan to enter graduate school; 2 took jobs in industry. • 2015 (N= 6 respondents out of 10): 3 entered graduate school, 2 planned to enter graduate school; 1 didn't plan to go to graduate school. |
| 4. | Contentment of students | <ul style="list-style-type: none"> • 2018: (N = 3 respondents out of 11) Of the three respondents, 1 was highly content/satisfied, 1 satisfied and 1 highly dissatisfied. • 2017: The 2017 cohort was much less content/less satisfied with the mentor-mentee relationship and the overall research experience than previous cohorts. • 2015 & 2016: The majority of 2015 & 2016 students were generally content/satisfied with all aspects of the REU program. |
| 5. | Percentage of REU participants from under-represented groups | <ul style="list-style-type: none"> • 2018 cohort included: 44% (N=4) women and 56% (N=7) men; 7 Caucasian, 4 Asian. • 2017 cohort included: 40% (N=4) women and 60% (N=6) men; 1 Hispanic/Latino, 2 Other, 2 Asian, 5 Caucasian. • 2016 cohort included: 44% (N=4) women and 56% (N=7) men; 1 Hispanic/Latino, 1 African American, 2 Other, 7 Caucasian. • 2015 cohort included: 40% (N=4) women and 60% (N=6) men; 2 Hispanic/Latino, 2 African American, 1 Other, 5 Caucasian. |
| 6. | Improved student understanding of the research process | <ul style="list-style-type: none"> • From 2015-2018, the majority of students indicated that after completion of the REU program, they had a better understanding of the research process and its application. Given that there were 3 out of 11 2018 Post-REU survey respondents, it's hard to say if their responses are representative of the whole. |

2018 DETAILED STUDENT RESPONSES

Student perception of attending graduate school.

TABLE 2. 2018 participants (Pre-REU: N=9; Post-REU: N=3). “Please rate your level of agreement to the following statements, where 5 is Strongly Agree and 1 is Strongly Disagree.”

| | | |
|----|--|--|
| 1. | For me to apply to graduate school is extremely good. | <p><u>Pre-REU</u>: 2 students indicated Strongly Agree; 4 Somewhat Agree; 3 Neutral</p> <p><u>Post-REU</u>: 1 student Somewhat Agree; 1 Somewhat Disagree; 1 Strongly Disagree</p> |
| 2. | Most people who are important to me think that I should apply to graduate school in [my REU project] discipline. | <p><u>Pre-REU</u>: 3 students indicated Strongly Agree; 2 Somewhat Agree; 4 Neutral</p> <p><u>Post-REU</u>: 1 student indicated Strongly Agree; 2 Neutral</p> |
| 3. | I plan to apply to graduate school in a [my REU project] discipline. | <p><u>Pre-REU</u>: 1 student indicated Strongly Agree; 3 Somewhat Agree; 4 Neutral; 1 Somewhat Disagree</p> <p><u>Post-REU</u>: 1 student indicated Strongly Agree; 2 Strongly Disagree</p> |
| 4. | For me, to apply to graduate school in [my REU project] discipline is valuable. | <p><u>Pre-REU</u>: 3 students indicated Strongly Agree; 5 Somewhat Agree; 1 Neutral</p> <p><u>Post-REU</u>: 1 student indicated Strongly Agree; 2 Somewhat Disagree</p> |
| 5. | It is expected of me that I will apply to graduate school in [my REU project] discipline. | <p><u>Pre-REU</u>: 1 student indicated Strongly Agree; 1 Somewhat Agree; 2 Neutral; 3 Somewhat Disagree; 2 Strongly Disagree</p> <p><u>Post-REU</u>: 1 student indicated Strongly Agree; 2 Somewhat Disagree</p> |
| 6. | I will make an effort to apply to graduate school in [my REU project] discipline. | <p><u>Pre-REU</u>: 1 student indicated Strongly Agree; 2 Somewhat Agree; 4 Neutral; 2 Somewhat Disagree</p> <p><u>Post-REU</u>: 1 student indicated Strongly Agree; 1 Somewhat Disagree; 1 Strongly Disagree</p> |

