REU Site: Undergraduate Research in Smart Environments: Year 3 Evaluation Report
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The WSU REU program project leadership team identified six student-focused indicators (SIs) 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 were:

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

In 2017, 10 students participated in the WSU REU program. Nine students participated in the pre-REU survey and 7 in the post- REU survey, although not all responded to each question. The project team intends to follow up with students in 2017 to see if the 2017 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 2015-2017

TABLE 1. Summary of student-focused indicator measurement results 2015-2017.

	Indicator	Results 2015-2017
1.	Retention in undergraduate science & engineering programs	• 2017: All participants intended to stay enrolled in BS programs. However, the actual retention data will be collected in 2018. • 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	• 2017: 1 conference proceedings paper during the REU. Further data will be requested in 2018. • 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
3.	Percentage of students that go on to graduate school	• 2017 (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	• The majority of 2015 & 2016 students were generally content/satisfied with all aspects of the REU program. The 2017 cohort was much less content/less satisfied with the mentor-mentee relationship and the overall research experience than previous cohorts.
5.	Percentage of REU participants from underrepresented groups	• The 2017 cohort included: 40% (N=4) women and 60% (N=6) men; 1 Hispanic/Latino, 0 African/American, 2 Other, 2 Asian, 5 Caucasian. • The 2016 cohort included: 44% (N=4) women and 56% (N=7) men; 1 Hispanic/Latino, 1 African American, 2 Other, 7 Caucasian. • The 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	• For (2015-2017), the majority of students indicated that after completion of the REU program, they had a better understanding of the research process and its application.

2017 DETAILED STUDENT RESPONSES

Student Indicator 3: Percentage of students that go on to graduate school.

TABLE 2. 2017 participants (Pre-REU: N=9; Post-REU: N=7). "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.	Pre-REU: 3 students indicated Strongly Agree; 3 Somewhat Agree; 3 Neutral Post-REU: 4 students indicated Strongly Agree; 4 Somewhat Agree; 1 Neutral; 1 Somewhat Disagree
2.	Most people who are important to me think that I should apply to graduate school in [my REU project] discipline.	Pre-REU: 2 students indicated Strongly Agree; 2 Somewhat Agree; 4 Neutral; 1 Somewhat Disagree Post-REU: 4 students indicated Strongly Agree; 1 Somewhat Agree; 1 Neutral; 1 Somewhat Disagree
3.	I plan to apply to graduate school in a [my REU project] discipline.	Pre-REU: 2 students indicated Strongly Agree; 4 Somewhat Agree; 1 Neutral; 2 Somewhat Disagree Post-REU: 4 students indicated Strongly Agree; 1 Somewhat Agree; 1 Neutral; 1 Somewhat Disagree
4.	For me, to apply to graduate school in [my REU project] discipline is valuable.	Pre-REU: 2 students indicated Strongly Agree; 4 Somewhat Agree; 3 Neutral Post-REU: 4 students indicated Strongly Agree; 2 Somewhat Agree; 3 Neutral
5.	It is expected of me that I will apply to graduate school in [my REU project] discipline.	Pre-REU: 2 students indicated Strongly Agree; 4 Somewhat Agree; 3 Neutral Post-REU: 4 students indicated Strongly Agree; 2 Neutral; 1 Somewhat Disagree
6.	I will make an effort to apply to graduate school in [my REU project] discipline.	Pre-REU: 4 students indicated Somewhat Agree; 3 Neutral; 1 Somewhat Disagree Post-REU: 5 students indicated Strongly Agree; 1 Somewhat Agree; 1 Somewhat Disagree

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

Student Indicator 6: Improved Understanding of the Research Process

Two question sets informed the 2017 achievement of this indicator, see Tables 3 & 4 for results.

TABLE 3. 2017 participants (Pre-REU: N=9; Post-REU: N=7) "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	Pre-REU: 2 students indicated Strongly Agree; 4 Somewhat Agree; 3 Somewhat Disagree Post-REU: 7 students indicated Strongly Agree; 1 Somewhat Agree
2.	Understand primary	Pre-REU: 3 students indicated Strongly Agree; 3 Somewhat Agree; 2 Neutral; 1 Somewhat Disagree

