Dean's Early Research Initiative (DERI) – Pathways to STEM

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Abstract

Two years ago, we initiated a collaborative program called "Dean's Early Research Initiative" (DERI) with area high schools that introduced students to the exciting world of research and development. These students were placed with engineering research teams within four engineering and one computer science discipline. The program has tripled the number of applicants and doubled in size within the span of three years. The students participating are culturally diverse and include a high percentage of female students. In this paper, we present the challenges and the benefits inherent in running a program like this as well as quantitative and qualitative results on the fellow and mentor experience. This will be done in the form of survey results, tracking of retention and perseverance in the program and goals for the future.

Keywords

Research, Outreach, High School, STEM, diversity.

Introduction

In 2013, we initiated a research internship for area high school students. In collaboration with a local Governor's School, we developed the Dean's Early Research Initiative (DERI), which is aimed at area high school students and also fulfills the requirements of the Governor's School internship experience. This initiative provides opportunities to enhance high school and undergraduate students' exposure to engineering research, but also provides undergraduate and graduate students and postdoctoral fellows with training in mentoring [1] [2] [3]. In addition to the benefit to the students [4] [5] [6], this outreach activity is being explored as an opportunity to attract these very competitive students to our school [7] [8] [8].

Program description

DERI fellows are required to work a total of 60 hours during the summer, and continue their fellowship during the school year, when they are expected to work four hours a week. DERI fellows receive up to $200 to participate in a local scientific event and may also apply for a travel allowance based on financial need. Research mentors involve the high school student in their ongoing research. Each mentor receives a $500 travel grant to attend a scientific conference approved by their mentor.

Program assessment

Public and academic debates suggest that early exposure of students to scientific or engineering work contributes to students' embracing a scientific or engineering discipline as career path [6]. The metrics that are being tracked to measure the impact and success of the initiative evaluate: (1) The student experience, (2) the mentor experience, (3) its efficacy in generating interest in STEM of the student scholar and (4) its efficacy in attracting students to the VCU School of Engineering.

The student and mentor experience were gauged qualitatively through surveys that for the students tracked the program's efficacy in improving their confidence in themselves in terms of independent research and their continued interest and persistence in STEM [1] [4] [5]. The mentors were asked questions that gauged their continued interest and willingness to engage again in the program (sustainability) [2] [9] [10]. The success of the program was further gauged by student persistence in the program as well as in pursuing studies in STEM. The success of the program in recruiting was gauged through tracking how many students applied to and/or accepted a position in our school or at VCU.

Results

Over the span of three years, the program grew from ten applicants from one school (all applicants were accepted) in 2014 to, in 2016, 44 applicants from 20 schools. Of those, 19 were admitted, 21 were not admitted and four were incomplete. A map of the growth of the program can be seen in **Error! Reference source not found.**. Finding applicants for the program is not a challenge, but care must be taken to not allow it to grow beyond our ability to administer it effectively.

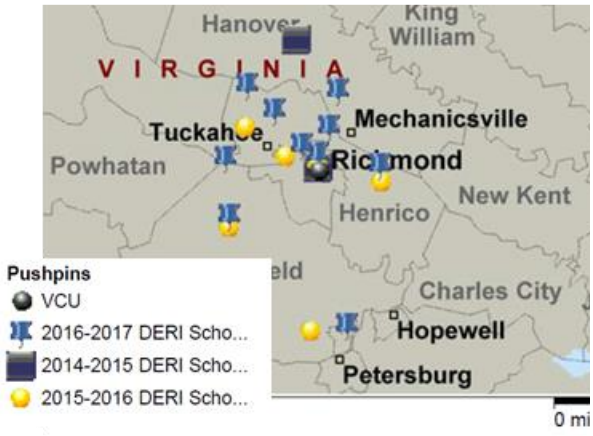
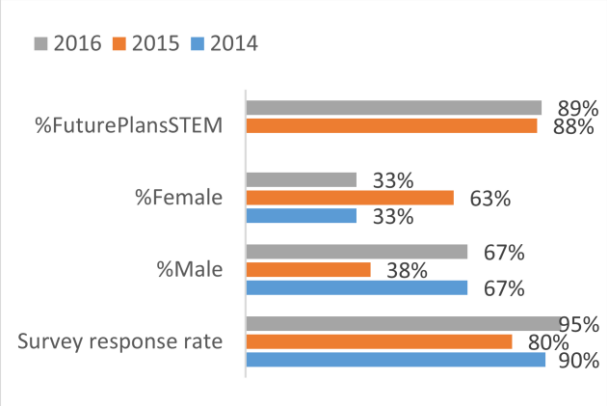


Figure 1: A map showing the expansion of the program from 2014 to 2016.

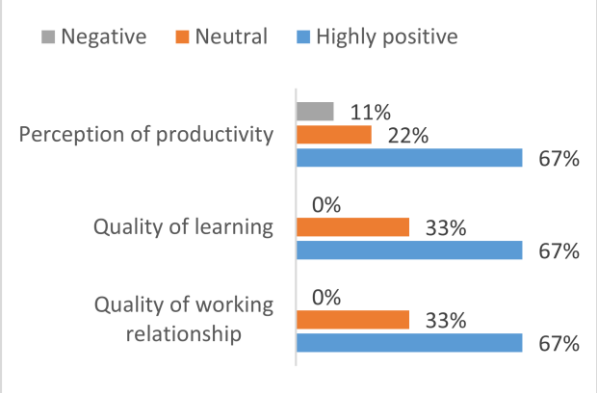
Error! Reference source not found. shows that the student-scholars persisted in the program and also persisted in their desire to study STEM. Some other survey results can be found in **Error! Reference source not found.** – **Error! Reference source not found.**. In 67% of the cases, the students were able to support with substantive statements their positive feedback of the program. Mentors were equally satisfied with the program; in 2016, 83% (10) were happy with the performance of their DERI scholar and 67% (8) would participate in the program again. The two mentors who were "sort of" or "not" happy had not set up a work schedule or clear expectations for their DERI scholars. For this age group especially, this is a necessity.

