Community Cultures: Broadening Participation By Understanding How Rural Communities Support Engineering as a College Major Choice

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Project Overview

Efforts to spark interest in engineering among PreK-12 students have increased substantially in recent years both to expand the number of engineers generally and to increase the diversity of the field. While many efforts seek to spark and develop student interest in engineering, past research has demonstrated that interest is not always sufficient to help students pursue engineering majors, particularly for rural students [1-3]. In many rural communities, influential adults (family, friends, teachers) often provide the primary support for engineering as a career choice, while factors such as lack of role models, lack of social and cultural capital, and limited course availability may all act as potential inhibitors. Collectively, such work suggests that current models of career choice that posit interest as the primary driver do not adequately account for the contextual factors that shape rural students' choices. Far less work has sought to explore communities more holistically to understand why and how key influencers choose to support or promote engineering as a career choice among rural students.

The gap in research on engineering career choice in rural communities is particularly compelling given regional economics. In the Appalachian region of Virginia where our study is situated, for example, the poverty rate was 120.5% of the overall U.S. rate for 2010-2014 (the most recent available data); 18.8% of the region's residents are in poverty, compared to 11.5% for the state and 15.5% for the nation.[4] College completion rates are similarly troubling at 63.5% of the national average. Given such conditions, our goal is to broaden participation in engineering in these economically disadvantaged rural communities. To achieve this goal, we address three research questions:

> RQ1. What community experiences do current undergraduate engineering majors from rural high schools describe as influences on their choice to pursue engineering as a post-secondary major?
>
> RQ2. What beliefs, experiences, and practices characterize community members or organizations who support or encourage rural students to choose engineering?
>
> RQ3. How are these supports transferable or adaptable by other schools? What community-level factors support or inhibit transfer and adaptation?

To frame our study, we draw on Social Cognitive Career Theory (SCCT), developed by Lent, Brown, and Hacket [5, 6] and widely used in studies of career choice, including career choice in rural Appalachia [7-9]. SCCT is particularly useful for this study because it includes contextual affordances (also called environmental influences or effects [6]) such as family socio-economic status, cultural values and norms, educational access, or supportive individuals that prior research has shown to be particularly salient among Appalachian students. Other constructs in the model include learning experiences, self-efficacy, outcome expectations, and interest.

These qualitative research questions will be explored throughout the life of the project following three phases, shown in Figure 1. The three phases correspond directly to the three research questions.

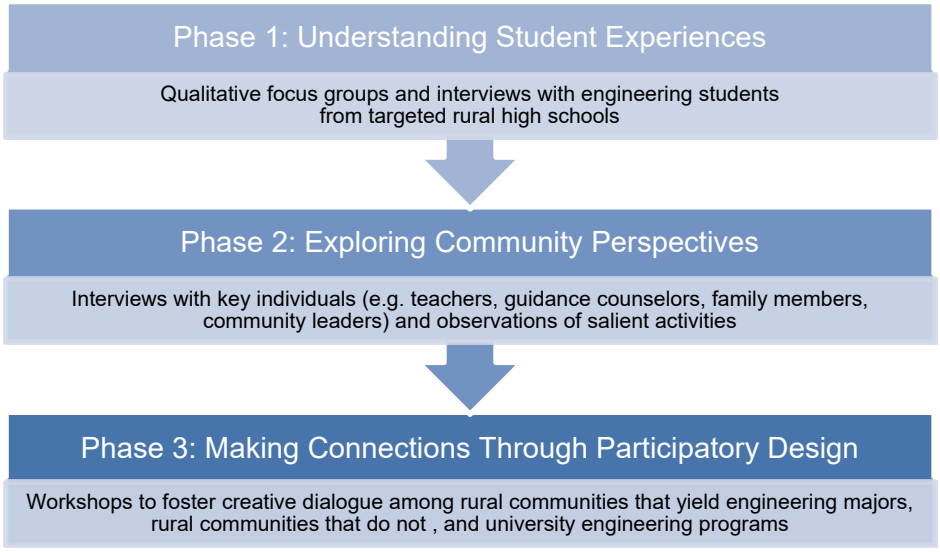

Figure 1: Project Phases

Preliminary Project Results

Our project is currently in Phase 1. In the first part of this phase, we targeted students who completed high school from rural regions within the Virginia (as defined by the Virginia Board of Education) who successfully matriculated into engineering at Virginia Tech. We selected Virginia Tech because of its position within a rural region and its mission. Located in the western region of the state in the Appalachian Mountains, Virginia Tech is the state land grant institution and awards the highest number of engineering degrees in the state (and in fact, is the fourth largest in the country [10]. Given its geographic location, its roots as the state agricultural and mechanical college, and its continued land grant mission, it is well-positioned to server rural Appalachian students interested in engineering careers.