| | | |
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| 7. | For me to apply to graduate school in [my REU project] discipline is beneficial. | <u>Pre-REU</u> : 1 student indicated Strongly Agree; 6 Somewhat Agree; 2 Neutral <u>Post-REU</u> : 1 student indicated Strongly Agree; 1 Neutral; 1 Somewhat Agree |
| 8. | I intend to apply to graduate school in [my REU project] discipline. | <u>Pre-REU</u> : 1 student indicated Strongly Agree; 4 Somewhat Agree; 4 Neutral <u>Post-REU</u> : 1 student indicated Strongly Agree; 1 Somewhat Disagree; 1 Strongly Disagree |
| 9. | For me to apply to graduate school in [my REU project] discipline is pleasant. | <u>Pre-REU</u> : 1 student indicated Strongly Agree; 3 Somewhat Agree; 5 Neutral <u>Post-REU</u> : 1 Somewhat Agree; 2 Somewhat Disagree |
| 10. | Most people whose opinions I value would approve of me applying to graduate school in [my REU project] discipline. | <u>Pre-REU</u> : 2 students indicated Strongly Agree; 5 Somewhat Agree; 2 Neutral <u>Post-REU</u> : 1 student indicated Strongly Agree; 1 Neutral; 1 Somewhat Disagree |

Improved Understanding of the Research Process

Two question sets informed the 2018 achievement of this indicator, see Tables 3 & 4 for results.

TABLE 3. 2018 participants (Pre-REU: N=7; Post-REU: N=3) “Please rate your degree of confidence with the following statements, where 5 is Strongly Agree and 1 is Strongly Disagree.”

| | I can: | |
|----|------------------------------------|--|
| 1. | Locate primary research literature | <u>Pre-REU</u> : 2 students indicated Strongly Agree; 4 Somewhat Agree; 3 Somewhat Disagree <u>Post-REU</u> : 7 students indicated Strongly Agree; 1 Somewhat Agree |
| 2. | Understand primary | <u>Pre-REU</u> : 3 students indicated Strongly Agree; 3 Somewhat Agree; 2 Neutral; 1 Somewhat Disagree |

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| | research literature | <u>Post-REU</u> : 3 students indicated Strongly Agree; 3 Somewhat Agree; 1 Somewhat Disagree |
| 3. | Formulate a research hypothesis | <u>Pre-REU</u> : 1 student indicated Strongly Agree; 4 Somewhat Agree; 2 Neutral; 2 Somewhat Disagree <u>Post-REU</u> : 3 students indicated Strongly Agree; 3 Somewhat Agree; 1 Neutral |
| 4. | Design an experimental test of a solution to a problem | <u>Pre-REU</u> : 3 students indicated Strongly Agree; 3 Somewhat Agree; 3 Neutral <u>Post-REU</u> : 4 students indicated Strongly Agree; 2 Somewhat Agree; 1 Somewhat Disagree |
| 5. | Collect data | <u>Pre-REU</u> : 4 students indicated Strongly Agree; 5 Somewhat Agree <u>Post-REU</u> : 5 students indicated Strongly Agree; 2 Somewhat Agree; 1 Neutral |
| 6. | Statistically analyze data | <u>Pre-REU</u> : 4 students indicated Somewhat Agree; 4 Neutral; 1 Somewhat Disagree <u>Post-REU</u> : 5 students indicated Strongly Agree; 2 Somewhat Agree |
| 7. | Interpret data analyses | <u>Pre-REU</u> : 1 student indicated Strongly Agree; 4 Somewhat Agree; 4 Neutral <u>Post-REU</u> : 5 students indicated Strongly Agree; 4 Somewhat Agree; 1 Somewhat Disagree |
| 8. | Reformulate a research hypothesis | <u>Pre-REU</u> : 1 student indicated Strongly Agree; 3 Somewhat Agree; 2 Neutral; 3 Somewhat Disagree <u>Post-REU</u> : 5 students indicated Strongly Agree; 4 Somewhat Agree; 1 Somewhat Disagree |
| 9. | Orally communicate the results of research projects | <u>Pre-REU</u> : 2 students indicated Strongly Agree; 3 Somewhat Agree; 2 Neutral; 2 Somewhat Disagree <u>Post-REU</u> : 2 students indicated Strongly Agree; 1 Somewhat Agree; 2 Somewhat Disagree |
| 10. | Write a research paper for publication | <u>Pre-REU</u> : 1 student indicated Somewhat Agree; 5 Neutral; 1 Somewhat Disagree; 2 Strongly Disagree <u>Post-REU</u> : 3 students indicated Strongly Agree; 1 Somewhat Agree; 1 Neutral; 2 Somewhat Disagree |