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

10.	Write a research paper for publication	Pre-REU: 1 student indicated Somewhat Agree; 5 Neutral; 1 Somewhat Disagree; 2 Strongly Disagree Post-REU: 3 students indicated Strongly Agree; 1 Somewhat Agree; 1 Neutral; 2 Somewhat Disagree
11.	Work with others to investigate a research problem	Pre-REU: 2 students indicated Strongly Agree; 4 Somewhat Agree; 2 Neutral; 1 Strongly Disagree Post-REU: 3 students indicated Strongly Agree; 2 Somewhat Agree; 1 Somewhat Disagree
12.	Discuss research with graduate students	Pre-REU: 3 students indicated Strongly Agree; 4 Somewhat Agree; 1 Neutral; 1 Somewhat Disagree Post-REU: 5 students indicated Strongly Agree; 1 Neutral; 1 Somewhat Disagree
13.	Discuss research with professors	Pre-REU: 3 students indicated Strongly Agree; 4 Somewhat Agree; 1 Neutral; 1 Somewhat Disagree Post-REU: 5 students indicated Strongly Agree; 1 Neutral; 1 Somewhat Disagree
14.	Discuss research at a professional meeting or conference	Pre-REU: 1 student indicated Strongly Agree; 3 Somewhat Agree; 3 Neutral; 1 Somewhat Disagree; 1 Strongly Disagree Post-REU: 2 students indicated Strongly Agree; 2 Somewhat Agree; 1 Somewhat Disagree

TABLE 4: 2017 (Pre-REU: N=9; Post-REU: N=6; 1 chose not to complete the survey) "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 | Pre-REU: 1 student indicated A Good Deal; 2 Neutral; 2 Somewhat Little; 3 Nothing at All

Post-REU: 1 student indicated A Great Deal; 2 A Good Deal; 1 Neutral; 1 Somewhat Little; 1 Nothing at All |

2.	Research presentation preparation	Pre-REU: 4 students indicated Neutral; 2 Somewhat Little; 2 Nothing at All Post-REU: 1 student indicated A Great Deal; 2 A Good Deal; 2 Neutral
3.	Research presentation	Pre-REU: 2 students indicated A Good Deal; 2 Neutral; 2 Somewhat Little; 2 Nothing at All Post-REU: 1 student indicated A Great Deal; 3 A Good Deal; 1 Neutral; 1 Nothing at All
4.	Technical & scientific writing tools	Pre-REU: 2 students indicated A Great Deal; 1 A Good Deal; 3 Neutral; 1 Somewhat Little; 1 Nothing at All Post-REU: 1 student indicated A Great Deal; 3 A Good Deal; 2 Neutral
5.	Ethics in scientific research	Pre-REU: 4 students indicated A Good Deal; 2 Neutral; 2 Nothing at All Post-REU: 2 students indicated A Good Deal; 1 Neutral; 1 Nothing at All
6.	Authorship citations	Pre-REU: 2 students indicated A Good Deal; 2 Neutral; 2 Nothing at All Post-REU: 1 student indicated A Great Deal; 1 A Good Deal; 3 Neutral; 1 Somewhat Little
7.	Project management	Pre-REU: 3 students indicated A Good Deal; 2 Neutral; 2 Somewhat Little; 1 Nothing at All Post-REU: 1 student indicated A Great Deal; 2 A Good Deal; 3 Neutral; 1 Nothing at All
8.	Application of the scientific method	Pre-REU: 2 students indicated A Great Deal; 4 A Good Deal; 2 Neutral Post-REU: 1 student indicated A Great Deal; 2 A Good Deal; 2 Neutral; 1 Somewhat Little
9.	Analyzing data with statistics or other tools	Pre-REU: 1 student indicated A Great Deal; 2 A Good Deal; 1 Neutral; 2 Somewhat Little; 2 Nothing at All Post-REU: 5 students indicated A Great Deal; 1 Neutral

