

Board 10: REU Site: Sustainability of Horizontal Civil Networks in Rural Areas

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REU Site: Sustainability of Horizontal Civil Networks in Rural Areas

Introduction

The University of Nebraska-Lincoln Sustainability of Horizontal Civil Networks in Rural Areas Summer Research Program (SRP) is funded through a National Science Foundation (NSF) Research Experience for Undergraduates (REU) grant. Rural areas, which contain approximately 20% of the US population and 80% of the land area in the United States, are fundamental to human well-being. Rural areas provide unique resources such as the infrastructure for food and bioenergy production as well as the transportation infrastructure from inland urban centers to ports. Despite this, little attention is paid to the unique challenges and opportunities for sustainable rural civil infrastructure. Substantial challenges facing sustainable rural development include low population densities; communities experiencing flat or negative population growth; and the close connections between rural communities and their surrounding natural environment, and necessitate new technologies and approaches for civil infrastructure in these areas. The primary focus of our REU site will be on sustainable rural infrastructure with emphasis in three areas: (1) environmental and water resources in rural and/or agricultural areas; (2) structural engineering and materials research for sustainable rural civil infrastructure; and (3) sustainable transportation research. These projects are based in fundamental research, but in many cases, include field sites or testbeds located in rural communities. The objectives of this REU site are to (1) provide research experiences to undergraduate students from institutions with limited research opportunities and from minority groups underrepresented in STEM; (2) provide participants with first-hand exposure to the engineering and infrastructure challenges facing the rural United States through research and professional development opportunities in both academia and civil engineering industry; and (3) promote and sustain the interest of undergraduate students in pursuing graduate education in STEM.

Evaluation Methods

Evaluation of the REU Site was conducted by the Methodology and Evaluation Research Core Facility (MERC) at the University of Nebraska-Lincoln. The evaluation plan included surveys conducted with the students before and after their time in the program and focus group sessions conducted with the students and interviews with their faculty mentors. The evaluation plan also includes follow-up surveys with the participating undergraduate students one year after their completion of the program. The quantitative data collection (pretest, posttest) was conducted by the University of Nebraska-Lincoln Office of Graduate Studies and the results were sent to the MERC for analysis and reporting. The qualitative data collection (i.e., interviews and focus group sessions) was conducted by MERC staff. Finally, a brief review of demographic information of the applications was conducted.

Applicant and Cohort Demographics

A total of 114 undergraduate students applied for the REU summer program; among them, 61 (54%) were female, and 35 (31%) were underrepresented minority students (URM). Meanwhile, among the ten students who accepted the offer from the program, 6 (67%) were female and 6 (67%) were URM, as shown in Table 1. Our 2018 cohort met our stated program goal of

recruiting at least 50% of the cohort from groups underrepresented in engineering (female and URM students). In addition, 5 of the 10 accepted students (50%) were from institutions with limited research opportunities.

Table 1. Demographics of the Applicants and Accepted Cohort

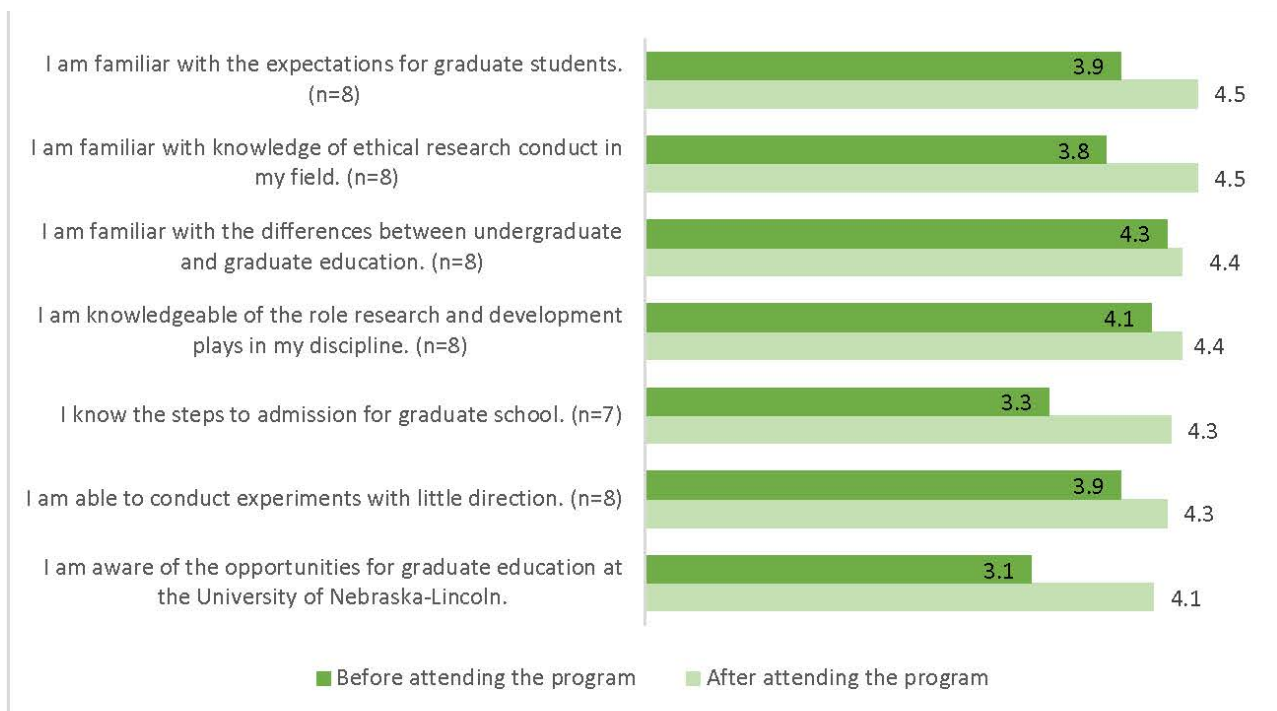
Demographics	Applied		Accepted Cohort	
Total	114	100%	10	100%
Female	61	54%	6	60%
Male	53	46%	4	40%
Unspecified Gender	0	0%	0	0%
Underrepresented Minority (URM)*	35	31%	6	60%
African-American	10	9%	1	10%
American-Indian	0	0%	0	0%
Hispanic/Latino	3	3%	3	30%
Multiracial	22	19%	2	20%
Hawaiian/Pacific Islander	0	0%	0	0%
Asian	12	11%	1	10%
White	67	59%	3	30%

