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Factors Associated With Student Decision-Making for Participation in the Research Experiences for Undergraduates Program*

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In the United States of America, the federally funded National Science Foundation (NSF) makes significant investments in exposing undergraduate students to academic research in engineering and science through its Research Experience for Undergraduates (REU) program. REU grants provide individual faculty members (and teams of faculty) across the USA with funds to conduct program sites, which generally occur during the summer months and are thematically organized around a specific area of research. These faculty administrators are not only responsible for providing a high quality research experience to participants, but are also focused on successfully recruiting a diverse pool of applicants and ensuring acceptances from highly competitive participants. This study examines how applicants view the importance of programmatic and application factors. With a goal to provide practical implications for program administrators and others interested in promoting undergraduate research participation, this study primarily considered items identified as controllable by the site directors/administrators to improve recruitment efforts. This study also considered some additional factors, such as the geography of programs to which applications are submitted, that could potentially give insight into how students are choosing programs. An online survey was created and distributed to current program participants by participating research site administrators at 34 American institutions yielding 129 complete responses. Initial results confirmed that most applicants seek positions within an array of sites encompassing a broad area (median values: three applications and 763 miles from home). Analysis of participants' responses showed that 34% were offered multiple positions and 17% of respondents declined another employment offer before accepting their current position. The primary factors that student applicants consider important for impacting their selections were (1) focus of the research project, (2) stipend or compensation, and (3) the date they receive their acceptance and offer. The first factor aligns with previous findings, but the second and third factors demonstrate how the program administrator can influence the selection, which has not been previously observed.

Keywords: research experiences for undergraduates; undergraduate research; student decision-making; summer programs

1. Introduction

Participation in research during the process of undergraduate education in science, technology, engineering, and mathematics (STEM) disciplines has been shown to boost both the retention of students to technical careers as well as graduate studies in STEM fields [1, 2]. Student participation in research has been shown to promote the development of scientific research identity for undergraduates (i.e. becoming a scientist/researcher) [3], and also helps students confirm or realize graduate education aspirations [4, 5]. As a result, significant funding is being allocated for undergraduate research programs with that expectation; one such example is the Research Experience for Undergraduates (REU) program funded by the National Science Foundation (NSF) [6]. At the time of writing, a total of 626 active NSF REU site grants accounted for over 180 million dollars in total research funding [7]. According to the historian of the NSF, funding for undergraduate research has been longstanding; the NSF REU programs originated in 1987 with over 600 proposals resulting in 142 awards in the inaugural year (M. Rothenberg, personal communication, January 16, 2014). The NSF currently awards two types of grants to fund undergraduate research: REU sites and supplements. An REU site is a program that engages a number of undergraduates in research tied to a

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central theme; while an REU supplement includes funds to hire one or more undergraduates in conjunction with research on a specific ongoing NSF-funded research project. The NSF REU program itself was predated by the Undergraduate Research Participation Program sponsored by NSF which ran from 1958 until 1982 (M. Rothenberg, personal communication, January 16, 2014).

The benefits of participating in and funding undergraduate research have been previously established [1, 3, 5]. As a result, many programs have sought to utilize undergraduate research to promote retention of underrepresented groups through their deliberate inclusion [8, 9] (defined for STEM as women, select ethnic minorities (Black, Hispanic, and Native American), and those with disabilities as determined by NSF [10]). Also, many administrators have sought to validate their programatic choices and impact through evaluations of the programs that they develop and oversee [11]. Using these previous studies as a backdrop for the importance of involvement in research, this work seeks to establish the primary actions that current and potential undergraduate research advisors and administrators should take when developing, promoting, and carrying out their research programs.

Initial studies of NSF REU site programs have sought to understand the factors that motivate undergraduate students to apply for and select individual sites [12]. Although a previous report identified some influencing factors for participation in an undergraduate research program [12], more work is needed to identify: *(1) the major factors associated with students' selection of individual research programs, (2) if additional factors, such as geography, are significant for impacting site selection, and (3) how undergraduate research advisors and administrators can maximize the impact of their program.* In this study, participants within NSF REU sites at 34 different institutions during the summer of 2013 were surveyed to help elucidate these aims.