In the three years of operation of the program, we have engaged with a total of 34 students; of these, 38% were female. Of the eight students who participated and completed the program in 2015-16 (the years we officially gathered this data), one did not attend college the next year (this was for financial reasons) and seven chose STEM disciplines. None chose our school, but there had not, at that point, been any concerted effort to incentivize them to do so.

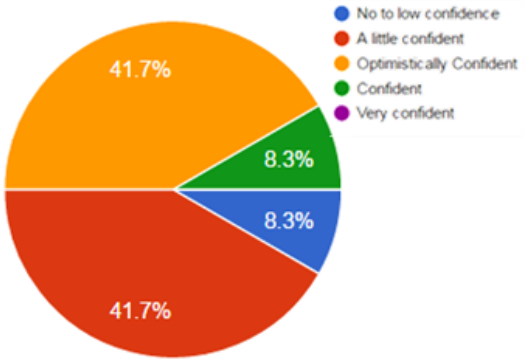
In response, this year, all 19 students have been offered a scholarship to attend our school in the fall and the application fee has been waived. At this time, three of the DERI students have applied to VCU.



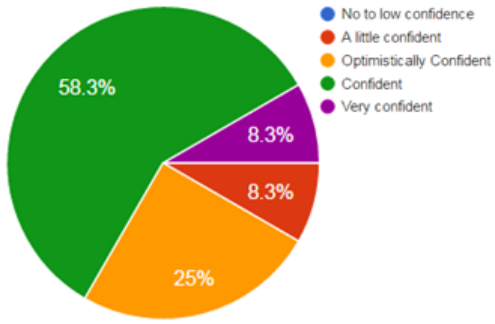
Graph 1: Survey – student diversity and persistence in STEM subsequent to the DERI experience.



Graph 1: Survey – Student perception of their experience.



Graph 3: 2016 cohort: level of student-scholar confidence in their ability to do research at the onset of the program.



Graph 4: 2016 cohort: level of student-scholar confidence in their ability to do research at the end of the summer.

Conclusion

The main direct benefits of the program are to the HS student-scholars and to the mentors, most of whom are graduate students. Surveys sent to students and mentors emphasize their satisfaction with the program and the student-scholars' ultimate goal to study STEM. In addition, through their year-long involvement, the scholars are able to engage in a substantive research experience

and are given ample time to develop their confidence, their creativity and other 21st-century skills [1] [11] [12] [13]. We are now using more sophisticated surveys to assess student and mentor satisfaction and student-scholar development during the program to further substantiate these early results. In addition, through this program, graduate student mentors have the opportunity to engage in proposal submission and student mentoring. Since they are under the direct supervision of their research advisor, this gives them valuable training for a career in academia [3] [6] [10] [14] [15].

The main challenges of this program are administrative, financial and in its short-term efficacy as a recruiting tool. The main administrative challenges involve rules and training around working with minors. In addition to the training, it was necessary to perform background checks on all employees who would be directly or indirectly responsible for the student. This was alleviated by the fact that the school has its own HR department, but still proved a significant hurdle. Concerns on safety and absenteeism were dealt with through rigorous training and by restricting the program to high school seniors. This also curtails absenteeism, as the students are not dependent on their parents to drive them to and from the school.

We are working towards a better understanding of what the true cost is in money and man hours in running this program. This will allow us to control its growth in a sustainable way. Currently, besides the very real cost of engaging a HS student in research, there is the time spent by the graduate student in mentoring and leading the research effort, as well as the HR resources necessary in on-boarding the student scholars. We also assign one of our professional advisors as a resource in case there are conflicts between a student scholar and their mentor. This process was established in 2016, to ensure that simple conflicts or difficulties do not lead to a student abandoning the program. Our advisors have thus far alleviated concerns in two cases and managed to help the mentor develop a working plan that would allow the student to continue their work on their research.

In terms of recruiting, we are being more intentional in our efforts to attract these students to our programs in the fall of 2017. We have just started to see the results of our efforts. Three students (up from zero) have applied to VCU; one student applied to be admitted into Biology while the other two are pursuing studies in engineering. On the other hand, the growing popularity of the program and the opportunities for outreach to high school counselors and STEM teachers provide other, less direct, but perhaps equally efficacious avenues for recruiting. In general, recruiting is a long game, and the effects of this program will probably be indirect rather than direct. Since the program can't grow to include more than twenty students, and can only engage with students in our immediate vicinity, ensuring we benefit from communicating with schools, parents and teachers about this outreach effort is very important.

Future papers will outline the evolution of this program, the activities in which we engage to ensure student perseverance and student and mentor satisfaction and the very important administrative tasks that are inherent with working with non-college students and minors in particular. They will also examine the program's success in attracting students to STEM fields and to a particular engineering school. In the meantime, the school will continue to engage in this outreach activity that has proven to be of such great benefit to the student scholars and to their graduate and faculty mentors.

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