

REU Site: Undergraduate Research in Smart Environments: Year 1 Evaluation Report
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The project leadership team identified six student-focused indicators of overall project success and five methods for measuring the indicators. The student-focused indicators are:

1. Retention in undergraduate science and engineering programs
2. Publications and presentations involving REU participants
3. Percentage of students that go on to graduate school
4. Contentment of students (during and after the program)
5. Percentage of REU participants who are from underrepresented groups in science and engineering.
6. Improved student understanding of the research process

The methods used to measure the indicators are:

1. Student records and feedback (measure 1, 3, and 4)
2. Self-reported demographic data (measure 5)
3. Literature searches for REU authors and self-reports from faculty (measure 2)
4. Preliminary and exit surveys of students (measures 4 and 6)
5. Assessment of students using critical thinking rubrics developed with internal WSU assessment specialists from the Office of Undergraduate Research (measure 6)

9 students participated in both pre and post REU program surveys, although not all responded to each question. In terms of indicators 1 (retention), 2 (publications/presentations) and 3 (graduate school), the data collection will take place after submission of this year's project report. The project team intends to follow up with students later to see if they (a) finished their BS degrees, (b) had any publications/presentations related to their REU experiences, and (c) pursued graduate degrees. In summer 2015, the WSU site project PI and the external evaluator decided to include indicators of project success from the faculty mentor perspective. Four faculty-focused indicators were developed:

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 faculty mentor expectations and the extent to which they were met. A pre and post summer REU survey was developed and administered; six out of seven faculty mentors participated in the pre-summer REU survey; six out of seven participated in the post-summer REU survey.

SUMMARY OF STUDENT RESULTS

TABLE 1. Summary of student-focused indicator measurement results 2015.

Performance Indicator		Results 2015
1.	Retention in undergraduate science & engineering programs.	<ul style="list-style-type: none"> After the REU, 4 out of 7 students indicated that they desired to continue in a science and engineering program.
2.	Publications and presentations involving REU participants.	<ul style="list-style-type: none"> None to date. Follow up with faculty and students to occur academic year 2015-2016.
3.	Percentage of students that go on to graduate school.	<ul style="list-style-type: none"> Prior REU: 67% of the 9 student survey respondents (N=9) indicated a desire to pursue graduate degrees. After REU: 43% of the 7 student survey respondents indicated a desire to pursue graduate degrees. Data regarding actual enrollment in graduate programs to be collected in forthcoming years.
4.	Contentment of students.	Post REU student survey (N=7) <ul style="list-style-type: none"> Program Assigned: Very satisfied=29%; Satisfied=57%; OK=14%; Very Dissatisfied=0% Research Project: Very satisfied=57%; Satisfied=0%; OK=43%; Dissatisfied= 4%; Very Dissatisfied=0% Advisor Interaction: Very satisfied=43%; Satisfied=43%; OK=0%; Dissatisfied= 0%; Very Dissatisfied=14%
5.	Percentage of REU participants from underrepresented groups	<ul style="list-style-type: none"> 44% (N=4) women and 56% (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"> 4 student respondents (N=9) indicated prior participation in an undergraduate research project. Post REU, students were asked how valuable the research experience was. 1 indicated "very valuable," 5 indicated "valuable," and 1 indicated "sort of valuable."

SUMMARY OF FACULTY MENTOR RESULTS

TABLE 2. Summary of faculty mentor-focused indicator measurement results 2015.

Performance Indicator		Results 2015
1.	Provision of an authentic research experience to students	<ul style="list-style-type: none"> 5 out of 6 faculty mentor respondents indicated that the REU program gave students “a lot” of authentic research experience. 1 out 6 indicated “a fair amount.”
2.	Encouragement of students to obtain an advanced degree in engineering.	<ul style="list-style-type: none"> 5 out of 6 faculty mentor respondents indicated that the REU program encouraged “a lot” the pursuit of a graduate degree. 1 out 6 indicated “a fair amount.”
3.	Development of students’ applied research skills.	<ul style="list-style-type: none"> All faculty mentor respondents (N=6) indicated “a lot” when asked: <i>To what extent did the REU program develop students’ applied research skills?</i> Faculty mentors were asked: <i>How well did the REU students meet your expectations in terms of research productivity?</i> Of the 5 faculty survey respondents, 1 indicated “not at all” and 4 indicated “well.” When asked: <i>How well did the student meet your expectations in terms of participation in your research program?</i>, 1 faculty mentor indicated “very well”; 3 indicated “well”, and 1 indicated “somewhat well.”
4.	Becoming more skilled as a faculty mentor	<ul style="list-style-type: none"> 2 faculty mentor respondents indicated that the REU program developed their mentor skills “a lot”; 4 indicated “a fair amount.”

DETAILED STUDENT RESPONSES

TABLE 3. What did students say about the benefits of the REU program?