2. Background

Prior research studies have focused on characterizing participant outcomes and benefits of participation in undergraduate research programs. These outcomes include students' individual development [3], career clarification and increases in social capital [4, 5]. The benefits are not limited to the undergraduates themselves, as studies have identified positive development of the research mentors [11], graduate students, and post-doctoral researchers [13]. The existing body of literature on administering undergraduate research programs is largely anecdotal [11] and admittedly limited, due to self-selection [9] and small sample sizes [4]. However, studies have specifically sought to combat the limitations by employing ethnographies [5], assessment by alumni well after participation in research (multiple years) [6], and wide surveying [1, 12].

Specific gains frequently noted by student participants include development of communication skills (oral and written) [5, 6], which was further bolstered if participants had a chance to disseminate their research via posters, conference presentations, or journal articles. Additionally, these experiences helped students to further develop their ability to communicate their work, a necessity in STEM fields [14]. Students noted that through their participation in research they were able to develop research identities and were able to determine "whether [they] belong" in STEM fields [5]. Additionally, it was noted that the research experiences frequently offered undergraduates a chance to clarify possible career options [4, 5, 9, 15]. Students have noted that they were using the experience as a chance to "test the waters" for graduate school, as many undergraduates perceive a research program as being similar to the expected graduate school environment [12, 15]. It was observed that this career clarification could be either positive or negative, as some students pre-existing choices were confirmed or promoted (developing interest in an academic career), while others saw the program as reason to decide *not* to pursue a research career [5]. It was also noted that student gains from participation in research were often limited to those in which the undergraduate student felt that their project was a "good fit" for them [6]. In order to ensure that student gains are maximized, careful integration of the undergraduate student into the research environment is needed. Students should be included into the design and planning stages [6] to avoid the unfortunate stereotype of being relegated to "only pushing buttons" and washing laboratory glassware as their primary contribution [5].

However with the breadth of work that has been devoted to assessing impact of these research programs, few studies have looked at how and why students select to participate in research. This is of ultimate importance considering the self-selection issues that have been noted in many undergraduate research studies [5]. As these programs have been shown to benefit students' development and help foster the research identities [5] and social capital [4] that are necessary for success in STEM graduate fields, understanding the process of recruitment into these research programs is essential. A previous study highlighted factors that influence a student's participation in a research program (Table 1) [12], showing that many factors are in play when students are deciding whether to participate in a research

Table 1. Excerpt of factors that an undergraduate research administrator can conceivably impact as revealed by an earlier report [12]. Students consider the research project itself to be most important factor when choosing to participate in undergraduate research

Program Aspect	Mean (1–4)
Project Sounded Interesting	3.3
Personal Interaction with Faculty	2.8
Living Arrangements	2.8
Stipend & Housing/Meal Package	2.6
Social/Cultural Activities	2.4
Close to Home	2.2
First Acceptance	2.2
Recommendation from Others	2.1
Far from Home	1.6

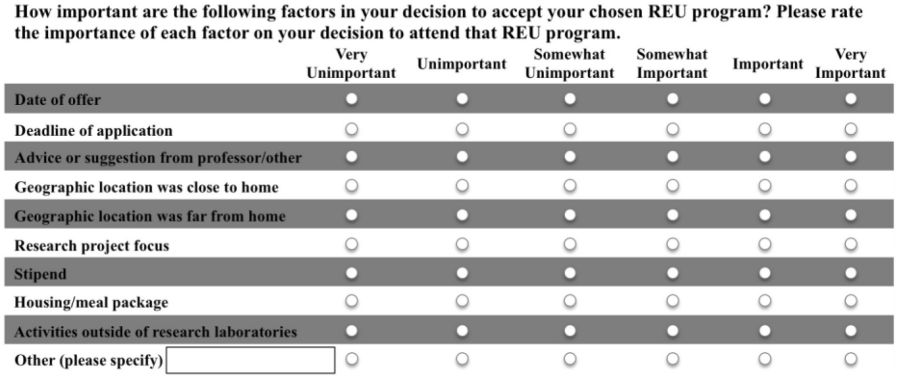
program as an undergraduate. The factors presented are an excerpt of those identified by the earlier report highlighting those that the program administrator could conceivably control (research project assignments, accommodations, primary intended audience from promotions, etc.).

