CERP
Computing Research Association
Evaluation

NSF CISE REU Site Evaluation Report 2022

REU Site Name
Award Number: REU Site ID

REPORT INFORMATION

This report presents data collected by the Center for Evaluating the Research Pipeline (CERP) on behalf of the National Science Foundation (NSF) Directorate for Computer and Information Science and Engineering. Pre- and post-REU program surveys measured the demographics and backgrounds of those participating in REUs, how they changed during the course of their REU participation, and their perceptions of their REU experiences.

Report contents

This report provides a summary of pre- and/or post-REU evaluation survey data collected from your REU students. This report contains:

- Detailed comparative tables for your REU participants and participants in similar REUs, including:
  - Summaries of participant characteristics
  - Pre- and post-REU self-perceptions, skills and knowledge, support, and future computing research interests and intentions
  - REU participant feedback

Defining "similar REUs" For this report, two types of similar REUs were created to allow you to compare your REU project evaluation results to those of other REUs.

- **Comparison Group 1: REU projects with a similar REU research area** One set of similar REUs was defined by the REU project research area that you and other participating REU PIs indicated on the Time PI Information Form. (If there were not enough other REU projects that shared your REU research area, your REU will be compared to all other REU projects.) Your REU survey results are shown alongside those with a similar research area focus in Chapter 1 of this report.
  - For your REU, the following REU research area was used to define REUs that were similar to yours: Machine Learning, Distributed Systems, Artificial Intelligence, Hardware/Architecture
- **Comparison Group 2: REU projects held at similar institutions**: A second set of similar REUs was defined by the type of institution where the REU was held (master's- or PhD-granting). Your REU survey results are shown alongside those held at a similar institution type in Chapter 2 of this report.
  - For your REU, the following institution type was used to define REUs that were similar to yours: Phd Granting

Inclusion of responses in the report
Your REU report includes the responses of all unique participants who completed surveys for your project who met the following criteria: (1) they consented to participate in the surveys; (2) they met the minimum age criterion for survey participation; and (3) they provided their name and contact information. **Please note that if your REU did not have at least 5 respondents for a particular survey item, there will be no content reported for that item**.
The following describes which REU participant responses were included in each set of results.

- **Participant demographics and background information (Sections 1.1 and 2.1)** were gathered at the pre-test, or at the post-test if a respondent did not fill out a pre-test survey. Thus, these results will include any REU participant who completed items at the pre-test or the post-test measurement. Because of this, in some cases, participants who did take a survey but dropped out of or did not complete the REU would be included in the results.
- **Pre- versus post-REU changes among REU participants (Sections 1.2 and 2.2)** include only those who completed survey items at both the pre-test and the post-test measurement.
- **REU participant feedback (Sections 1.3 and 2.3)** is based on post-test survey items. Thus, this section includes any REU participant who completed items at the post-test measurement.

Table layout For each survey question, either a mean or a proportion (percentage) is reported depending on the type of survey question. Sample sizes within each table are notated with 'n' in the bottom row of each table; 'n' indicates the number of students who responded to that specific item or series in the survey. Sample sizes may vary across tables because all survey questions were voluntary. The table column labeled "Sig." indicates the results of the inferential statistics described below in "Statistical tests and reporting."
Statistical tests and reporting

- **Participant demographics and background information:** Two-proportion z-tests were used to assess differences in proportions between your REU and similar REUs.
- **Pre- versus post-REU changes among REU participants:** Paired samples t-tests and two-proportion z-tests were used to assess differences between pre- and post-test measures. These tests were performed separately for your REU and similar REUs. No significance testing was conducted to compare your REU pre-post results to similar REUs pre-post results.
- **REU participant feedback:** Independent samples t-tests and two-proportion z-tests were used to assess differences in means and proportions, respectively, between your REU and similar REUs.

For each statistical test, we indicate whether a comparison between two groups is "significant". Significance is determined using a two-step process. First, we assessed whether group differences meet the conventional $p \leq .05$ threshold for inferential statistics. Then, if the $p \leq .05$ threshold was met, we observed the effect size for the two-group comparison using Cohen's d for the independent samples t-tests and Cohen's h for the two-proportion z-tests. In the current report, group comparisons are only deemed "significant" if they reach the $p \leq .05$ threshold and their effect size is $\geq .30$ (indicating an effect size of "medium" or greater). For an explanation of why we use this two-step process and more information on how to interpret inferential statistics, see the Appendix.

Thank you for participating in the CERP NSF CISE REU Evaluation! Your data help NSF and the computing community better understand REU experiences and their impacts on students.

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Chapter 1

Results Compared to REUs at Similar Institutions

1.1 Summary of REU Participants

Table 1.1.1 Do you currently describe yourself as male, female or transgender?

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
Male	60%	49%	
Female	20%	44%	
Transgender	10%	4%	
None of these	10%	3%	
n	10	287	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.1.2 What is your race?
Select all that apply.

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
Arab/Middle Eastern	0%	6%	
Asian/Asian American	45%	29%	
African American/African/Black	9%	15%	
American Indian/Alaska Native	0%	3%	
Native Hawaiian/Pacific Islander	0%	0%	
Caucasian/European/White	45%	57%	
n	11	307	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.1.3 What is your ethnicity?

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
Hispanic/Latino	0%	14%	
Not Hispanic/Latino	100%	86%	
n	11	307	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.1.4 What type of disability do you have?

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
Reported one or more disabilities	18%	23%	
Did not report a disability	82%	77%	
n	11	306	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.1.5 What is the highest level of education attained by any of your parent(s)/guardians?

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
Student is a first-generation college student	91%	77%	
Student is not a first-generation college student	9%	23%	
n	11	309	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.1.6 Participant undergraduate major(s)

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
Declared computing major	91%	72%	
Declared non-computing major	9%	21%	
Undeclared major intending computing	0%	4%	
Undeclared major not intending computing	0%	2%	
n	11	326	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.1.7 In what year do you expect to complete your current program?

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
2022	9%	7%	
2023	27%	38%	
2024	55%	35%	
2025	9%	19%	
Later than 2025	0%	1%	
I am not completing a degree or certificate	0%	0%	
n	11	326	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.1.8 Which of the following reasons best explain your motivations to participate in this REU?
Choose up to 3 responses.

