An Exploration of the Diverse Stories of Engineering Students at Community Colleges: Findings from Year One

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Abstract

In this NSF-funded Research in the Formation of Engineering (RFE) project, we are exploring the unique experiences of students from underrepresented groups (URGs) at community colleges who have the opportunity to transfer to engineering programs. We are specifically investigating how their experiences in community college influence their plans for future education and careers. While the diversity of 4-year universities has remained stagnant, the diversity of community college student populations is actually increasing. Therefore, community colleges represent a potential source of talent for future engineers from diverse backgrounds. We are currently in the first year of data collection where we have piloted the study at one of the data collection sites. Five students from traditionally underrepresented groups in engineering have been interviewed. We use a narrative inquiry methodology to understand these students' experiences at community colleges. This paper shares 3 lessons learned during this pilot phase of research, which include allowing sufficient time for institutional access, the criticality of a willingness to iterate on participant recruitment procedures, and the need for constant consideration of the broader political climate when recruiting participants.

Introduction

In recent years, substantial resources have been invested to broaden participation in engineering undergraduate programs. While the percentage of Hispanic engineering students has increased, overall, the diversity of undergraduate engineering student bodies has primarily been stagnant, and in some cases, decreased. Despite the growing trend of individuals from underrepresented groups to be overrepresented at community colleges compared to the U.S. population, community colleges continue to be overlooked as a means of increasing diversity in the university setting.

Over the last decade, articulation agreements have been developed between community colleges and 4-year institutions to enable more seamless transitions from community colleges to Bachelor's degrees. However, in contrast to the more than 81% of community college students desire at least a Bachelor's degree, only 33% of community college undergraduates actually transfer to a 4-year institution within six years [1], [2]. That indicates potentially a 50% missed opportunity to transition demonstrative talent to the pursuit of a Bachelor's degree. Particularly for engineering as a discipline, conversion of this talent pool could be an impactful avenue of broadening participation.

The overall purpose of this research project is to develop a deeper understanding of community college engineering students' experiences, especially those from URGs, to gain insight that may be used to increase the number of transfer students from community colleges to four-year institutions, their graduation rates, and therefore, support the broadening of participation in engineering. In the first year of this NSF-funded RFE project, we have focused our efforts on the following:

1) Refining our narrative inquiry research design. This includes participant selection techniques as it is critical for this study to identify participants who represent diverse perspectives. As such, we will be conducting four interviews over the course of the year with each of our nine participants.
2) Beginning data collection and partnerships with community colleges in three states. We chose three community colleges that are in different US regions as defined by the U.S. census, diversity of campus types and sizes, and student demographics.
3) Lessons learned after the first year of study.

Data Collection: Refining our narrative inquiry research design

Participant recruitment began in fall 2017 at a community college at one of the data collection sites, SCC. SCC is a pseudonym for the community college system. In the Spring of 2015, over 39,000 students were enrolled at SCC, 55% female, 45% White, 7% Black, 30% Hispanic, 5% Asian, 0.1% Hawaiian/Pacific Islander; 0.8% American Indian/Alaskan Native, and 3.4% Non-Resident Alien. Over 82% of students were enrolled at the community college with the intent of earning a degree or certificate or transferring to a four-year university. Engineering was ranked 8th out of the top 10 intended majors.

Access to Site

Prior to recruiting students, the research team completed a number of compliance exercises to ensure that SCC was aware and approved of the research study. Once the research team decided to conduct research at SCC, an email was sent to the head of the Science, Technology, Engineering, and Mathematics (STEM) education department requesting a letter of support for the NSF grant. Although the individual was enthusiastic about participating, the research team was referred to SCC's Department of Institutional Planning, Development and Evaluation for internal review at SCC. After a few weeks, SCC approved the study and the research team was able to procure a letter of support for research on the campus.

Participant Recruitment

Once funding was received, a research team member met with the head of the STEM department, and together they identified an introduction to engineering class and a statics class that would be considered ideal for participant recruitment. After establishing email contact with the professors, the research team member visited the classes during the first few weeks of the Fall 2017 semester. During this visit, she shared the study purpose and an electronic survey which asked for demographic information, number of semesters enrolled in the community college, and plans after completing coursework at SCC. As a result of this recruitment effort, a total of five students completed the survey, and ultimately three were interviewed within a month of completing the survey. Two of the three students interviewed were from typically underrepresented groups in engineering. For the purposes of this study, underrepresented groups include individuals that are Black, Hispanic, women, LGBTQ, persons with disabilities, veterans, low socioeconomic status, and first generation college students.