This work further bolsters the gains observed from participation in undergraduate research as students expect to be able to use the experience as a chance to ascertain if research is a "good fit" for them personally [12]. However, to the authors' knowledge, no other researchers have attempted to examine which factors students consider important when choosing between various summer research options. In our earlier work, we began to explore how students select research programs [16]; however, small sample size limited our ability to draw strong conclusions about the data that was collected. Our preliminary results highlighted the importance of understanding the application patterns of students applying to research programs and the factors they considered important; therefore further study was warranted [16]. Furthermore, we reported that students who participate in an REU site often applied to multiple sites, and may receive multiple offers from the various sites to which they applied [16]. This highlights that in order to yield a diverse pool of participants; a diverse method of recruitment may be required. Thus, understanding the factors involved during the students' decision-making process is of paramount importance to those in academia who both administrate these types of programs as well as anyone considering involvement in promoting undergraduate research. Therefore, this work aims to not only understand the factors that influence students to participate in a summer research program, but specifically focuses on factors that influence students' decisions to accept an offer to participate in one particular opportunity over another. In order to elucidate the student decision-making process for summer research selection, the following research questions were developed: *(1) What do students participating in research programs report as being the most important programmatic factors affecting their choice of a specific research program? (2) Do statistically significant differences exist in participants' responses regarding important programmatic factors based on student demographics and characteristics of the research institution? And (3) What do application patterns of undergraduate researchers reveal about the student decision-making process for research programs and how do additional factors such as offers of employment, offer timing, and willingness to travel from their home institution influence this process?*

3. Methodology

3.1 Data collection

Our instrument was based on a refinement of a preliminary study published elsewhere [16]. Grounded with those observations and results, a modified instrument was developed to be able to better compare various factors and improve internal consistency. The final instrument involved demographic items (applicant sex, race/ethnicity, hometown postal code, home institution, class standing, major, and whether or not the student transferred from another institution). In addition, other items characterized the application behavior of respondents (total applications submitted for summer positions, the number of those applications sent to various types of summer employment, the geographic location those applications were submitted to, and the final offer accepted). Additionally, the instrument included six-point Likert-like items for respondents to rate the importance of various factors involved in selecting their current program (Fig. 1). Finally, respondents were asked to detail their future academic and professional plans, including if they expected to enroll in graduate school, their intended terminal degree, and the type of job they hope to obtain upon finishing their education. The factors included in the final instrument were chosen based on prior instruments used to gauge why students chose to participate in research [12] modified to focus on factors that could conceivably be affected by site administrators (or how they choose to promote their site), as well as further refined by the previous study [16]. As an incentive, students were offered a chance to be entered into a raffle for two $50 Amazon.com cards, which were emailed to the recipients following a blinded randomized drawing. Feedback was solicited from participants at REU programs located across 34 different institutions. The online survey (SurveyMonkey) was distributed on a voluntary basis via email to the participants through their


How important are the following factors in your decision to accept your chosen REU program? Please rate the importance of each factor on your decision to attend that REU program.

	Very Unimportant	Unimportant	Somewhat Unimportant	Somewhat Important	Important	Very Important
Date of offer	●	●	●	●	●	●
Deadline of application	○	○	○	○	○	○
Advice or suggestion from professor/other	●	●	●	●	●	●
Geographic location was close to home	○	○	○	○	○	○
Geographic location was far from home	●	●	●	●	●	●
Research project focus	○	○	○	○	○	○
Stipend	●	●	●	●	●	●
Housing/meal package	○	○	○	○	○	○
Activities outside of research laboratories	●	●	●	●	●	●
Other (please specify)	○	○	○	○	○	○

Fig. 1. Example of item used to determine student importance of various decision factors when choosing their research program.

site administrators. The data collection instrument for this study was approved by Clemson University's Institutional Review Board prior to administration.