| | | |
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| 11. | Work with others to investigate a research problem | <p><u>Pre-REU</u>: 2 students indicated Strongly Agree; 4 Somewhat Agree; 2 Neutral; 1 Strongly Disagree</p> <p><u>Post-REU</u>: 3 students indicated Strongly Agree; 2 Somewhat Agree; 1 Somewhat Disagree</p> |
| 12. | Discuss research with graduate students | <p><u>Pre-REU</u>: 3 students indicated Strongly Agree; 4 Somewhat Agree; 1 Neutral; 1 Somewhat Disagree</p> <p><u>Post-REU</u>: 5 students indicated Strongly Agree; 1 Neutral; 1 Somewhat Disagree</p> |
| 13. | Discuss research with professors | <p><u>Pre-REU</u>: 3 students indicated Strongly Agree; 4 Somewhat Agree; 1 Neutral; 1 Somewhat Disagree</p> <p><u>Post-REU</u>: 5 students indicated Strongly Agree; 1 Neutral; 1 Somewhat Disagree</p> |
| 14. | Discuss research at a professional meeting or conference | <p><u>Pre-REU</u>: 1 student indicated Strongly Agree; 3 Somewhat Agree; 3 Neutral; 1 Somewhat Disagree; 1 Strongly Disagree</p> <p><u>Post-REU</u>: 2 students indicated Strongly Agree; 2 Somewhat Agree; 1 Somewhat Disagree</p> |

TABLE 4: 2018 (Pre-REU: N=8; Post-REU: N=3) “Please indicate how much you know about the following on a scale from 1 to 5, with 1 being Nothing at All and 5 being A Great Deal.”

| | | |
|----|-----------------------------------|--|
| 1. | Research proposal write up | <p><u>Pre-REU</u>: 1 student indicated A Good Deal; 3 Neutral; 1 Somewhat Little; 3 Nothing at All</p> <p><u>Post-REU</u>: 2 Somewhat Little; 1 Nothing at All</p> |
| 2. | Research presentation preparation | <p><u>Pre-REU</u>: 2 students indicated A Good Deal; 1 Neutral; 1 Somewhat Little; 4 Nothing at All</p> <p><u>Post-REU</u>: 1 student indicated A Good Deal; 1 Neutral; 1 Somewhat Little</p> |
| 3. | Research presentation | <p><u>Pre-REU</u>: 1 student indicated A Good Deal; 2 students indicated Neutral; 1 Somewhat Little; 4 Nothing at All</p> <p><u>Post-REU</u>: 1 student indicated A Good Deal; 1 Neutral; 1 Somewhat</p> |

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| | | Little |
| 4. | Technical & scientific writing tools | <u>Pre-REU</u> : 1 student indicated A Great Deal; 3 A Good Deal; 3 Somewhat Little; 1 Nothing at All <u>Post-REU</u> : 1 A Good Deal; 2 Somewhat Little |
| 5. | Ethics in scientific research | <u>Pre-REU</u> : 1 student indicated A Great Deal; 2 A Good Deal; 2 Neutral; 2 Somewhat Little; 1 Nothing at All <u>Post-REU</u> : 1 student indicated A Great Deal; 2 Neutral |
| 6. | Authorship citations | <u>Pre-REU</u> : 1 student indicated A Great Deal; 2 A Good Deal; 1 Neutral; 2 Somewhat Little; 2 Nothing at All <u>Post-REU</u> : 1 student indicated A Great Deal; 1 Neutral; 1 Somewhat Little |
| 7. | Project management | <u>Pre-REU</u> : 2 students indicated A Great Deal; 3 Neutral; 3 Somewhat Little <u>Post-REU</u> : 1 student indicated A Great Deal; 1 Neutral; 1 Nothing at All |
| 8. | Application of the scientific method | <u>Pre-REU</u> : 1 student indicated A Great Deal; 1 A Good Deal; 4 Neutral; 1 Somewhat Little; 1 Nothing at All <u>Post-REU</u> : 1 student indicated A Great Deal; 1 Neutral; 1 Somewhat Little; 1 Nothing at All |
| 9. | Analyzing data with statistics or other tools | <u>Pre-REU</u> : 5 students indicated A Good Deal; 1 Neutral; 1 Somewhat Little; 1 Nothing at All <u>Post-REU</u> : 1 student indicated A Good Deal; 2 Neutral |
| 10. | Formulating a research hypothesis that could be answered with data | <u>Pre-REU</u> : 3 students indicated A Good Deal; 2 Neutral; 1 Somewhat Little; 2 Nothing at All <u>Post-REU</u> : 1 student indicated A Good Deal; 1 Neutral; 1 Nothing at All |
| 11. | Identifying appropriate research methods and designs | <u>Pre-REU</u> : 3 students indicated A Good Deal; 2 Neutral; 2 Somewhat Little; 1 Nothing at All <u>Post-REU</u> : 1 student indicated A Good Deal; 1 Neutral; 1 Somewhat Little |