10.	Formulating a research hypothesis that could be answered with data	Pre-REU: 2 students indicated A Good Deal; 5 Neutral; 1 Nothing at All Post-REU: 1 student indicated A Great Deal; 3 A Good Deal; 2 Neutral
11.	Identifying appropriate research methods and designs	Pre-REU: 2 students indicated A Good Deal; 2 Neutral; 3 Somewhat Little; 1 Nothing at All Post-REU: 3 students indicated A Great Deal; 3 Neutral
12.	Understanding the theory and concepts guiding a research project	Pre-REU: 5 students indicated A Good Deal; 2 Somewhat Little; 1 Nothing at All Post-REU: 3 students indicated A Great Deal; 3 Neutral
13.	Defending an argument when asked questions	Pre-REU: 5 students indicated A Good Deal; 2 Neutral; 1 Somewhat Little Post-REU: 5 students indicated A Great Deal; 2 A Good Deal; 2 Neutral
14.	Explaining my project to people outside my field	Pre-REU: 4 students indicated A Good Deal; 3 Neutral; 1 Somewhat Little Post-REU: 4 students indicated A Great Deal; 1 A Good Deal; 1 Neutral
	Understanding and summarizing journal articles	Pre-REU: 1 student indicated A Great Deal; 3 A Good Deal; 4 Neutral Post-REU: 2 students indicated A Great Deal; 1 A Good Deal; 2 Neutral; 1 Somewhat Little
	Relate results to the "bigger picture"	Pre-REU: 3 students indicated A Great Deal; 2 A Good Deal; 3 Neutral Post-REU: 4 students indicated A Great Deal; 2 Neutral

The following results pertain to the mentor-mentee relationship. Of the 7 respondents to the Post-REU survey, 3 students were assigned to faculty advisors and 4 to graduate students; 6 of the mentors were men and 1 was a woman. In summary, the 2017 cohort were more dissatisfied (with more responses as Strongly Disagree) with the mentor-mentee relationship.

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

My mentor:		
1.	was accessible	2 Strongly Agree; 2 Somewhat Agree; 2 Neutral; 1 Strongly Disagree
2.	demonstrated professional integrity	3 Strongly Agree; 1 Neutral; 1 Strongly Disagree
3.	demonstrated content expertise in my area of need	4 Strongly Agree; 1 Neutral; 1 Somewhat Disagree; 1 Strongly Disagree
4.	was approachable	3 Strongly Agree; 1 Somewhat Agree; 3 Strongly Disagree
5.	was supportive and encouraging	3 Strongly Agree; 1 Somewhat Agree; 3 Strongly Disagree
6.	provided constructive and useful critiques of my work	3 Strongly Agree; 1 Somewhat Agree; 3 Strongly Disagree
7.	was helpful in providing direction and guidance on research project issues	3 Strongly Agree; 1 Somewhat Agree; 2 Somewhat Disagree; 1 Strongly Disagree
8.	answered my questions satisfactorily (e.g. timely, clear, comprehensive)	3 Strongly Agree; 2 Somewhat Agree; 1 Neutral; 1 Strongly Disagree
9.	acknowledged my contributions appropriately	4 Strongly Agree; 2 Neutral; 1 Strongly Disagree
10.	suggested appropriate resources	4 Strongly Agree; 1 Somewhat Agree; 1 Somewhat Disagree; 1 Strongly Disagree
11.	challenged me to extend my abilities	3 Strongly Agree; 1 Somewhat Agree; 3 Strongly Disagree

The following results relate to student satisfaction.

TABLE 6. How satisfied were you with:
Scale: Highly Satisfied, Somewhat Satisfied, Neutral, Somewhat Dissatisfied, Highly Dissatisfied.
(N= 7 for the Post-REU Survey)

1.	You faculty advisor	3 Highly Satisfied; 2 Somewhat Dissatisfied; 2 Highly Dissatisfied
2.	Your housing arrangements	6 Highly Satisfied; 1 Somewhat Dissatisfied
3.	The program in general	5 Highly Satisfied; 1 Somewhat Satisfied; 1 Somewhat Dissatisfied
4.	Your research experience	4 Highly Satisfied; 1 Somewhat Dissatisfied; 2 Highly Dissatisfied
5.	Your interaction with project staff	4 Highly Satisfied; 2 Neutral; 1 Somewhat Dissatisfied
6.	Your interaction with other students	7 Highly Satisfied

Students (N = 5; 2 didn't respond) were asked: *What was the most rewarding experience for you during the REU project?*
- "The most rewarding experience was getting to know everyone in the REU and sharing moments with them."
- "Teaching myself about machine learning"
- "Completing difficult tasks relating to the research project."
- "The culmination of a summer of hard work into a research paper."
- "Presenting my poster."

Students (N = 6; 1 didn't respond) were asked: *What was the most frustrating experience for you during the REU project?*
- "The mismanagement of the project coordinator and my mentor."
- "Lack of communication from faculty mentor."
- "Feeling unable to complete a difficult task relating to the research project."
- "Faculty advisor did not once even try to reach out to me - I understand people are busy and I should have taken the initiative but to essentially ignore me for 8 weeks then expect to have a significant role in the final poster is preposterous. Project was poorly planned/not really a thing and I don't think my mentor cared about my work at all. Never seemed to know what was going on."
- "When the results weren't what I wanted."
- "Reading papers to find appropriate algorithms, and looking for specified programs."