3.2 Sample

From the survey administration, 129 complete responses were received representing 34 institutions hosting REU programs. At the time of writing, a total of 626 active grants funded these programs, with some institutions hosting multiple sites [7]. General sample demographics are presented in Table 2. The sample represented 63% Caucasian/White students, 9% African American/Black students, 9% Asian/Pacific Islanders, 9% Multiracial students, 5% Hispanic/Latino/Chicanos, 1% American Indians, and 4% that did not disclose their race or ethnicity. A majority of the sample (57%) identified with an underrepresented group (female or an ethnic minority).

Based on classifications by the Carnegie Foundation for the Advancement of Teaching [17] 49% of responding students were obtaining their current degree (home institution) from RU-VH institutions (Research University—Very High Research Activity), 19% attended RU-H institutions (Research University—High Research Activity), and 32% came from other institutions (17% Master's Colleges and Universities, 9% Baccalaureate Colleges, 4% Special Focus Institutions, and 2% Doctoral Research Universities). Classifying the institutions that were hosting the REU programs yielded similar results: 57% of students that responded were attending an REU program at a RU-VH institution, 34% at a RU-H institution, and 9% at another institution (including special focus institutions with a school of engineering (SFI-Eng.) and those with the highest graduate degree awarded being a Master's). Seventeen percent of respondents turned down an offer before accepting their final REU selection. Also, 8% of respondents indicated that they had transferred to their current institution while completing their undergraduate degree (compared with the national average of approximately one third according to National Association of College Admission Counseling [18]).

Table 2. Survey sample demographics. A total of 129 complete responses were received from undergraduate students currently participating in an REU program; of particular note is that 34% of students indicated that they were accepted into more than one research program

Sample Demographics $N = 129$	***n* (%)**
Sex	
Male	63 (49)
Female	66 (51)
Class Standing	
Underclassman	11 (9)
Junior	39 (30)
Senior	79 (61)
Offers Received	
Single	85 (66)
Multiple	44 (34)

3.3 Data analysis

Once results were collected, responses were stripped of any potential identifying information and specific institutional references were converted to classifications as determined by the Carnegie Foundation for the Advancement of Teaching [17] and postal codes for anonymity. Incomplete responses were removed prior to further analysis. Mean values were calculated for the Likert-like items by coding the responses to numerical analogs with one corresponding to the most negative value (very unimportant) and six corresponding to the most positive value (very important). Data processing was performed in Microsoft Excel for Mac 2011, and data analysis was performed primarily in IBM SPSS Statistics Ver. 21 with some additional analysis using R (Ver. 3.0.2). Data were examined graphi-

cally to visually determine normality of Likert-like items, which were observed to exhibit non-normal behaviors. As a result, non-parametric tests were chosen to evaluate associations between various demographics (e.g., sex, class-standing, number of offers received) and decision factors (e.g., research project focus) using the Wilcoxon Rank Sum test for factors with two groups (e.g., sex), or the Kruskal-Wallis test for factors with multiple groups (e.g., class-standing). Open coding was used to group open-ended responses, which were typically in the form of short two to four word phrases. Distances between students' homes, home institutions, and summer programs were found by using Google Maps to find shortest driving route between postal codes noted in survey.

4. Findings

4.1 Research Question 1: Importance of programmatic factors

Based on comparison of mean importance values of the factors included in the survey, students consider research project focus to be the most important factor (mean = 5.16). Stipend amount and date of offer were listed as being the second and third most important factors respectively with the full range of factors presented below (mean = 4.92 and mean = 4.54, respectively; Table 3).

The results shown in Table 3 are directly corroborated by the survey items that followed, which asked students to list the factors that they considered to be in their ''top three'' of importance. Of the students, 81% listed research project focus, 67% listed stipend, and 39% listed date of offer in their top three. When students were asked to name the factor that was least important, 20% listed that the geographic location of the program was ''close to home'' was not important. Further, 17% listed deadline of application, and 17% listed activities outside of research laboratories as the least important factors. Additionally, no students responded that research project focus was the least important factor, the only factor to receive no responses in a particular section.