*URM includes African-American, American-Indian, Hawaiian/Pacific Islander, Hispanic/Latino, & Multiracial Students

Impact of Program on Familiarity with Research and Graduate Education

The majority of students in the REU program reported feeling like their familiarity with issues in research and graduate education increased in eight of eight items (see Figure 1). The greatest gains were in their awareness of opportunities for graduate study at the University of Nebraska-Lincoln where the rating increased from 3.1 on the pre-test to 4.1 on the post-test and in their knowledge of the steps for admission to graduate school, which increased from 3.3 on the pre-test to 4.3 on the post-test.

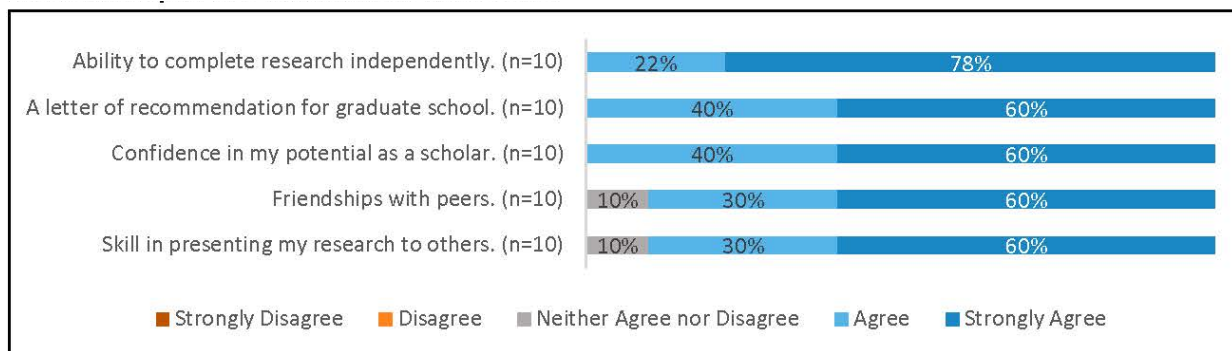
Students in the REU program reported that they agreed or strongly agreed that they benefited from the program (see Figure 2). 100% agreed or strongly agreed that they gained in ability to complete research independently as well as gains in letters of recommendation for graduate school and confidence in their potential as a scholar. Nine of the ten students reported gains in friendships with peers and skill in presenting research to others, while one student reported a neutral response (neither agree or disagree).



Source: Summer Research Program Pre-Survey, Summer Research Program Post-Survey

Note: 1 = Strongly Disagree, 5 = Strongly Agree

Figure 1. Changes in Familiarity with Issues in Research and Graduate Education (n=7 or 8)



Source: Summer Research Program Post-Survey

Figure 2 - What did you gain from attending the 2018 {University} Summer Research Program? (n=10)

Student's Focus Group Reponses

Students in the REU program participated in an exit focus group in August 2018 to share their perceptions of the program and provide input on potential program improvement. When asked how at the end of the program what students enjoyed the most about their time in the REU, responses included learning more about graduate school expectation, enhancing their

organizational skills and social events. However, they felt the program was stressful at times and they didn't always have the guidance they needed.

Students felt they were well prepared to begin the program, based on the information provided on the website, which was an increase in preparedness from what they reported at the midpoint focus group. Students also felt the program met expectations to consider this experience a success and that it prepared them for graduate studies and future career plans; specifically by providing them with a hands on experience of graduate school, lab exposure, and organizational skills.

The students' relationships with their faculty mentors varied, with some students reporting they met very little with their mentor while some reported they had a great relationship and communicated frequently. The main reason for the lack of communication and support were travel obligations. However, the students all had graduate student mentors they could rely on as well.

Conclusions

The most common research experiences for students prior to the REU were through course credit and in a research program at their home institution. All students were knowledgeable about careers in their discipline prior to the program beginning. The majority of REU students reported high confidence in scientist skills, with the lowest confidence for using entrepreneurship skills and knowledge in their work. Students expected to gain confidence, skills, and relationships through the program.

All students expressed an interest in pursuing a career in STEM and hoped to use this program as a way to help them refine what they wanted to do for graduate school. Students reported an increase in knowledge about ethical research conduct, graduate education at UNL, and how to apply for graduate school. Other skills students gained were communication skills and interdisciplinary work. Students felt most strongly they gained an ability to complete research independently. They also felt mostly satisfied with mentor interactions and the social events during the REU.