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| 12. | Understanding the theory and concepts guiding a research project | <u>Pre-REU</u> : 3 students indicated A Good Deal; 2 Neutral; 2 Somewhat Little; 1 Somewhat Little <u>Post-REU</u> : 2 Neutral; 1 Somewhat Little |
| 13. | Defending an argument when asked questions | <u>Pre-REU</u> : 1 student indicated A Great Deal; 4 a Good Deal; 1 Neutral; 2 Somewhat Little <u>Post-REU</u> : 1 student indicated A Good Deal; 1 Neutral; 1 Somewhat Little |
| 14. | Explaining my project to people outside my field | <u>Pre-REU</u> : 1 student indicated A Great Deal; 3 A Good Deal; 1 Neutral; 2 Somewhat Little; 1 Nothing at All <u>Post-REU</u> : 2 students A Good Deal; 1 Somewhat Little |
| | Understanding and summarizing journal articles | <u>Pre-REU</u> : 2 students indicated A Good Deal; 2 Neutral; 3 Somewhat Little; 1 Nothing at All <u>Post-REU</u> : 1 student indicated A Good Deal; 1 Neutral; 1 Somewhat Little |
| | Relate results to the "bigger picture" | <u>Pre-REU</u> : 1 student indicated A Great Deal; 3 A Good Deal; 1 Neutral; 2 Somewhat Little <u>Post-REU</u> : 2 students indicated A Good Deal; 1 Somewhat Little |

Mentor-mentee relationship

TABLE 5. Please indicate the extent to which you agree with each statement below about your mentor. Scale: Strongly Agree, Agree, Neutral, Somewhat Disagree, Strongly Disagree (N=3)

| My mentor: | | |
|-------------------|---|--|
| 1. | was accessible | 2 Strongly Agree; 1 Strongly Disagree |
| 2. | demonstrated professional integrity | 1 Strongly Agree; 1 Agree; 1 Neutral |
| 3. | demonstrated content expertise in my area of need | 1 Strongly Agree; 1 Agree; 1 Neutral; |
| 4. | was approachable | 1 Strongly Agree; 1 Agree; 1 Strongly Disagree |
| 5. | was supportive and encouraging | 2 Strongly Agree; 1 Strongly Disagree |
| 6. | provided constructive and useful critiques of my work | 1 Strongly Agree; 1 Agree; 1 Strongly Disagree |

| | | |
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| 7. | was helpful in providing direction and guidance on research project issues | 1 Strongly Agree; 1 Agree; 1 Strongly Disagree |
| 8. | answered my questions satisfactorily (e.g. timely, clear, comprehensive) | 2 Strongly Agree; 1 Strongly Disagree |
| 9. | acknowledged my contributions appropriately | 2 Strongly Agree; 1 Somewhat Disagree |
| 10. | suggested appropriate resources | 2 Strongly Agree; 1 Somewhat Disagree |
| 11. | challenged me to extend my abilities | 1 Strongly Agree; 1 Agree; 1 Strongly Disagree |

Student contentment/satisfaction with the program

TABLE 6. How satisfied were you with: Scale: Highly Satisfied, Somewhat Satisfied, Neutral, Somewhat Dissatisfied, Highly Dissatisfied. (N= 3)

| | | |
|----|--------------------------------------|---|
| 1. | You faculty advisor | 1 Highly Satisfied; 2 Somewhat Satisfied; 1 Highly Dissatisfied |
| 2. | Your housing arrangements | 2 Somewhat Satisfied (only 2 responded) |
| 3. | The program in general | 1 Highly Satisfied; 1 Somewhat Satisfied; 1 Somewhat Dissatisfied |
| 4. | Your research experience | 1 Highly Satisfied; 1 Somewhat Satisfied; 1 Highly Dissatisfied |
| 5. | Your interaction with project staff | 1 Highly Satisfied; 1 Somewhat Satisfied; 1 Highly Dissatisfied |
| 6. | Your interaction with other students | 1 Highly Satisfied; 2 Somewhat Satisfied |

Students (N=2) were asked: *What was the most rewarding experience for you during the REU project?*

- “The opportunity to work on a real-world problem.”
- “The other students.”

Students (N = 3) were asked: *What was the most frustrating experience for you during the REU project?*

- “The problem was more challenging than anticipated.”