Table 3. Mean values of selection factors based on Likert-like responses (1: Very Unimportant to 6: Very Important) showing that research project focus, stipend, and date of offer were considered to be the most important factors in selecting the program that they attended.

Aspect	Mean (1-6)
Project focus	5.16
Stipend	4.92
Date of offer	4.54
Housing/meal package	4.41
Advice	4.23
Activities	3.85
Deadline of application	3.71
Far from home	2.96
Close to home	2.95

When these results were compared with those previously identified [12], we observed similar responses. In both instances respondents considered the project assignment itself to be the most important factor. Additionally, activities outside of labs and being far away from home received similar importance, which did not rank highly overall. The importance pertaining to being close to home, the date of acceptance, and advice from others did vary when compared to the earlier study. Also, during the development of our data collection instrument, it was decided to make stipend and housing & meal packages individual items, as it is possible that students do not consider these aspects to be synonymous, which appears to be the case. It was observed that housing & meal package received a similar response to the earlier study but stipend rose to being the second most important factor. It is important to note that direct comparison of the two scales is not ideal, as the previous study did not utilize a symmetric Likert-like response [12].

4.2 Research Question 2: Responses regarding programmatic factors based on demographics and institutional characteristics

To examine correlations between various demographics and categories, Wilcoxon Rank Sum and Kruskal-Wallis tests were used to identify significant differences (Table 4). It was observed that when broken down by student sex, female students placed greater importance on the geographic location of the program being far away from their homes, as well as the housing/meal package and activities outside of the laboratories. Students who received multiple research offers placed more importance on the activities offered outside of the labs as well as the site being located far away from home than students who received a single offer. Correspondingly, the students receiving multiple offers considered the close proximity of the site to their home to be less important than those that received a single offer. When comparing the responses based on Carnegie classifications of the institution hosting the program they attended, there were significant differences of importance given to application deadline. It is possible that institutions with more research-intensive classifications were more attractive due to their reputation and more students applied to their programs regardless of deadlines imposed. Table 4 contains an excerpt of the results from statistical testing to highlight those factors with significant differences. Factors that received unanimous importance across all demographic and categorical groups included research project focus, stipend,

Table 4. Wilocoxon Rank Sum and Kruskal-Wallis tests were used to assess the responses of students broken down by various demographics and categories. It was seen that the number of offers received, race/ethnicity, REU classification, and student sex correlated with different emphasis on various factors. Note: Mean values reported on a 1–6 Likert like scale, $*p < 0.05$, $**p < 0.01$

Demographic/Category	Application deadline	Close to home	Far from home	Housing & meal package	Activities outside of labs
By Sex					
Female ($n = 63$)	3.70	2.83	3.37**	4.79**	4.25**
Male ($n = 66$)	3.73	3.06	2.58**	4.05**	3.46**
By # of offers received					
One ($n = 85$)	3.84	3.16*	2.76*	4.26	3.66*
More Than One ($n = 44$)	3.48	2.52*	3.34*	4.70	4.23*
By REU Classification					
RU-VH ($n = 74$)	3.59*	3.14	3.18	4.65	3.91
RU-H ($n = 44$)	3.86*	2.75	2.59	4.02	3.49
Other ($n = 11$)	3.91*	2.45	3.00	4.36	4.91

date of offer, and advice from others. Additionally, various demographic groups were examined that showed no significant associations; these included student major, transfer status, class standing, and classification of students' home institution. Small sample sizes limited statistical testing from being conducted for the race/ethnicity variable.