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
To build connections and/or collaborate with particular faculty	0%	7%	
To build connections and/or collaborate with other student researchers	0%	7%	
To increase my competitiveness for graduate school	27%	27%	
To build my confidence as a researcher	9%	6%	
To better understand the connection between research and real world applications	0%	15%	
To expand on what I had been learning about in my classes	18%	19%	
To help pay for my living expenses while in college	0%	4%	
To build work experience and my resume/CV	45%	57%	
To develop or improve my technical skills	9%	38%	
The research project(s) seemed interesting	27%	21%	
To learn more about what being a researcher is like	36%	17%	
To have something to do outside of my coursework	18%	8%	
Other; please specify:	0%	1%	
To have a paid opportunity	9%	13%	
To participate in something prestigious	0%	5%	
To learn more about a specific research area of interest to me	36%	19%	
To learn more about what graduate school might be like	64%	33%	
n	11	326	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

1.2 Pre- and Post-REU Program Results

Table 1.2.1 How true of you are the following statements?
(1) Not at all true - (5) Extremely true

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
I have a strong sense of belonging to the community of scientists.	2.50 (0.97)	3.00 (1.12)		2.83 (1.21)	2.99 (1.18)	
I am a scientist.	2.40 (0.97)	2.78 (1.20)		2.58 (1.19)	2.98 (1.22)	*
Being a scientist is an important reflection of who I am.	2.50 (1.18)	3.22 (1.39)		2.82 (1.20)	2.97 (1.28)	
In general, being a scientist is an important part of my self-image.	2.90 (0.88)	3.11 (1.27)		2.97 (1.18)	3.12 (1.23)	
I have come to think of myself as a scientist.	2.20 (1.03)	2.78 (1.39)		2.48 (1.26)	2.87 (1.24)	*
n	10	9		293	269	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.2 Please indicate the extent to which you disagree or agree with the following statements:
(1) Strongly disagree - (5) Strongly agree

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
I see myself as a computing person	3.80 (1.03)	3.89 (0.93)		3.92 (1.05)	4.11 (0.97)	
I feel like I belong in computing	3.90 (0.88)	3.89 (1.05)		3.80 (1.06)	3.98 (1.02)	
I feel like an outsider in computing	2.50 (0.97)	2.00 (0.71)		2.60 (1.24)	2.49 (1.23)	
Computing is a big part of who I am	3.20 (0.92)	3.67 (1.00)		3.47 (1.12)	3.65 (1.10)	
I feel welcomed in computing	3.50 (0.71)	3.89 (0.93)		3.75 (1.05)	3.93 (0.98)	
I do not have much in common with the other students in my computing classes	2.80 (0.79)	2.67 (1.22)		2.76 (1.17)	2.58 (1.15)	
n	10	9		293	269	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.3 In your opinion, to what extent are each of the following statements true of you:
(1) Not at all true - (5) Extremely true

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
I can give the impression that I'm more competent than I really am	2.70 (1.25)	2.67 (0.87)		3.03 (1.26)	3.07 (1.26)	
When others praise me for something I have accomplished, I'm afraid I won't be able to live up to their expectations of me in the future	2.70 (1.42)	3.00 (1.50)		3.21 (1.38)	3.09 (1.41)	
At times, I feel my success has been due to some kind of luck	3.00 (1.05)	3.00 (0.71)		3.12 (1.37)	3.01 (1.36)	
I'm disappointed at times in my present accomplishments and think I should have accomplished much more by now	3.70 (0.95)	3.44 (1.13)		3.24 (1.43)	3.10 (1.40)	
n	10	9		290	267	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.4 I am confident that I can...
(1) Strongly disagree - (5) Strongly agree

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
contribute to a research project in computing	4.10 (0.74)	4.44 (0.53)		4.37 (0.72)	4.32 (0.86)	
clearly communicate technical problems and solutions to a range of audiences	3.60 (0.84)	4.00 (0.50)		3.95 (0.85)	4.15 (0.81)	
articulate thoughtful answers to questions about my work during a presentation	3.30 (0.82)	3.78 (0.44)		3.95 (0.88)	4.14 (0.89)	
introduce myself to new peers/colleagues at professional meetings	3.30 (0.95)	3.78 (0.83)		4.00 (1.07)	4.15 (1.00)	
be a capable researcher in computing	3.80 (1.03)	4.33 (0.50)		4.00 (0.87)	4.09 (0.90)	
find employment in an area of computing interest	4.50 (0.71)	4.44 (0.53)		4.08 (0.88)	4.21 (0.87)	
complete an undergraduate degree in computing	4.90 (0.32)	4.78 (0.44)		4.59 (0.80)	4.57 (0.81)	
get admitted to a graduate computing program	4.10 (0.57)	4.44 (0.53)		3.92 (1.01)	4.08 (1.03)	
be successful in a graduate computing program	3.90 (0.88)	4.33 (0.71)		3.99 (0.96)	4.10 (1.02)	
n	10	9		292	267	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.5 How would you rate your current skill level in each of the following?
(1) Poor - (5) Excellent

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
Generating hypotheses	2.80 (0.79)	3.00 (0.71)		3.08 (0.93)	3.25 (0.85)	
Using scientific methods to test a hypothesis	2.90 (0.74)	3.11 (0.93)		3.11 (0.95)	3.35 (0.90)	
Collaborating with colleagues	3.40 (0.97)	3.33 (0.87)		3.79 (0.96)	3.86 (0.97)	
Collecting data or conducting experiments	2.80 (0.92)	3.11 (0.78)		3.31 (0.98)	3.58 (0.98)	
Analyzing data with statistics or other tools	2.90 (1.20)	3.11 (0.60)		3.08 (1.04)	3.37 (1.05)	
Summarizing published research results	2.70 (1.06)	3.00 (0.87)		2.92 (0.98)	3.35 (1.00)	*
Explaining research results	2.80 (0.92)	3.11 (0.78)		3.12 (0.94)	3.56 (0.97)	*
Writing or co-authoring a research paper or report	2.30 (0.67)	2.56 (0.73)		2.58 (1.06)	3.07 (1.11)	*
Presenting a research paper or report	2.70 (0.48)	3.22 (0.83)		2.91 (1.08)	3.50 (1.08)	*
Publishing a research paper or report	1.60 (0.84)	2.67 (1.22)	*	2.10 (0.98)	2.74 (1.09)	*
n	10	9		293	269	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.6 Please rate the degree of your proficiency (how skilled you are) in the following items
(1) Highly deficient - (5) Highly proficient

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
Building/maintaining a professional network	2.70 (0.67)	3.11 (0.78)		3.21 (0.94)	3.49 (0.92)	
Dealing with conflict	3.30 (0.82)	3.22 (0.67)		3.78 (0.85)	3.77 (0.87)	
Providing constructive feedback	3.50 (0.71)	3.33 (0.50)		3.87 (0.77)	3.87 (0.79)	
Time management	3.70 (1.34)	4.00 (1.32)		3.69 (1.00)	3.74 (0.99)	
Speaking clearly and effectively	3.50 (0.53)	3.56 (0.73)		3.68 (0.91)	3.82 (0.93)	
Presenting research	3.20 (0.63)	3.67 (0.71)		3.40 (0.90)	3.87 (0.82)	*
Planning and organizing projects	3.50 (0.97)	3.56 (1.01)		3.77 (0.85)	3.80 (0.84)	
Writing scientific papers	2.60 (0.70)	3.33 (0.71)	*	3.13 (0.97)	3.35 (0.90)	
Identifying career options	3.40 (1.07)	3.33 (1.00)		3.44 (0.88)	3.58 (0.93)	
Preparing graduate school application materials	2.60 (0.97)	3.00 (1.00)		2.58 (0.97)	3.19 (0.99)	*
Identifying graduate school options	2.30 (0.95)	3.00 (0.71)		2.68 (1.01)	3.35 (1.00)	*
n	10	9		292	269	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.7 How much do you feel you know about the following?
(1) Nothing - (5) A lot