Continued Participant Recruitment

The initial goal of the research study was to recruit at least three students at each data collection site from underrepresented groups and interview each participant four times over the course of an academic year. During the winter of 2017, the research team recognized the need to recruit more participants from underrepresented groups. The resulted in a need to ask for more detailed demographic information. At this point, the team analyzed the current participant interviews and revised the initial recruitment survey. The new recruitment survey was redesigned using recommendations made by Fernandez et al. and included more specific demographic questions asking students to identify not only their race and gender and goals after community college, but also their socioeconomic status, parent education level, disability, and veteran status [3]. This survey (Appendix A) was shared with an Introduction to Engineering class as well as an Engineering Academy class which has an articulation agreement with a state university, in the Spring of 2018. At the time of submission, nine students completed the survey and one interview was completed.

Interview Protocol

The interview protocol was created within the theoretical framework of narrative inquiry. An essential component in executing narrative inquiry, is attending to the lived and told stories of participants. Using this technique, we can investigate a phenomenon, or phenomena, to gain a deeper understanding of the students lived and told experiences [4]. The purpose of the first interview was to determine potential participants' fit for the study and to establish rapport and trust between the research team member and the participant. Such dynamics of the relationship are important as the data collection process must endure over the course of an academic year. Interviews lasted about half an hour in length and gathered information about the participants' reasons for attending community college, examples of positive and negative experiences in community college, and their plans after attending community college.

Lessons Learned

Allow sufficient time for institutional barriers for access to site

As discussed, access to the community college sites was not a quick and linear process. The primary lesson learned from this effort was to share the approved IRB from the research institution with the community college ahead of time. Additionally, when visiting each research site, the team plans to have physical copies of the IRB on hand to share with administrators, faculty, students and any other necessary party to mitigate these barriers. At SCC, one faculty member shared that SCC receives many research requests throughout the academic year and that the barrier to access is purposeful with the intent of protecting their students from excessive participant recruitment efforts.

Iterate on participant recruitment design

Even though our first attempt to recruit participants from SCC was somewhat successful, we did not recruit as many students from URGs as initially planned. The research team spent time critically reviewing the first efforts and determined not only to change the survey questions, but also the types of classes that were targeted to recruit participants. This willingness to change and iterate on the design of participant recruitment proved immediately successful as we now have

more students recruited from underrepresented groups than initially planned. Also, by using the more detailed demographic survey, we were able to target a more diverse set of participants including students from LGBTQ communities, students with disabilities, and veteran students.

Acknowledge current political climate influencing study

This study began in the Fall of 2017, which was also when the federal government began shifting its tone on immigration policies. Currently, the federal government is threatening to rescind the Deferred Action for Childhood Arrivals (DACA) program. Consequently, at the time of submission, there was more disagreement than consensus regarding DACA recipients and immigration policies in general.

This political climate is important because SCC is located in a state with a large population of DACA recipients and a large population of immigrants. When creating the recruitment survey, our research group initially wanted to ask questions about US citizenship, but given the large immigrant population at our study site, ethics, and overall empathy, we decided not to include this question on the survey. Additionally, we believe that this political climate might influence some students to make the decision not to participate in our study if they perceive a threat from disclosing their citizenship status.

In sum, the combined lesson learned from these three issues (e.g., site access, participant recruitment design, and the current political climate) are important, as the strength of the study lies in the data collected. If not sensitive to institutional barriers to data collection, valuable connections to potential participants are lost. Without attention paid to the particularities of a study's target population, researchers may waste time recruiting a sample, which fails to address their research questions and/or reflect accurate experiences of the study's population of interest. If the socio-political climate of a research site is overlooked, there exists the danger of not being politically sensitive to participants' needs regarding anonymity and self-protection.

Next Steps

As we complete the first year of this project, we will continue data collection at our first site, move into more data collection from the remaining two sites, and concurrently conduct analysis for all of the collected data. With the first site being slightly ahead of the other two sites, we will continue to use this site as a pilot site, refining interview protocols to ensure that high quality and rich data is collected from the study's participants. Findings from this work will ultimately inform community colleges and four-year universities of opportunities to create more viable pathways for students from URGs into engineering careers.