4.3 Research Question 3: Student application patterns

In addition to understanding the factors that students consider important when deciding the summer opportunities in which they will participate, looking at the applications that they submit also can help elucidate their decision making process. The survey included items to ascertain the programs and job opportunities to which they applied, how many applications were submitted to NSF REU programs, summer research that was not affiliated with an NSF REU specifically, and internships. Students were also asked to describe any opportunities the student applied to that did not fit into one of those categories. Various other employment options included clerical work at the student's home institution, counselor at summer camps, military training, part-time job at home, among others. Student respondents were primarily focused on attending REU programs (Figs 2 and 3). Fig. 2 illustrates the number of applications each student submitted to NSF REU programs with the largest group of responses indicating that students were responding to many research programs (74% applied to more than one). Additionally, the second largest group of responses is from students that applied to a single research program. Some students indicated that they did not apply to a research program; we understood this to mean that they were accepted into their REU program without having to submit an application and were instead offered positions through their connections or contacts. With the prevalence of students applying to

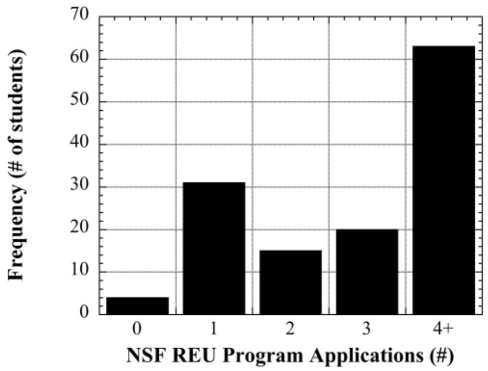


Fig. 2. Number of applications per student submitted to NSF REU programs. Most students indicated that they applied to four or more similar programs.

multiple programs coupled with 34% of students receiving more than one acceptance offer, it is expected that there is overlap in the pools of students that are being recruited for similar sites. When the potential overlap is considered with the factors noted in the previous section, it is important to make sure that the program itself is competitively matched with the other offerings especially in research project assignments, stipend, and the date that the offer letters go out.

The application patterns of these students can be further understood when the distribution of NSF REU applications submitted is compared to applications to other research opportunities and internships (Fig. 3). It was observed that while most students that participated in this study applied to many similar sites, they did not apply to many other options. Fig. 3 shows that most students did not apply for other research opportunities or internships. Further analysis shows that 34% of respondents indicated that they applied to NSF REU programs and nothing else.

Our data highlight some of the reasons that accepted students chose to attend REU sites over other prospective options. When asked if they

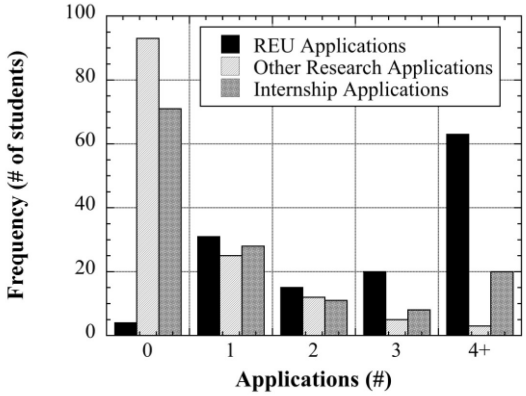


Fig. 3. Number of applications per student submitted to various summer professional options. Most of students surveyed only applied for research options indicating possible self-selection of sample. Thirty-four percent of students indicated that they applied to NSF REU options and no others.

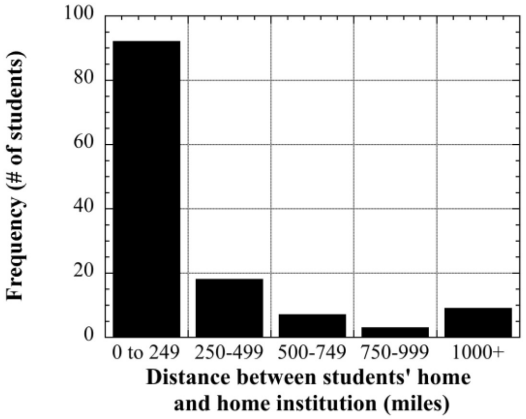


Fig. 4. Distance between students' home and where they are pursuing their degree. Most students attend institutions that are within 250 miles of their home (where they graduated high school).

Table 5. Classification of open-ended responses of why students chose to participate in an REU program over other options from students that received non-REU offers. Values are given as a percentage with respect to how many students indicated they were given other offers, with the possibility of a single student's response falling into multiple categories. A total of 44 students indicated they were accepted into multiple programs.