	Not particularly valuable	Sort of valuable	Valuable	Extremely valuable benefit of this program	Total
1. Learned what it's like to be a researcher		1	5	1	7
2. Determined that I want to continue studying science or engineering	1	2	2	2	7
3. Travel to an interesting/different/new place	2	1	1	3	7
4. I found a particular field of research offered through this program very interesting		4	2	1	7
5. Learned what it's like to do research for grad school	1	1	3	2	7
6. Obtain hands-on experience to go with my class experience		1	2	4	7
7. Get experience/publications that I'm proud of and can put on my resume		1		6	7
8. Financially benefit		1		6	7
9. I want to improve my analytical abilities		2	2	3	7
10. Something different than I've done before		1		6	7
11. This was my only option/job possibility for this time during the summer	4	1		1	6

TABLE 4. How satisfied were students with particular aspects of the REU program?

	Very Satisfied	Satisfied	Ok	Not Satisfied	Very Unsatisfied	Total
the program you participated in	2	4	1			7
your specific research project	4		3			7
your interaction with your advisor	3	3			1	7
your interaction with your group members	3	3	1			7
housing and living arrangements	2	2	2	1		7
amount of stipend	3	4				7

Students were asked if they had any additional comments or questions about the REU program experience, the most representative of which follow:

- “[I] enjoyed the diversity of students in the programs; the experience offered a new perspective into the type of people I would likely meet in grad school.”

- “Everything was amazing. WSU is officially an institution I'll consider for graduate school.”
- “I understand advisors are usually busy directing their research lab, but there needs to be some sort of availability/disposition from the advisor to communicate with the research intern. I only spoke with my advisor 3 times during the program and I've learned nothing about how to interact with PIs about the topic of my research.”

DETAILED FACULTY MENTOR RESPONSES

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

20% thought that they did so “somewhat well,” 60% thought they did so “well,” and 20% thought they did so “very well.” Open-ended responses follow:

- “It was a mixed experience... One was really great and the second was an average student.”
- “One of the REU students 1) decided to go to grad school; 2) decided to continue working on this project after the completion of the program and... 3) the project that we initiated... is now being continued as a senior design project for the student.”
- “The student... fully participate[d] in the program and worked hard on the project.”

Common themes that arose were admittance that the *program period was brief*, but that the students *generally were above average*.

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

20% thought that they did so “not at all,” and 80% thought they did so “well.” Open-ended responses follow:

- “The student understands the problem well and starts implementing the required algorithm and systems in a timely fashion... student needed some guidance on how to capture important problems and stick with the focus of the research direction.”

Common themes that arose were feelings of meeting expectations in a satisfactory way.

How much did you benefit from serving as an REU mentor?

20% thought that they did “not at all,” 20% thought that they did “a little,” 40% thought they benefitted “a fair amount” and 20% thought they did so “a lot.” Open-ended responses follow:

- “There are a number of undergrads working in my lab. Having one more didn't make a huge difference to me.”
- One of the tool[s] that was developed will be further enhanced in my lab and we hope that it can be used as part of our research in the near future”

- “Communication with the student gave me more experience on how to communicate with undergrads about core research ideas”

Common themes that arose were mixed, but included *benefit for the student only, help on future research, and better communication with students.*

How much do you think your REU student benefitted from your mentorship?

40% thought they benefitted “a fair amount” and 60% thought they did so “a lot.” Open-ended responses follow:

- “We went from no research experience at the beginning through experimental design, data collection, analysis, and paper writing.”
- “The student is led through a complete research process and got a rich experience.”

Common themes that arose were great benefits of *research and lab experience.*

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

- “Offering the projects abstract online in advance... let students pick their research topic with priority option.”
- “More support for available computing research or instructions for finding available computing resource.”

EVALUATOR COMMENDATIONS

Overall, the project leadership team has achieved its goals regarding providing an authentic applied research experience to undergraduate students. Students and faculty alike agree that the program provides this opportunity, as well as providing motivation for continuing education in graduate programs.

EVALUATOR RECOMMENDATIONS

Ensuring a well-supported research program, in terms of induction and data provision, as well as on-going instruction is critical to providing a robust experience to students. I recommend developing and communicating an on-going feedback loop for students.

I recommend adapting the UNC Charlotte's CISE REU "A la Carte Survey" for the 2016 REU cycle. The current pre and post surveys are extensive and include areas outside the scope of the WSU REU Smart Environments program. The PI and external evaluator will work to choose those sections that are relevant to project goals. <http://reu.uncc.edu/toolkit/la-carte-survey>

Finally, I recommend that the PI consider using Mentor Effectiveness Scale, originally developed at Johns Hopkins University, to measure student perception of the effectiveness of the student-mentor relationship. <http://www.statisticssolutions.com/mentorship-effectiveness-scale/>