2017 MENTOR RESULTS

As a result of the 2015 evaluation, 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 mentor expectations and the extent to which they were met. 11 mentors respond to the Post-REU survey (the Pre-REU survey was not administered in 2017). In sum, mentors thought that the REU program, their mentor-mentee relationship, and the benefits to the students were much better than did the students.

MENTOR RESULTS

TABLE 2. Summary of faculty mentor-focused indicator measurement results 2016 (N = 9)
Scale: 1 = Not at All; 5 = A Lot

	Indicator	Responses 2017
1.	Provision of an authentic research experience to students.	9 indicated that students got "a lot" of authentic research experience; 2 indicated "a fair amount."
2.	Encouragement of students to obtain an advanced degree in engineering.	7 that they thought the program encouraged students "a lot" to obtain an advanced degree in engineering. 2 indicated "a fair amount" and 1 "a little."
3.	Development of students' applied research skills.	7 indicated that the program helped students develop these skills "a lot." 2 indicated "a fair amount" and 1 "a little." When asked: *How well did the student meet your expectations in terms of participation in your research program?*, Of 4 faculty mentors indicated "very well", 5 indicated "well", and 2 indicated "somewhat well." Faculty mentors were asked: *How well did the REU students meet your expectations in terms of research productivity?* 2 indicated "very well"; 6 indicated "well"; 2 "somewhat well" and 1 "not at all."

4.	Becoming more skilled as a faculty mentor	When asked how much they had *benefitted from the mentoring*, 2 indicated "a lot"; 6 "a fair amount" and 3 "a little."

DETAILED MENTOR RESPONSES

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

- "The student I worked with this summer exceeded my expectation. I enjoyed working with the student very much. The student learned a lot, but also contributed to my research program."
- "The student was good but such a short time does not allow them to contribute enough. Since this specific UG is a WSU student, she will continue to work on the project."
- "She showed great interest and enthusiasm in handling the multi-level skilled problem assigned to her on pain prediction on infants which include data analysis, classification, coding, embedded hardware programming and understanding of signal processing algorithms. Her attitude was commendable as we were able to port the work developed in the undergraduate project into the lab computer with success and validate the algorithms with more use cases. In the process, she became familiar and well-versed with Fast Fourier Transforms, linear classifiers, C and Python programming and handling embedded hardware."
- "The student was able to understand the problem and provide solutions without a lot of guidance from me."
- "My REU student was attentive and made sufficient efforts to learn about sensors and high-frequency signaling and using coding around it. He made 2 internal presentations regarding his progress to the group which was good. In addition, he showed good communication skills when interacting with the senior group members. He however needs to build his basics a bit more and with practice and motivation, he will be able to take it to the next level. It was good to have him in the lab."
- "The student was given a clearly defined small project in one of the active projects in my research program. The student was given an opportunity to meet weekly with myself and other members of the team. We were very committed to providing guidance and help. The student's level of participation, however, was mediocre."

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

- "We submitted a short conference paper partly based on the research the student help accomplish."
- "With her background she performed very well and was able to ramp up very quickly. The project needed a bit longer of a stay but she did show a very good attitude to learn these concepts which she will get in the coming year."
- "Student had a slow start, and so we had to scale back the outcomes a bit. Part of it was that the student was only a sophomore and so had only preliminary CS skills."
- "He did pretty well for the assigned project to him which was based on micro 3D resolution in sub-cm space through ultra-wideband high-frequency signaling. With his background, he showed vigor and tried to adapt to details on the coding and hardware design. However, he needs to adapt to paying more attention to smaller details and use that towards the goal and the target in his mind. His research productivity will improve further from this."
- "I did spend considerable time to make the experience valuable to the student, and to mentor broadly, including on matters related to graduate programs and schools. And the student was given significant exposure to resources and people around my research program. Unfortunately, this was not reciprocated by the student to my expectation. I was disappointed by the student's overall level of commitment and honesty."
- "REU student did a great job on working a nontrivial problem. He understood and established the problem well, and via communicating with graduate level students, he is able to come up with several good optimization strategy to improve the efficiency of the algorithm. His poster and presentation look good. In general, I am satisfied with the REU student. He will be continue working on the research project towards a submission to a conference."
- "I mentored two students. One did very well, making good progress. The other slowed done near the end when some of the tools became challenging to use."