Category	n (%)
To experience research	14 (32)
"New" experience	11 (25)
Location	11 (25)
Stipend	10 (23)
Timing of offer	9 (21)
Résumé/CV building	8 (18)

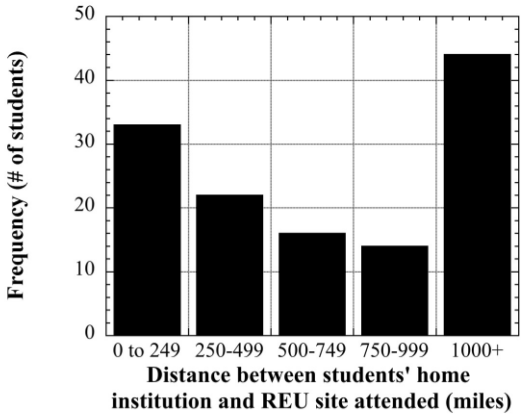


Fig. 5. Distance between students' home institution and their research institution. Many students apply very far away from home (1000+ miles), but there is still a large group that does not travel far to participate in their research program (< 250 miles).

received any offers aside from research programs 33% of student respondents indicated that they were accepted elsewhere (13% non-REU research, 10% industry internships, 5% non-STEM jobs (e.g. clerical work), 5% mentoring (e.g. STEM summer camp counselor), some responses indicated multiple options). Those students were then asked why they chose to participate in the current research program over the other options that they were offered in an open-ended free response format; their reasons were classified into multiple groups as shown above (Table 5).

Another way to view the distribution of students' applications to research programs is by distance. Participants were asked to list the various programs to which they applied. This list was used to find the distances they considered traveling to work for the summer using the postal code that the institutions were located and Google Maps to calculate the most direct driving route. The distance was found between a student's hometown and their home institution (Fig. 4), between their home institution and the program they attended (Fig. 5), and all of the program applications they submitted (not just the one they chose to attend). We considered the student's home institution where the students were pursing their undergraduate studies.

It can be seen that while most students remain relatively close to home to obtain their degree (Fig. 4), they look to travel much further for their summer research program (Figs 5 and 6). Additionally, when comparing the distribution of the sites to which each student applied with the location each participant attended, a similar trend is noted. However, there is one distinct difference, the number of students that traveled the shortest distance to attend a program, which accounts for more of their respective population than when including all of the applications that were submitted. This discrepancy is due to the frequency of students attending research programs at their home institutions, 17% of students surveyed did so. Only an additional 4% of students indicated that they applied to a program

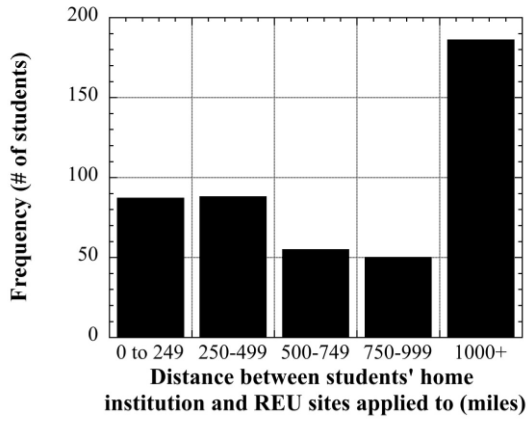


Fig. 6. Distance between students' home institution and all of the REU programs that they indicated that they applied. This figure shows similar distribution to where students eventually attend, but it is noted that the frequency in the smallest distance range is reduced, which is likely due to the frequency of students that attend REU programs at their home institutions.

at their home institution that did not attend. However, applications to students' home institutions only accounted for 6% of the total applications submitted to programs reported in this study. It is expected that this discrepancy could be explained by the additional social capital that students have at their home institution. It is likely that they are able to develop relationships with program administrators if they are interested in pursuing research at their home institution.