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
What to look for in a graduate research advisor	1.50 (0.71)	2.67 (0.87)	*	2.19 (1.07)	3.30 (1.02)	*
The research areas you would pursue in graduate school	2.60 (1.07)	2.89 (0.78)		2.62 (1.11)	3.21 (1.05)	*
What graduate admissions committees look for in an applicant	2.00 (1.05)	2.89 (1.05)		2.19 (1.05)	3.10 (1.10)	*
How to choose graduate programs that are a good fit for you	1.70 (0.82)	2.44 (0.88)		2.25 (1.06)	3.11 (1.13)	*
What being a graduate student would be like	2.00 (0.67)	3.00 (0.87)	*	2.32 (1.07)	3.56 (1.02)	*
Career options in computing	3.20 (0.63)	3.67 (0.71)		3.09 (0.94)	3.43 (0.93)	*
Career options in research	2.40 (0.97)	3.44 (1.01)	*	2.46 (0.97)	3.22 (0.92)	*
What it would be like to work in academia	2.60 (1.07)	3.33 (1.00)		2.60 (1.09)	3.39 (1.02)	*
n	10	9		289	257	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.8 To what extent do you have a mentor who...
(1) Not at all - (5) Very much

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
helps you improve your computing skills	2.40 (1.65)	3.44 (1.01)		2.49 (1.34)	3.03 (1.30)	*
helps you improve your research skills?	2.30 (1.57)	3.44 (0.88)		2.45 (1.37)	3.33 (1.27)	*
helps you identify or develop your research interests?	2.40 (1.35)	3.22 (1.09)		2.42 (1.30)	3.12 (1.34)	*
gives you insight into what graduate school is like?	2.20 (1.23)	3.11 (0.60)		2.36 (1.33)	3.31 (1.31)	*
provides information or advice about applying for graduate school?	2.30 (1.06)	3.11 (0.60)		2.30 (1.33)	3.24 (1.25)	*
shows compassion for any issues you discussed with them	2.90 (1.45)	3.33 (1.12)		3.33 (1.38)	3.68 (1.20)	
shares personal experiences as an alternative perspective to your problem	2.70 (1.42)	3.33 (1.12)		2.79 (1.40)	3.28 (1.24)	*
explores career options with you	2.10 (1.10)	3.11 (0.93)	*	2.53 (1.29)	2.95 (1.30)	*
encourages you to do the best you can in your coursework	3.20 (1.55)	3.56 (1.24)		3.37 (1.45)	3.64 (1.23)	
supports your research ideas	2.50 (1.43)	2.89 (0.78)		2.74 (1.40)	3.30 (1.28)	*
provides constructive feedback	2.90 (1.29)	3.11 (0.78)		3.17 (1.42)	3.73 (1.16)	*
n	10	9		290	262	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.9 To what extent is each of the following available to you at this point?
(1) Not at all - (5) Very much

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
People with whom you can ask questions related to your professional development	3.20 (1.03)	3.78 (1.09)		3.39 (1.13)	3.71 (1.02)	*
People with whom you can discuss graduate school opportunities	3.20 (1.23)	3.89 (1.05)		3.13 (1.19)	3.65 (1.14)	*
A strong network of peers to interact with at conferences	2.20 (1.03)	2.44 (0.53)		2.36 (1.25)	3.02 (1.21)	*
A strong network of mentors to interact with at conferences	1.70 (0.82)	2.56 (0.88)	*	2.14 (1.15)	2.91 (1.21)	*
People who would be excited to learn about your professional successes	2.90 (0.57)	3.44 (0.73)		3.48 (1.16)	3.81 (0.95)	*
People with whom you can discuss issues you are having	2.90 (0.57)	3.56 (0.73)	*	3.34 (1.18)	3.60 (1.04)	
n	10	9		291	262	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.10 What is your current level of interest in the following?
(1) Not at all interested - (5) Extremely interested

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
Conducting research as an undergraduate	4.20 (0.79)	3.89 (0.93)		4.18 (0.86)	3.74 (1.18)	*
Conducting research as a graduate student	3.90 (1.10)	4.00 (1.00)		3.60 (1.24)	3.33 (1.32)	
Learning more about computing	4.40 (0.84)	4.56 (0.73)		4.46 (0.78)	4.29 (0.95)	
Pursuing a research career	3.00 (1.25)	4.00 (1.12)		3.10 (1.22)	3.04 (1.34)	
Pursuing a non-research career	2.90 (1.20)	3.11 (0.78)		3.66 (0.95)	3.83 (0.92)	
Mentoring others on a future formal research project	2.70 (1.25)	2.78 (0.83)		2.98 (1.20)	2.91 (1.34)	
n	10	9		290	258	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.11 How likely is it that you will enroll in a ...
(1) Not at all likely - (5) Extremely likely

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
How likely is it that you will enroll in a terminal master's program in a computing field?	2.80 (1.23)	2.44 (0.73)		2.68 (1.21)	2.96 (1.27)	
How likely is it that you will enroll in a doctoral program in a computing field?	3.00 (1.41)	3.56 (1.33)		2.47 (1.24)	2.58 (1.30)	
n	10	9		289	257	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.12 What is the highest degree you plan to attain?

	Your REU Students			REU Students at Similar Institutions		
	Time 1 (%)	Time 2 (%)	Sig.	Time 1 (%)	Time 2 (%)	Sig.
High school degree	0%	0%		0%	0%	
Technical certificate	0%	0%		0%	0%	
Associate's degree	0%	0%		0%	0%	
Bachelor's degree	10%	0%		18%	16%	
Graduate certificate	10%	0%		1%	2%	
Master's degree	10%	11%		34%	40%	
Doctoral degree	70%	89%		47%	42%	
n	10	9		290	258	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.13 In which field do you intend to earn your highest degree?
Choose up to 2 responses.