Acknowledgements

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References

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[4] M. Rice, "Adolescent boys' literate identity," Bingley, West Yorkshire, England: Emerald Group Publishing Limited, 2011.

Appendix A: Improved Demographic Survey

If you are interested in participating in a research study that will help researchers better understand the experiences of underrepresented students who are enrolled in community colleges, please complete the following survey.

The research team will review responses to this short survey and select students to participate in this study. These interviews should last no longer than an hour in length. If selected for an interview, you will receive a $25 Amazon gift card in thanks for your participation.

Q1 Name

_____

Q2 Email Address

_____

Q3 Major or Program

_____

Q4 Number of semesters in community college and four year universities (check all that apply)

- o 1
- o 2
- o 3
- o 4
- o 5
- o 6
- o 7 (or more)
- o Other _____

Q5 Which semester will be your last semester to attend classes at the community college (if known)?

- Spring 2018
- Summer 2018
- Fall 2018
- Spring 2019
- Summer 2019
- Fall 2019
- Spring 2019
- I'm not sure. Comments: _____

Q6 What are your plans after finishing classes at the community college? If you are planning to work, describe the type of job that you will be seeking. If you are planning to transfer to a four year university, describe your intended major (if known) and whether you will attend full or part time.

_____

_____

_____

Q7 Click to write the question text

- Male
- Female
- Transgender
- Cisgender
- Genderqueer
- Agender
- A gender not listed _____

Q8 How do you describe your sexual identity? (Mark all that apply)

- Heterosexual/straight
- Homosexual/gay/lesbian
- Bisexual
- Asexual
- A sexuality not listed _____

Q9 How do you describe your disability/ability status? We are interested in this identification regardless of whether or not you typically request accommodations for this disability. (Mark all that apply)

- A sensory impairment (vision or hearing)
- A learning disability (e.g., ADHD, dyslexia)
- A long-term medical illness (e.g., epilepsy, cystic fibrosis)
- A mobility impairment
- A mental health disorder
- A temporary impairment due to illness or injury (e.g., broken ankle, surgery)
- A disability or impairment not listed above
  _____
- I do not identify with a disability or impairment

Q10 Please print your specific disability/ability statuses in the space below. Examples of statuses include: Anxiety, Bipolar disorder, Auditory Processing Disorder, Blindness, Colorblindness, Dyslexia, PTSD, Use of a mobility aid (e.g., wheelchair), etc. Note, you may report more than one.

_____

Q11 With which racial and ethnic group(s) do you identify? (Mark all that apply)

- American Indian or Alaska Native
- Asian
- Black or African American
- Hispanic, Latino, or Spanish origin
- Middle Eastern or North African
- Native Hawaiian or Other Pacific Islander
- White
- Another race or ethnicity not listed above

  _____

Q12 What is the highest level of education that your mother received?

- Did not finish high school
- Graduate from high school
- Attended community college but did not complete a degree
- Completed an Associates degree
- Completed a Bachelors Degree
- Completed a Masters Degree
- Completed a Doctoral or Professional degree (e.g., Medical, Law)

Q13 What is the highest level of education that your **father** received?

- Did not finish high school
- Graduate from high school
- Attended community college but did not complete a degree
- Completed an Associates degree
- Completed a Bachelors Degree
- Completed a Masters Degree
- Completed a Doctoral or Professional degree (e.g., Medical, Law)

Q14 Would you describe your family as:

- Low Income
- Lower-Middle Income
- Middle Income
- Upper-Middle Income
- High Income
- I prefer not to answer

Q15 Have you ever served on active duty in the U.S. Armed Forces, Reserves, or National Guard?

- Never served in the military
- Only on active duty for training in the Reserves or National Guard
- Now on active duty
- On active duty in the past, but not now

Additional research study information: The purpose of this survey is to allow researchers to be able to select a diverse group of interviewees. There are no anticipated risks or benefits for providing this information. If you are selected for an interview the demographic information in this survey will be kept with your interview transcript. After the Spring 2018, if you were not selected your information will be destroyed. For any questions related to this research project, please contact the lead researchers, Dr. Nadia Kellam, at nkellam@asu.edu or Dr. Brooke Coley, at bccoley@asu.edu

Thank you for your time!