For further analysis, distances were grouped into two categories: under 120 miles and over 300 miles (Table 6). The 120 and 300 mile increments, as an assumption of short or a long trip by car. In all instances, over 70% of respondents chose or considered programs further away from either their home or their home institution. The students who traveled a far distance to their program can be contrasted with where they chose to obtain their degree: only 23% of students surveyed attended an institution > 300 miles from their parents' home.

Overall, it can be seen that students are primarily applying to multiple research programs (74%) that are far away from their hometown (77%) and also where they are pursuing their undergraduate degree (78%). This spread of applications when viewed on a map is frequently distributed across a large area, however this can also be exemplified by the large distances noted in Table 6. However, it is again noted, that there is a considerable group of students that remain at their home institution to pursue research (17%).

5. Limitations

In this study we focused on obtaining responses from students that selected to attend REU programs, but in order to better understand student perception of research programs as a whole, similar attention should be devoted to students that did not participate in these programs. Particularly of interest would be to examine the perspective of students that were accepted into similar programs and chose not to attend. Obtaining relevant viewpoints outside of the current sample could allow for a better understanding of possible self-selection that might occur. The prevalence of students applying to summer research programs and no other opportunities highlight that the sample included in this study is largely limited to those who solely intend on pursuing research.

In order to better grasp the breadth of engineering students that consider research programs, it would be beneficial to also focus on students that did not eventually attend an REU program. Efforts to include other viewpoints could focus on students who submit applications to similar programs that were not admitted and those who declined their offers. It could be valuable to study how those students who heavily considered research programs but did not attend one (how they spent their summers and why they chose to apply to an undergraduate research program). Additionally, to further bolster these results, this survey could be administered to a larger sample of students to be able to better discern the responses of various demographics.

6. Conclusions

Many factors are at play when STEM students are deciding how and where to spend their summers, such as how to boost their résumé as well as figuring out what field they will choose for their career. Through this study we examined the factors which students consider important when they are selecting an REU program. Participants reported that the

Table 6. Categorization of distances between students' home, home institution, REU site attended, and all REU site applications showing frequency percentages for various distances.

Distance	Home Inst. to REU	Home Inst. to REU App.	Home to REU	Home to REU App.	Home to Home Inst.
< 120 miles	20%	9%	17%	11%	50%
> 300 miles	71%	78%	71%	77%	23%

most important factors affecting their decision to accept an offer from a particular program site were the focus of their research project, stipend, and the date of acceptance. Participants' application patterns demonstrate that students often apply to multiple research programs across a wide area (> 300 miles) and many are accepted into multiple programs. An administrator of undergraduate research programs is therefore often not just recruiting students from nearby or even regional institutions. Additionally, many of the potential students may be considering summer employment in non-research environments, as 66% of study respondents applied to programs that they did not consider as research.

These results can be used to develop implications for both current and prospective undergraduate research administrators to enhance their programs or possibly as guidelines for beginning a new program. This is especially the case from the viewpoint of recruiting a diverse set of applicants to include those considered underrepresented by NSF and improving acceptance rates from first-choice applicants. Firstly, an administrator can devote special attention to the actions that they are taking during the planning stages of their program. For example, research assignments should be attractive to current students; efforts should be directed to communicate the project's intellectual merit and broader impacts to potential participants and match students to a research project with a possibility for feedback between the student and the research mentor even at early stages to ensure that students find a "good fit". Also, the stipends that are offered need to be competitive with other academic undergraduate research programs. It is important to also consider the timing of when positions are being offered; one possible option to consider could be a rolling deadline for admission (so that a diverse cohort of students can be recruited and these students can make informed decisions between various offers for how to spend their summer). Finally, given the long distances that students are willing to travel for a summer research experience, program administrators should seek to widely promote their program through multiple national avenues to reach diverse students. These efforts include websites to describe and promote the program, directed emails and promotional materials, and more recently utilizing online avenues such as LinkedIn. While social media shows promise as a possible avenue to reach potential participants, the authors have yet to see it used effectively in this regard. Through this study we have begun to understand the complex nature of undergraduate student decision making in regards to participation in summer research programs, an established method for promoting retention of students into STEM disciplines.

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