	Your REU Students			REU Students at Similar Institutions		
	Time 1 (%)	Time 2 (%)	Sig.	Time 1 (%)	Time 2 (%)	Sig.
Another field	0%	0%		5%	2%	
An arts and humanities field	0%	0%		3%	3%	
Bioinformatics/Computational biology	0%	0%		5%	6%	
A biological science field	0%	0%		4%	3%	
A business field	0%	0%		3%	5%	
Computer Information Systems/Informatics	0%	0%		3%	4%	
Computing and Business	0%	0%		1%	0%	
Computer Engineering	0%	11%		6%	6%	
Other computing and technology field	0%	0%		4%	4%	
Computer Science	90%	78%		60%	63%	
Data Science	30%	33%		12%	17%	
Electrical and Computer Engineering (ECE)	0%	0%		3%	6%	
An education field	0%	0%		2%	2%	
Electrical Engineering and Computer Science (EECS)	0%	0%		5%	3%	
Other engineering field	0%	0%		7%	7%	
Game Design	0%	0%		4%	4%	
Information Technology	0%	0%		3%	5%	
A mathematics field	30%	22%		12%	9%	
A physical sciences field	0%	0%		3%	4%	
A professional field	0%	0%		1%	1%	
Software Engineering	0%	11%		6%	13%	
A social science field	20%	22%		4%	3%	
n	10	9		290	255	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.14 How interested are you in having the types of jobs listed below?
(1) Very uninterested - (5) Very interested

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
College or university professor in computing field (teaching focused)	3.10 (1.37)	3.56 (1.01)		2.74 (1.38)	2.69 (1.39)	
College or university professor in computing field (research focused)	3.60 (1.51)	4.11 (1.27)		2.85 (1.35)	2.76 (1.35)	
K-12 computing teacher	1.90 (1.37)	2.44 (1.74)		1.93 (1.10)	2.07 (1.20)	
Computing researcher in industry	3.40 (0.84)	3.89 (0.78)		3.57 (1.13)	3.60 (1.20)	
Computing researcher in a government lab or agency	3.20 (1.03)	3.78 (0.97)		3.40 (1.21)	3.25 (1.32)	
A non-research computing position in industry (e.g., software engineer)	3.10 (1.52)	3.00 (1.66)		3.79 (1.21)	3.85 (1.18)	
A non-research computing position in government	2.70 (1.34)	2.44 (1.42)		3.14 (1.30)	3.25 (1.32)	
Entrepreneur (computing related; e.g., individual contractor, build a start-up)	2.80 (1.14)	2.89 (1.45)		3.02 (1.36)	3.13 (1.39)	
Non-computing career	1.90 (0.88)	2.33 (1.00)		2.68 (1.32)	2.80 (1.28)	
n	10	9		289	254	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.15 For your future career, in which setting would you like to work the most?

	Your REU Students			REU Students at Similar Institutions		
	Time 1 (%)	Time 2 (%)	Sig.	Time 1 (%)	Time 2 (%)	Sig.
Academia	50%	56%		21%	16%	
Industry	20%	22%		57%	58%	
Government (includes national labs)	10%	0%		11%	12%	
Self-employment	10%	22%		7%	12%	
Something else	10%	0%		4%	2%	
n	10	9		290	254	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 1.2.16 How likely will your future career have a...
(1) Extremely unlikely - (5) Extremely likely

	Your REU Students			REU Students at Similar Institutions		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
How likely will your future career have a computing-related focus?	4.60 (0.70)	4.89 (0.33)		4.46 (0.78)	4.40 (0.90)	
How likely will your future career have a research focus?	3.70 (0.67)	4.33 (0.71)		3.54 (1.01)	3.42 (1.10)	
n	10	9		290	253	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

1.3 REU Participant Feedback

Table 1.3.1 To what degree did you build the following skills during your REU?
(1) Not at all - (5) A great deal

	Your REU Students Mean (SD)	REU Students at Similar Institutions Mean (SD)	Sig.
Programming skills	3.10 (1.20)	3.42 (1.27)	
Other technical skills	3.40 (1.43)	3.64 (1.12)	
Research design	3.10 (1.10)	3.56 (1.15)	
Data collection and analysis	2.80 (1.32)	3.49 (1.23)	
Scientific writing	3.00 (0.82)	3.21 (1.20)	
Career development	3.20 (1.03)	3.34 (1.15)	
Professional communication	3.30 (0.67)	3.69 (1.04)	
Working effectively with a team	2.70 (1.25)	3.53 (1.26)	
n	10	275	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.3.2 To what degree did you learn the following during your REU?
(1) Not at all - (5) A great deal

	Your REU Students Mean (SD)	REU Students at Similar Institutions Mean (SD)	Sig.
How to apply to graduate school	3.70 (1.34)	3.24 (1.25)	
What it's like to be a graduate student	3.60 (1.35)	3.68 (1.15)	
How to prepare a job application	2.70 (0.95)	2.31 (1.13)	
What it's like to have a research career	3.70 (1.34)	3.87 (1.00)	
n	10	275	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.3.3 To what degree did your REU help you develop relationships with each of the following?
(1) Not at all - (5) Very much

	Your REU Students Mean (SD)	REU Students at Similar Institutions Mean (SD)	Sig.
People with whom you can discuss professional development questions.	3.80 (1.14)	3.85 (1.07)	
A strong network of peers to interact with at conferences.	2.90 (0.99)	3.49 (1.22)	
A strong network of mentors to interact with at conferences.	2.90 (1.10)	3.36 (1.21)	
People who would be excited to learn about your professional successes.	3.80 (0.92)	3.70 (1.13)	
People with whom you can discuss issues you are having.	3.30 (0.82)	3.52 (1.20)	
Mentors with whom you can seek advice and assistance in advancing your career.	3.60 (0.84)	3.72 (1.17)	
n	10	272	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.3.4 Overall, how collaborative was your REU experience?
(1) Not at all collaborative - (5) Extremely collaborative

	Your REU Students Mean (SD)	REU Students at Similar Institutions Mean (SD)	Sig.
Overall, how collaborative was your REU experience?	2.90 (1.45)	3.68 (1.17)	
n	10	271	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.3.5 Overall, to what degree did you feel like you were competing with other undergraduates working on the same project or lab during the research process?

	Your REU Students (%)	REU Students at Similar Institutions (%)	Sig.
Not at all	60%	48%	
A little	20%	19%	
A moderate amount	0%	13%	
Quite a bit	10%	3%	
Very much	10%	4%	
Not applicable - I did not work with other students	0%	14%	
n	10	273	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.3.6 Please indicate the extent to which each statement below is true about your experiences with your primary REU mentor or research advisor.
(1) Not at all true - (5) Extremely true

	Your REU Students Mean (SD)	REU Students at Similar Institutions Mean (SD)	Sig.
My REU mentor was accessible when I needed to speak with them	4.30 (0.82)	4.05 (1.07)	
My REU mentor demonstrated professional integrity	4.80 (0.42)	4.42 (0.95)	*
My REU mentor demonstrated content expertise in my research area	4.70 (0.48)	4.36 (0.98)	
My REU mentor was supportive and encouraging	4.70 (0.48)	4.26 (1.04)	*
My REU mentor provided constructive and useful critiques of my work	4.30 (0.67)	4.11 (1.15)	
My REU mentor was helpful in directing and guiding me on research project issues	4.00 (0.94)	3.92 (1.22)	
My REU mentor answered my questions satisfactorily (for example, timely, clearly, comprehensively)	4.30 (0.67)	3.91 (1.23)	
My REU mentor acknowledged my contributions appropriately	4.30 (0.48)	4.24 (1.01)	
My REU mentor challenged me to extend my abilities	4.20 (0.92)	3.98 (1.19)	
n	10	272	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 1.3.7 How dissatisfied or satisfied were you with the following aspects of your REU?
(1) Very dissatisfied - (5) Very satisfied