- “I honestly didn’t really have one [a mentor].”
- “Feeling lost and alone in my project.”
- “I didn’t like how my summer went it turned me off of research and that’s unfortunate. I worked alone for the entire summer which is something that I can do if it’s my project, but finding out you’re wrong on someone else’s vision (which you don’t have access to because they are never around) is very frustrating. There were weeks that I had no idea what to do and no one to turn to. That was more than 25% of my time here.”

2018 MENTOR RESULTS

The project’s four mentor objectives are:

1. Provision of an authentic research experience to students.
2. Encouragement of students to obtain an advanced degree in engineering.
3. Development of students’ applied research skills.
4. Becoming more skilled as a faculty mentor (so that students can achieve project goals).

The method chosen to measure the indicators was a brief survey focusing on mentor expectations and the extent to which they were met. All six participating mentors responded to all questions in the Pre and Post-REU surveys.

PRE-REU SURVEY MENTOR RESULTS

The Pre-REU survey questions focused on capturing mentor motivation for participating in the program and expectations of themselves and their students.

TABLE 7. Summary of faculty mentor Pre-REU survey response results by indicator. *Rate the degree to which the following impacted your decision to participate in this summer’s REU program.* Scale: Not At All; A Little; A Fair Amount; A Lot.

| Indicator | | Survey Statement and Responses 2018 |
|-----------|--|--|
| 1. | Provision of an authentic research experience to students. | <i>I think it’s important to give undergraduate students authentic research opportunities.</i> A Fair Amount = 1; A Lot = 5 |
| 2. | Encouragement of students to obtain an advanced degree in engineering. | <i>I think the experience will encourage undergraduate students to pursue an advanced degree in engineering.</i> A Lot = 6 |
| 3. | Development of students’ applied research skills. | <i>I think the experience will help undergraduate students develop their applied research skills.</i> A Lot = 6 |
| 4. | Becoming more skilled as a faculty mentor | <i>I would like to become more skilled at mentoring undergraduate students in the research process.</i> |

| | |
|--|---------------------------------|
| | A Little = 3; A Fair Amount = 3 |
|--|---------------------------------|

DETAILED MENTOR PRE-REU SURVEY RESPONSES

What do you expect from the REU student in terms of participation in your research program?

- [To be] Actively involved in discussion, group meeting and regular one-on-one meeting, to develop basic skills on problem solving and programming in Big Data area.
- I expect them to learn and gain research experience, and to make concrete contribution to my research program.
- Help graduate student in research deliverables with an independent task.
- To participate in sub-projects or sub-activities related to a research project in my group.
- Strongly motivated to learn and contribute to research project.
- Attend regular meetings and contribute to ongoing research projects.

What do you expect in terms of research productivity of the REU student?

- Develop basic skills in algorithm analysis and development in Big data and databases; a poster/research conference paper/demo.
- Make enough contribution to work that could lead to a short paper.
- Co-author paper with another student.
- To facilitate the research project by producing tangible outcomes such as data (as a result of data collection), software (as a result of software development), document, etc.
- Ability to get the assigned tasks done in a timely manner.
- Success implementation and testing of their approach, and a paper on their research.

How do you think you will benefit from serving as an REU mentor? (N=5)

- Practice and improve on the skills to work with undergraduate students and to find undergraduate students talent towards further graduate-level study
- Gain more experience in mentoring undergraduate students. Advance in small way my research program. Create opportunities for graduate students in my lab to interact with undergrads.
- In many cases, the outcomes produced by these students will be useful in our research. An example is the data that are collected by these students will be used for validation of our core research techniques. (2) My graduate students will have an opportunity to mentor the REU students.
- Satisfaction of providing research opportunity to a young undergraduate.
- Progress on research project, publication, evaluation of potential future grad student.

How do you think your REU student will benefit from your mentorship? (N=5)

- Get trained with unique and innovative research project; get experience in state-of-the-art techniques and systems/tools; find career interests and build up professional profile/internship opportunities.
- The student will be exposed to interesting research problems, will gain practical experience in doing research, and will be given good access to mentorship (I plan to meet with the student at least once a week to provide guidance, answer questions and discuss things related to research and graduate school.)
- They work on real-world problems, become familiar with research challenges in my area, and learn how to do team work.
- Improve skills including research, project management, communication, problem solving, presentation etc.
- Learn about, and get excited about, research.