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

- "I learned how better to scale my expectations and projects to the skill level of the student."
- "The student's work has provided us some key details about the sensor system we are using and the limitations of it. We identified the sources of error in the messaging scheme that is limiting the performance of the current system and will benefit from the algorithm that the group has recently proposed. The next step is to substitute the system algorithm with the new proposed algorithm and make a distinction between the performance in the two methods."
- "I learned a lesson on how to calibrate my time expenditure mentoring."
- "I gained much experience working with undergraduate students from student motivating to management and supervision. The process gives me a chance to think

from undergraduate level student perspective, understand their needs and interests, and shape and connect a research problem to a real-world application. The outcome can be directly used by the students in their future research and career path."

- "Obtained some good research results. One will definitely lead to a top conference paper. The other will lead to a paper, but probably second-tier conference or workshop. Both students were enthusiastic and enjoyable to work with."

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

- "My own assessment is that student learned a great deal about the specific problem they worked on and research more broadly. What the student self-expressed in words agrees with this assessment."
- "She learned several basic and advanced concepts related with Electrical and computer engineering which will benefit her in the long run. Part of her work has also earned her a transfer to a top engineering school.
- "She seemed genuinely proud of her accomplishments, expressed her satisfaction with the experience, and indicated she would like to keep doing research in the future."
- "He got useful exposure related with the design of sensor systems, hardware design, tools used in the lab and the approach and expectations from students in Microelectronics design. He has shown enthusiasm in continuing this further through his senior year and learn more details with respect to board design and IC design using the signal processing and algorithmic approaches."
- "The student was given maximum opportunity and generous access."
- "My REU student experienced the complete research process, from motivation and problem formulation, to the dataset preparation, algorithm design and experimental study. The feedback, which I quote, says "I learned so many new things from you and the team, and every single one of them are extremely valuable to me." In the last day of the poster session, he got the chance to also learn and practice how to present the work to others, and grab the chance to learn from both domain experts and practitioners about their need to initialize the application of his project."
- "Both made good progress and had a good research experience. Both wished there was more time, but both also want to continue the work."

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

- "I think the research team has done an excellent job running this program this year. It was planned and executed well, starting from student selection and matching with mentors to the actual summer stay at WSU. I also attended the Research Symposium at the end of the program. It was great, except that it was a bit tight in space, which made wandering around to see the posters difficult. A suggestion for next year would be to see if there is an alternate, bigger venue."
- "All is good!"

- "I will appreciate if the research team can contact the students a few weeks in advance so the students can learn the basic concepts before they arrive in Pullman. The 8 week duration can then be used even more efficiently towards research in the lab. Besides that, I'm fairly happy with the current setup."
- "Might want to limit participation to students who are at least juniors, as below that level, it is struggle to find a project that has a research component, but is still doable at that level of skill."
- "I don't have any specific suggestions but now that I know of this, I will prepare in advance to get the undergraduate student aware of this opportunity much earlier. I have been mentoring another junior student in the year and had excellent results through him as he started his readings with the project in Jan this year. This also allows the students to identify with the project more closely."
- "Regular social events would enhance their experience."
- "The REU research team has done an excellent job planning, coordinating and managing the REU program this year. I could not ask for a more organized and effective set up. Congratulations on a job well done!"
- "None. Good program."

EVALUATOR COMMENTS

Overall, the project leadership team has achieved its goals over the three 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. Only in 2017 did there seem to be a drop in student satisfaction about the research experience and the mentor-mentee relationship.

The leadership team chose to use UNC Charlotte's CISE REU "A la Carte Survey" for the final two 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 were 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 did not pertain to the student indicators and many were redundant and/or confusing. Should the team decide to conduct future REU programs, I suggest choosing and/or developing and/or adapting two to three targeted questions per indicator. This will give more accurate and useful data in order to make decisions.

Future WSU REU programs may want to summarize faculty expectations from previous programs in regards to student productivity and participation. Faculty mentors could then make clear at the outset how specifically they would like students to participate and what the

expectations are in regards to the mentor-mentee relationship, producing reports, presentations, conference papers, etc. Post-REU faculty mentor responses during the three years of this REU program suggest that students do not always live up to faculty expectations. It's possible that being more overt at the outset could successfully address this issue.