	Your REU Students Mean (SD)	REU Students at Similar Institutions Mean (SD)	Sig.
Communication about the program	3.67 (0.87)	3.85 (1.15)	
Housing arrangements	4.22 (0.83)	4.11 (1.20)	
Quality of the interactions with the research group	4.44 (0.53)	4.32 (1.00)	
Support and guidance from faculty and mentors involved in the program	4.11 (0.60)	4.09 (1.19)	
Orientation activities	4.22 (0.97)	3.81 (1.12)	
How dissatisfied or satisfied were you with your REU experience overall?	3.78 (0.83)	4.34 (0.93)	
Opportunities for professional development	4.22 (0.97)	3.93 (1.10)	
Support and guidance from other students involved in the program	4.11 (0.78)	4.32 (0.94)	
Your access to the resources you needed to do your research	4.22 (0.67)	4.10 (1.08)	
Group social activities	2.89 (1.62)	3.94 (1.26)	
Stipend	4.22 (0.97)	4.31 (0.92)	
n	9	271	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Chapter 2

Results Compared Based on REU Research Area

2.1 Summary of REU Participants

Table 2.1.1 Do you currently describe yourself as male, female or transgender?

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
Male	60%	58%	
Female	20%	37%	
Transgender	10%	3%	
None of these	10%	3%	
n	10	184	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.1.2 What is your race?
Select all that apply.

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
Arab/Middle Eastern	0%	5%	
Asian/Asian American	45%	31%	
African American/African/Black	9%	13%	
American Indian/Alaska Native	0%	4%	
Native Hawaiian/Pacific Islander	0%	0%	
Caucasian/European/White	45%	56%	
n	11	202	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.1.3 What is your ethnicity?

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
Hispanic/Latino	0%	15%	
Not Hispanic/Latino	100%	85%	
n	11	201	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.1.4 What type of disability do you have?

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
Reported one or more disabilities	18%	21%	
Did not report a disability	82%	79%	
n	11	198	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.1.5 What is the highest level of education attained by any of your parent(s)/guardians?

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
Student is a first-generation college student	91%	78%	
Student is not a first-generation college student	9%	22%	
n	11	201	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.1.6 Participant undergraduate major(s)

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
Declared computing major	91%	74%	
Declared non-computing major	9%	19%	
Undeclared major intending computing	0%	4%	
Undeclared major not intending computing	0%	2%	
n	11	213	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.1.7 In what year do you expect to complete your current program?

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
2022	9%	8%	
2023	27%	38%	
2024	55%	38%	
2025	9%	15%	
Later than 2025	0%	1%	
I am not completing a degree or certificate	0%	0%	
n	11	213	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.1.8 Which of the following reasons best explain your motivations to participate in this REU?
Choose up to 3 responses.

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
To build connections and/or collaborate with particular faculty	0%	7%	
To build connections and/or collaborate with other student researchers	0%	4%	
To increase my competitiveness for graduate school	27%	27%	
To build my confidence as a researcher	9%	7%	
To better understand the connection between research and real world applications	0%	15%	
To expand on what I had been learning about in my classes	18%	22%	
To help pay for my living expenses while in college	0%	3%	
To build work experience and my resume/CV	45%	58%	
To develop or improve my technical skills	9%	37%	
The research project(s) seemed interesting	27%	21%	
To learn more about what being a researcher is like	36%	15%	
To have something to do outside of my coursework	18%	9%	
Other; please specify:	0%	0%	
To have a paid opportunity	9%	16%	
To participate in something prestigious	0%	5%	
To learn more about a specific research area of interest to me	36%	18%	
To learn more about what graduate school might be like	64%	33%	
n	11	212	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

2.2 Pre- and Post-REU Program Results

Table 2.2.1 How true of you are the following statements?
(1) Not at all true - (5) Extremely true

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
I have a strong sense of belonging to the community of scientists.	2.50 (0.97)	3.00 (1.12)		2.86 (1.24)	2.90 (1.22)	
I am a scientist.	2.40 (0.97)	2.78 (1.20)		2.67 (1.20)	2.97 (1.24)	
Being a scientist is an important reflection of who I am.	2.50 (1.18)	3.22 (1.39)		2.87 (1.22)	2.93 (1.34)	
In general, being a scientist is an important part of my self-image.	2.90 (0.88)	3.11 (1.27)		3.05 (1.19)	3.11 (1.25)	
I have come to think of myself as a scientist.	2.20 (1.03)	2.78 (1.39)		2.54 (1.29)	2.87 (1.28)	
n	10	9		189	183	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.2 Please indicate the extent to which you disagree or agree with the following statements:
(1) Strongly disagree - (5) Strongly agree

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
I see myself as a computing person	3.80 (1.03)	3.89 (0.93)		3.94 (1.00)	4.11 (0.93)	
I feel like I belong in computing	3.90 (0.88)	3.89 (1.05)		3.84 (1.04)	3.96 (1.04)	
I feel like an outsider in computing	2.50 (0.97)	2.00 (0.71)		2.59 (1.18)	2.53 (1.27)	
Computing is a big part of who I am	3.20 (0.92)	3.67 (1.00)		3.47 (1.13)	3.68 (1.10)	
I feel welcomed in computing	3.50 (0.71)	3.89 (0.93)		3.71 (1.04)	3.88 (0.98)	
I do not have much in common with the other students in my computing classes	2.80 (0.79)	2.67 (1.22)		2.79 (1.15)	2.69 (1.15)	
n	10	9		189	183	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.3 In your opinion, to what extent are each of the following statements true of you:
(1) Not at all true - (5) Extremely true

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
I can give the impression that I'm more competent than I really am	2.70 (1.25)	2.67 (0.87)		2.98 (1.20)	3.04 (1.24)	
When others praise me for something I have accomplished, I'm afraid I won't be able to live up to their expectations of me in the future	2.70 (1.42)	3.00 (1.50)		3.18 (1.40)	3.10 (1.40)	
At times, I feel my success has been due to some kind of luck	3.00 (1.05)	3.00 (0.71)		3.07 (1.30)	2.97 (1.31)	
I'm disappointed at times in my present accomplishments and think I should have accomplished much more by now	3.70 (0.95)	3.44 (1.13)		3.22 (1.41)	3.07 (1.36)	
n	10	9		187	183	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.4 I am confident that I can...
(1) Strongly disagree - (5) Strongly agree