POST-REU SURVEY MENTOR RESULTS

Table 8. Summary of faculty mentor Post-REU survey response results by indicator (N = 6)
Rate the degree to which the following describes your experience in this summer's REU program. Scale 1: Not At All; A Little; A Fair Amount; A Lot. Scale 2: Not At All; Somewhat Well; Well; Very Well

| Indicator | | Survey Statement and Responses 2018 |
|------------------|--|--|
| 1. | Provision of an authentic research experience to students. | <i>I think the experience gave the undergraduate students authentic research opportunities.</i> A Lot = 6 |
| 2. | Encouragement of students to obtain an advanced degree in engineering. | <i>I think the experience encouraged the undergraduate students to pursue an advanced degree in engineering.</i> A Fair Amount = 1; A Lot = 5 |
| 3. | Development of students' applied research skills. | <i>I think the experience helped the undergraduate students develop their applied research skills.</i> A Lot = 6 <i>When asked: How well did the student meet your expectations in terms of participation in your research program? 3 mentors indicated "Well" and 3 "Very Well"</i> <i>When asked: How well did the REU students meet your expectations in terms of research productivity? 3 indicated "Well"; 3 indicated "Very Well"</i> |
| 4. | Becoming more skilled as a faculty mentor | <i>I became more skilled at mentoring undergraduate students in the research process.</i> A Fair Amount = 2; A Lot = 4 |

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| | | <p>When asked how much they had <i>benefitted from the mentoring</i>, 1 mentor indicated “A Little”; 3 “A Fair Amount”; 2 “A Lot”</p> <p>When asked: <i>How much do you think your REU student benefited from your mentorship?</i> 6 mentors indicated “A Lot”</p> |
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DETAILED MENTOR POST-REU RESPONSES

How well did the REU students meet your expectations in terms of participation in your research program?

- “I had a wonderful REU student this summer. She was hard working and could get the preliminary results that I hoped for.”
- “The project was designed to fit to my program and the student met my expectations well.”
- “During the training program, the REU student has successfully demonstrated his potential in both theoretical analysis and practical algorithm design and implementation. The program has provided a good chance for him to get involved in solving a real world, nontrivial network problem (NP-hard) and he has developed new approximation algorithm with provable guarantees. He also helped the team to build a critical component of a demo. We also had multiple conversations and exchanged interesting ideas he had in mind from the internship he did last year at Google. In general, the student meets our expectations well.”
- “REU student was very professional and team player. She worked with several other students to complete the work.”

How well did the REU students meet your expectations in terms of research productivity?

- “The student started as a novice, but made good strides in terms of learning new skills and tools to solve his research problem. He is reasonably productive.”
- “We expect to have a paper ready in few weeks.”
- “I spent quite some time initially to bring the student up to speed, but the student overall was reasonably productive.”

What suggestions for improvement do you have for the research team as they prepare next year’s REU program?

- “I think the program is run in an excellent way. The guidance/advice offered in the beginning is very helpful, and necessary information is provided in a clear and timely manner throughout the process, starting from the time of recruiting students. I do not see anything that needs improvement. It was a pleasure participating in the program. Thank you!”
- None. Great job.”

EVALUATOR COMMENTS

Overall, the project leadership team has achieved its goals over the four years of this project to provide an authentic applied research experience to undergraduate students. The majority of students and faculty agree that the program provides this opportunity, as well as providing motivation for continuing education in graduate programs. Faculty, overall seem to enjoy mentoring the students and think that they perform that role adequately.

In 2018 there seemed to be a drop in student satisfaction about the research experience and the mentor-mentee relationship. In order to address this, a set of mentor guidelines were developed. They are located here: <http://reu.eecs.wsu.edu/docs/REU-Mentor-Guidelines.pdf> Given that only three of the 10 students responded to the Post-REU survey, it's difficult to gauge the extent to which students were satisfied with their mentor relationship. However, it is notable that one student was highly dissatisfied as expressed in the quote submitted in the survey. It could serve the program well to ensure that students have a well-advertised feedback loop to the program director so that such issues can be identified early on and addressed satisfactorily well before the end of the program.

The leadership team chose to use UNC Charlotte's CISE REU "A la Carte Survey" for the last three years of the program; this survey was developed by engineering educators as part of a NSF project and is used by many REU programs. There are a number of items not related to the performance indicators of the project, such as those related to motivation, self-efficacy, teamwork and leadership. The results of those survey items are not presented here. Many of the questions do not pertain to the student indicators and many are redundant and/or confusing. Starting in 2019, a tailored survey will be administered by the WSU REU program in order to ensure that the questions are aligned with project objectives and in efforts to increase the student response rate.