Our initial sampling frame included 139 students who met our study criteria, with a demographic breakdown of 19% female, 6% races or ethnicities associated with under representation in engineering, and 14% first-generation college students. Students were invited to participate in a focus group, which included a $25 gift card incentive. Out of these 139 students, 21 participated in one of seven focus groups. Institutional data on our participants indicates that our sample consisted of seven females, one with races or ethnicities associated with underrepresentation in engineering, and six first-generation college students, closely mirroring the sampling population, with a slight oversampling of females (33%) and first-gen students (28%) and a slight undersampling of URM students (5%).

Focus group questions (see Appendix) aimed to understand (a) how and why participants chose to enroll in college generally and engineering specifically, (b) the community-level influences that supported or hindered their decision-making, and (c) general perceptions regarding how the community portrays both college and engineering careers as well as who should/should not

pursue such aspirations. Focus groups not only provided rich data to begin answering RQ1 but they also helped to identify which individuals from within our sample should be invited for follow-up interviews to understand experiences in greater depth.

First pass analysis of focus group data included developing participant summaries and categorizing supports, barriers, and major influences that participants described. These elements were highlighted in this preliminary analysis because, in accordance with SCCT, they represented environmental influences that have previously been shown to be particularly important for the career choices of Appalachian youth.[1-3, 11]. Comprehensive exploration of RQ1 requires analysis of follow-up interviews, which are ongoing through the end of the Spring 2018 semester. However, preliminary insights from the focus groups are as follows:

- Eight of the students in our sample chose engineering because of an immediate or extended family member who is an engineer. While this is not surprising since we know family members have significant influences on career choice, it is a factor that cannot be altered through school reform or community participation efforts. As a result, given our focus on *community* experiences to broaden participation, we have excluded these participants from subsequent phases.
- Consistent with previous research, key individuals within schools (guidance counsellors, teachers) often played critical roles in guiding students into particular math courses or engineering programs that paved the way for major choices.
- Key barriers participants had to overcome included family concerns about the costs of an engineering education as well as an emphasis on trades or professions that do not require a college degree, concerns over the level of academic challenge posed by engineering programs, and, in one case, gender bias against women becoming engineers.
- An unexpected emergent support for some students was the growth in programs in rural regions that offer full funding for community college for graduating seniors with GPAs above a certain threshold. Though this was not a primary pathway for most of the students in our sample, it has led us to more intentionally sample for this pathway in the interview portion of Phase 1.

Based on these findings and additional analysis of state and university demographics, we choose to expand the sampling frame significantly for the individual interviews, adding additional rural school districts as well as students from the region of interested who transferred to Virginia Tech from regional community colleges. To date we have interviewed 28 individuals, including five focus group participants. The pool includes 11 women, one (male) underrepresented student, seven first-generation college students, and 14 students who transferred from community colleges.

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Appendix: Community Cultures: Fall 2017 Focus Group Questions

Below are the questions asked in the focus groups. Note that we have omitted introductory text.

1. As we get started, let's all go around and briefly introduce ourselves by saying your name and major, and telling us a little bit about the community where you grew up, including one thing you really like about that community.

2. I'd like you to think back to when you were first seriously considering attending college.

- When did you start thinking about attending college, and what were some of the primary influences on the decision to pursue college?
- What are some of the things people (peers or adults) would say to you about pursuing a college degree?
- How did you decide what college you would attend and what characteristics were most important (e.g., location, size, quality)?
- When you think about your high school and the surrounding community, what do you feel was the dominant message about attending college?

3. Now let's talk a little more specifically about engineering.

- When did you start thinking engineering, and what were some of the primary influences on your specific decision to pursue engineering?
- What factors were most important to you in your decision to pursue engineering (e.g., job prospects, interest)?
- What do you think engineering is?
- What are some of the things people (peers or adults) would say to you about pursuing engineering or being an engineer?
- How did people (peers and adults) react when you decided to attend college and pursue engineering at [University]?

4. I want to ask a bit of a broader question now: In your opinion, broadly speaking, who are the people who have the most influence on college and career decisions of students at your high school?

5. If you could give current students from your home community advice as they make decisions about whether or not to pursue college, which college to choose, and whether or not to pursue engineering, what would you say?

6. If you wanted more students from your hometown to go to college and pursue engineering careers, what is one specific thing that you think could be done by someone (e.g., by individuals, by high schools, by [University]) to achieve that goal?

7. Is there anything you feel we should have discussed that we didn't discuss or things you want to share before we close?