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
contribute to a research project in computing	4.10 (0.74)	4.44 (0.53)		4.30 (0.74)	4.33 (0.86)	
clearly communicate technical problems and solutions to a range of audiences	3.60 (0.84)	4.00 (0.50)		3.95 (0.86)	4.18 (0.79)	
articulate thoughtful answers to questions about my work during a presentation	3.30 (0.82)	3.78 (0.44)		3.97 (0.87)	4.15 (0.87)	
introduce myself to new peers/colleagues at professional meetings	3.30 (0.95)	3.78 (0.83)		3.95 (1.14)	4.08 (1.05)	
be a capable researcher in computing	3.80 (1.03)	4.33 (0.50)		3.99 (0.87)	4.07 (0.88)	
find employment in an area of computing interest	4.50 (0.71)	4.44 (0.53)		4.08 (0.90)	4.24 (0.86)	
complete an undergraduate degree in computing	4.90 (0.32)	4.78 (0.44)		4.61 (0.79)	4.61 (0.71)	
get admitted to a graduate computing program	4.10 (0.57)	4.44 (0.53)		3.93 (0.97)	4.13 (0.95)	
be successful in a graduate computing program	3.90 (0.88)	4.33 (0.71)		4.01 (0.95)	4.15 (0.94)	
n	10	9		189	182	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.5 How would you rate your current skill level in each of the following?
(1) Poor - (5) Excellent

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
Generating hypotheses	2.80 (0.79)	3.00 (0.71)		3.15 (0.93)	3.30 (0.83)	
Using scientific methods to test a hypothesis	2.90 (0.74)	3.11 (0.93)		3.24 (0.91)	3.46 (0.92)	
Collaborating with colleagues	3.40 (0.97)	3.33 (0.87)		3.85 (0.92)	3.83 (0.99)	
Collecting data or conducting experiments	2.80 (0.92)	3.11 (0.78)		3.36 (0.98)	3.59 (1.00)	
Analyzing data with statistics or other tools	2.90 (1.20)	3.11 (0.60)		3.18 (1.06)	3.46 (1.03)	
Summarizing published research results	2.70 (1.06)	3.00 (0.87)		2.98 (1.06)	3.42 (1.04)	*
Explaining research results	2.80 (0.92)	3.11 (0.78)		3.20 (1.00)	3.66 (1.03)	*
Writing or co-authoring a research paper or report	2.30 (0.67)	2.56 (0.73)		2.66 (1.08)	3.16 (1.14)	*
Presenting a research paper or report	2.70 (0.48)	3.22 (0.83)		2.96 (1.09)	3.58 (1.12)	*
Publishing a research paper or report	1.60 (0.84)	2.67 (1.22)	*	2.09 (1.00)	2.85 (1.13)	*
n	10	9		190	183	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.6 Please rate the degree of your proficiency (how skilled you are) in the following items
(1) Highly deficient - (5) Highly proficient

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
Building/maintaining a professional network	2.70 (0.67)	3.11 (0.78)		3.23 (1.01)	3.53 (0.94)	*
Dealing with conflict	3.30 (0.82)	3.22 (0.67)		3.81 (0.84)	3.76 (0.89)	
Providing constructive feedback	3.50 (0.71)	3.33 (0.50)		3.85 (0.78)	3.87 (0.83)	
Time management	3.70 (1.34)	4.00 (1.32)		3.70 (0.99)	3.83 (1.00)	
Speaking clearly and effectively	3.50 (0.53)	3.56 (0.73)		3.63 (0.94)	3.84 (0.98)	
Presenting research	3.20 (0.63)	3.67 (0.71)		3.47 (0.87)	3.92 (0.86)	*
Planning and organizing projects	3.50 (0.97)	3.56 (1.01)		3.81 (0.85)	3.89 (0.87)	
Writing scientific papers	2.60 (0.70)	3.33 (0.71)	*	3.23 (0.95)	3.43 (0.94)	
Identifying career options	3.40 (1.07)	3.33 (1.00)		3.50 (0.89)	3.60 (0.96)	
Preparing graduate school application materials	2.60 (0.97)	3.00 (1.00)		2.77 (0.99)	3.20 (1.03)	*
Identifying graduate school options	2.30 (0.95)	3.00 (0.71)		2.80 (1.00)	3.31 (1.03)	*
n	10	9		188	183	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.7 How much do you feel you know about the following?
(1) Nothing - (5) A lot

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
What to look for in a graduate research advisor	1.50 (0.71)	2.67 (0.87)	*	2.30 (1.07)	3.22 (1.03)	*
The research areas you would pursue in graduate school	2.60 (1.07)	2.89 (0.78)		2.59 (1.12)	3.20 (1.03)	*
What graduate admissions committees look for in an applicant	2.00 (1.05)	2.89 (1.05)		2.24 (1.08)	3.08 (1.08)	*
How to choose graduate programs that are a good fit for you	1.70 (0.82)	2.44 (0.88)		2.26 (1.09)	3.02 (1.11)	*
What being a graduate student would be like	2.00 (0.67)	3.00 (0.87)	*	2.34 (1.05)	3.45 (1.02)	*
Career options in computing	3.20 (0.63)	3.67 (0.71)		3.15 (0.92)	3.50 (0.95)	*
Career options in research	2.40 (0.97)	3.44 (1.01)	*	2.48 (1.00)	3.18 (1.00)	*
What it would be like to work in academia	2.60 (1.07)	3.33 (1.00)		2.66 (1.07)	3.21 (1.04)	*
n	10	9		186	178	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.8 To what extent do you have a mentor who...
(1) Not at all - (5) Very much

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
helps you improve your computing skills	2.40 (1.65)	3.44 (1.01)		2.57 (1.36)	3.16 (1.32)	*
helps you improve your research skills?	2.30 (1.57)	3.44 (0.88)		2.52 (1.39)	3.43 (1.25)	*
helps you identify or develop your research interests?	2.40 (1.35)	3.22 (1.09)		2.54 (1.33)	3.22 (1.32)	*
gives you insight into what graduate school is like?	2.20 (1.23)	3.11 (0.60)		2.39 (1.33)	3.32 (1.26)	*
provides information or advice about applying for graduate school?	2.30 (1.06)	3.11 (0.60)		2.38 (1.33)	3.23 (1.22)	*
shows compassion for any issues you discussed with them	2.90 (1.45)	3.33 (1.12)		3.21 (1.39)	3.53 (1.21)	
shares personal experiences as an alternative perspective to your problem	2.70 (1.42)	3.33 (1.12)		2.82 (1.42)	3.19 (1.27)	
explores career options with you	2.10 (1.10)	3.11 (0.93)	*	2.54 (1.27)	2.95 (1.27)	*
encourages you to do the best you can in your coursework	3.20 (1.55)	3.56 (1.24)		3.31 (1.41)	3.62 (1.25)	
supports your research ideas	2.50 (1.43)	2.89 (0.78)		2.76 (1.42)	3.31 (1.21)	*
provides constructive feedback	2.90 (1.29)	3.11 (0.78)		3.16 (1.38)	3.63 (1.14)	*
n	10	9		187	180	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.9 To what extent is each of the following available to you at this point?
(1) Not at all - (5) Very much

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
People with whom you can ask questions related to your professional development	3.20 (1.03)	3.78 (1.09)		3.33 (1.14)	3.68 (1.05)	*
People with whom you can discuss graduate school opportunities	3.20 (1.23)	3.89 (1.05)		3.11 (1.20)	3.59 (1.14)	*
A strong network of peers to interact with at conferences	2.20 (1.03)	2.44 (0.53)		2.37 (1.20)	2.99 (1.21)	*
A strong network of mentors to interact with at conferences	1.70 (0.82)	2.56 (0.88)	*	2.17 (1.15)	2.93 (1.24)	*
People who would be excited to learn about your professional successes	2.90 (0.57)	3.44 (0.73)		3.40 (1.17)	3.78 (0.95)	*
People with whom you can discuss issues you are having	2.90 (0.57)	3.56 (0.73)	*	3.27 (1.14)	3.52 (1.10)	
n	10	9		188	180	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.10 What is your current level of interest in the following?
(1) Not at all interested - (5) Extremely interested

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
Conducting research as an undergraduate	4.20 (0.79)	3.89 (0.93)		4.11 (0.89)	3.63 (1.20)	*
Conducting research as a graduate student	3.90 (1.10)	4.00 (1.00)		3.61 (1.25)	3.28 (1.34)	
Learning more about computing	4.40 (0.84)	4.56 (0.73)		4.47 (0.81)	4.29 (0.96)	
Pursuing a research career	3.00 (1.25)	4.00 (1.12)		3.10 (1.30)	2.99 (1.37)	
Pursuing a non-research career	2.90 (1.20)	3.11 (0.78)		3.61 (1.04)	3.81 (0.99)	
Mentoring others on a future formal research project	2.70 (1.25)	2.78 (0.83)		3.02 (1.25)	2.82 (1.31)	
n	10	9		186	177	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.11 How likely is it that you will enroll in a ...
(1) Not at all likely - (5) Extremely likely

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
How likely is it that you will enroll in a terminal master's program in a computing field?	2.80 (1.23)	2.44 (0.73)		2.65 (1.20)	2.98 (1.22)	
How likely is it that you will enroll in a doctoral program in a computing field?	3.00 (1.41)	3.56 (1.33)		2.52 (1.30)	2.56 (1.35)	
n	10	9		186	178	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.12 What is the highest degree you plan to attain?

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 (%)	Time 2 (%)	Sig.	Time 1 (%)	Time 2 (%)	Sig.
High school degree	0%	0%		0%	0%	
Technical certificate	0%	0%		1%	0%	
Associate's degree	0%	0%		1%	0%	
Bachelor's degree	10%	0%		21%	18%	
Graduate certificate	10%	0%		2%	3%	
Master's degree	10%	11%		28%	38%	
Doctoral degree	70%	89%		49%	41%	
n	10	9		187	178	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.13 In which field do you intend to earn your highest degree?
Choose up to 2 responses.

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 (%)	Time 2 (%)	Sig.	Time 1 (%)	Time 2 (%)	Sig.
Another field	0%	0%		5%	3%	
An arts and humanities field	0%	0%		2%	3%	
Bioinformatics/Computational biology	0%	0%		4%	4%	
A biological science field	0%	0%		5%	1%	
A business field	0%	0%		4%	5%	
Computer Information Systems/Informatics	0%	0%		2%	2%	
Computing and Business	0%	0%		0%	0%	
Computer Engineering	0%	11%		6%	6%	
Other computing and technology field	0%	0%		4%	3%	
Computer Science	90%	78%		66%	66%	
Data Science	30%	33%		12%	17%	
Electrical and Computer Engineering (ECE)	0%	0%		3%	5%	
An education field	0%	0%		2%	2%	
Electrical Engineering and Computer Science (EECS)	0%	0%		5%	4%	
Other engineering field	0%	0%		5%	6%	
Game Design	0%	0%		4%	1%	
Information Technology	0%	0%		2%	3%	
A mathematics field	30%	22%		13%	10%	
A physical sciences field	0%	0%		5%	3%	
A professional field	0%	0%		1%	2%	
Software Engineering	0%	11%		6%	14%	
A social science field	20%	22%		5%	4%	
n	10	9		187	176	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.14 How interested are you in having the types of jobs listed below?
(1) Very uninterested - (5) Very interested

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
College or university professor in computing field (teaching focused)	3.10 (1.37)	3.56 (1.01)		2.78 (1.38)	2.63 (1.37)	
College or university professor in computing field (research focused)	3.60 (1.51)	4.11 (1.27)		2.94 (1.37)	2.79 (1.36)	
K-12 computing teacher	1.90 (1.37)	2.44 (1.74)		1.99 (1.15)	2.06 (1.24)	
Computing researcher in industry	3.40 (0.84)	3.89 (0.78)		3.51 (1.11)	3.53 (1.20)	
Computing researcher in a government lab or agency	3.20 (1.03)	3.78 (0.97)		3.33 (1.24)	3.23 (1.32)	
A non-research computing position in industry (e.g., software engineer)	3.10 (1.52)	3.00 (1.66)		3.74 (1.28)	3.85 (1.26)	
A non-research computing position in government	2.70 (1.34)	2.44 (1.42)		3.10 (1.32)	3.21 (1.33)	
Entrepreneur (computing related; e.g., individual contractor, build a start-up)	2.80 (1.14)	2.89 (1.45)		3.14 (1.36)	3.29 (1.42)	
Non-computing career	1.90 (0.88)	2.33 (1.00)		2.62 (1.31)	2.77 (1.26)	
n	10	9		186	176	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.15 For your future career, in which setting would you like to work the most?

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 (%)	Time 2 (%)	Sig.	Time 1 (%)	Time 2 (%)	Sig.
Academia	50%	56%		22%	16%	
Industry	20%	22%		56%	58%	
Government (includes national labs)	10%	0%		10%	11%	
Self-employment	10%	22%		7%	14%	
Something else	10%	0%		5%	1%	
n	10	9		187	176	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

Table 2.2.16 How likely will your future career have a...
(1) Extremely unlikely - (5) Extremely likely

	Your REU Students			REU Students in Similar Research Areas		
	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.	Time 1 Mean (SD)	Time 2 Mean (SD)	Sig.
How likely will your future career have a computing-related focus?	4.60 (0.70)	4.89 (0.33)		4.41 (0.88)	4.45 (0.81)	
How likely will your future career have a research focus?	3.70 (0.67)	4.33 (0.71)		3.50 (1.00)	3.36 (1.15)	
n	10	9		187	175	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$, (N/A) $n < 5$ or test criteria were not met

2.3 REU Participant Feedback

Table 2.3.1 To what degree did you build the following skills during your REU?
(1) Not at all - (5) A great deal

	Your REU Students Mean (SD)	REU Students in Similar Research Areas Mean (SD)	Sig.
Programming skills	3.10 (1.20)	3.45 (1.21)	
Other technical skills	3.40 (1.43)	3.61 (1.11)	
Research design	3.10 (1.10)	3.56 (1.15)	
Data collection and analysis	2.80 (1.32)	3.49 (1.22)	
Scientific writing	3.00 (0.82)	3.23 (1.20)	
Career development	3.20 (1.03)	3.30 (1.16)	
Professional communication	3.30 (0.67)	3.67 (1.07)	
Working effectively with a team	2.70 (1.25)	3.44 (1.32)	
n	10	188	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.3.2 To what degree did you learn the following during your REU?
(1) Not at all - (5) A great deal

	Your REU Students Mean (SD)	REU Students in Similar Research Areas Mean (SD)	Sig.
How to apply to graduate school	3.70 (1.34)	3.14 (1.30)	
What it's like to be a graduate student	3.60 (1.35)	3.58 (1.23)	
How to prepare a job application	2.70 (0.95)	2.41 (1.22)	
What it's like to have a research career	3.70 (1.34)	3.74 (1.10)	
n	10	188	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.3.3 To what degree did your REU help you develop relationships with each of the following?
(1) Not at all - (5) Very much

	Your REU Students Mean (SD)	REU Students in Similar Research Areas Mean (SD)	Sig.
People with whom you can discuss professional development questions.	3.80 (1.14)	3.79 (1.10)	
A strong network of peers to interact with at conferences.	2.90 (0.99)	3.46 (1.22)	
A strong network of mentors to interact with at conferences.	2.90 (1.10)	3.32 (1.21)	
People who would be excited to learn about your professional successes.	3.80 (0.92)	3.63 (1.14)	
People with whom you can discuss issues you are having.	3.30 (0.82)	3.39 (1.21)	
Mentors with whom you can seek advice and assistance in advancing your career.	3.60 (0.84)	3.62 (1.22)	
n	10	185	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.3.4 Overall, how collaborative was your REU experience?
(1) Not at all collaborative - (5) Extremely collaborative

	Your REU Students Mean (SD)	REU Students in Similar Research Areas Mean (SD)	Sig.
Overall, how collaborative was your REU experience?	2.90 (1.45)	3.65 (1.19)	
n	10	185	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.3.5 Overall, to what degree did you feel like you were competing with other undergraduates working on the same project or lab during the research process?

	Your REU Students (%)	REU Students in Similar Research Areas (%)	Sig.
Not at all	60%	43%	
A little	20%	20%	
A moderate amount	0%	17%	
Quite a bit	10%	4%	
Very much	10%	6%	
Not applicable - I did not work with other students	0%	10%	
n	10	186	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.3.6 Please indicate the extent to which each statement below is true about your experiences with your primary REU mentor or research advisor.
(1) Not at all true - (5) Extremely true

	Your REU Students Mean (SD)	REU Students in Similar Research Areas Mean (SD)	Sig.
My REU mentor was accessible when I needed to speak with them	4.30 (0.82)	3.98 (1.12)	
My REU mentor demonstrated professional integrity	4.80 (0.42)	4.40 (0.91)	*
My REU mentor demonstrated content expertise in my research area	4.70 (0.48)	4.32 (0.96)	*
My REU mentor was supportive and encouraging	4.70 (0.48)	4.17 (1.07)	*
My REU mentor provided constructive and useful critiques of my work	4.30 (0.67)	4.01 (1.19)	
My REU mentor was helpful in directing and guiding me on research project issues	4.00 (0.94)	3.85 (1.22)	
My REU mentor answered my questions satisfactorily (for example, timely, clearly, comprehensively)	4.30 (0.67)	3.80 (1.24)	
My REU mentor acknowledged my contributions appropriately	4.30 (0.48)	4.11 (1.03)	
My REU mentor challenged me to extend my abilities	4.20 (0.92)	4.02 (1.13)	
n	10	186	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

Table 2.3.7 How dissatisfied or satisfied were you with the following aspects of your REU?
(1) Very dissatisfied - (5) Very satisfied

	Your REU Students Mean (SD)	REU Students in Similar Research Areas Mean (SD)	Sig.
Communication about the program	3.67 (0.87)	3.72 (1.17)	
Housing arrangements	4.22 (0.83)	4.04 (1.23)	
Quality of the interactions with the research group	4.44 (0.53)	4.25 (0.98)	
Support and guidance from faculty and mentors involved in the program	4.11 (0.60)	4.01 (1.20)	
Orientation activities	4.22 (0.97)	3.83 (1.13)	
How dissatisfied or satisfied were you with your REU experience overall?	3.78 (0.83)	4.21 (1.01)	
Opportunities for professional development	4.22 (0.97)	3.81 (1.12)	
Support and guidance from other students involved in the program	4.11 (0.78)	4.29 (0.91)	
Your access to the resources you needed to do your research	4.22 (0.67)	3.98 (1.11)	
Group social activities	2.89 (1.62)	3.96 (1.24)	
Stipend	4.22 (0.97)	4.26 (0.85)	
n	9	184	

(*) $p \leq .05$ and Cohen's d or $h \geq .30$; (N/A) $n < 5$ or test criteria were not met

APPENDIX

Statistical significance

For each statistical test in this report, statistical significance is determined using a two-step process. First, we assessed whether group differences meet the conventional $p \leq .05$ threshold for inferential statistics. Then, if the $p \leq .05$ threshold was met, we observed the effect size for the two-group comparison using Cohen's d for the independent samples t tests and Cohen's h for the two-proportion z tests. According to Cohen (1988) [1], the magnitude of effect sizes indicate the following: .10 - .29 is a small effect, .30 - .49 is a medium effect, and .50 or greater is a large effect; values less than .10 are considered inconsequential. In the current report, group comparisons are only deemed "significant" if they reach the $p \leq .05$ threshold, and their effect size is $\geq .30$ (indicating an effect size of "medium" or greater).

We opted to use a two-step method to test for significant effects so that we could control for unequal sample sizes. This is because large sample sizes tend to yield group differences that easily meet the $p \leq .05$ threshold, but have small effect sizes. On the other hand, it is relatively more difficult to detect a significant effect when sample sizes are small. Thus, our two-step strategy required that a group comparison meet the $p \leq .05$ threshold, and for that effect to be at least medium in size.

Statistical tests were not run if sample size was too small, $n < 5$.

[1] Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Lawrence Earlbaum Associates.