Board 223: Broadening Participation in Engineering via the Transfer Student Pathway: Findings from an S-STEM-Enabled Partnership

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Broadening Participation in Engineering via the Transfer Student Pathway: Findings from an S-STEM-Enabled Partnership

Building partnerships between community colleges and four-year institutions has been identified as a cost-effective strategy for academically talented low-income students to earn a bachelor's degree [1]. What often happens, however, is that the onus is placed on the community college to support students through the transfer pathway with much less engagement by the four-year institution during this process [2]. Funded through the National Science Foundation's (NSF) Scholarships in Science, Technology, Engineering, and Mathematics Program (S-STEM) program, the Virginia Tech Network for Engineering Transfer Students (VT-NETS) project has focused on improving collaboration efforts between the College of Engineering at Virginia Tech (VT) and its two primary community college partners: Virginia Western Community College (VWCC) and Northern Virginia Community College (NOVA). Beyond providing scholarships to students while they are in community college and at Virginia Tech, a primary project objective of VT-NETS has been to identify and evaluate mechanisms whereby the four-year institution can play a more active role in increasing the success and efficiency of engineering transfer throughout the full community college-to-bachelor's degree pathway, increasing attainment of A.S. and B.S. degrees in engineering by low-income students.

Our project has expanded current work on transfer student capital, articulation agreement efficacy, transfer support services, enrollment and guaranteed transfer policies, coursework transfer processes, co-curricular support programs, and credit loss. We made these contributions by leveraging quantitative analyses of student data for transfer and non-transfer students in engineering, as well as qualitative data collected from interviews and focus groups with students and key faculty and academic advisors working within the transfer space. Our poster will highlight some of the more recent findings from this initiative, including: the ways in which pre-transfer programs can influence transfer processes; information asymmetry as a barrier for transfer students; and the magnitude and sources of credit loss experienced by engineering transfer students. The poster will showcase how collaborative partnerships between institutions can improve our understanding of transfer pathways, barriers for transfer students to degree attainment in engineering, and community college-university partnerships that effectively support student access and success. We also point to some of our lessons learned overall in this project.

Advancing a key deliverable from this NSF grant, our project serves as an example of how to establish stronger networks between a university and its state's community college system. Further, we provide a guide for four-year institutions and community college educators to develop new interventions that enhance transfer pathways and identify pitfalls or gaps in services and transfer structures that need be remedied. Ultimately, these findings illuminate and help prioritize the human, financial, and physical resources dedicated towards supporting all transfer students in engineering.

Summary of Selected Results

Cultivating a cohort: Integrating community college students in pre-transfer programs

As we fully describe in Grote et al. [3], the VT-NETS program focused on a variety of pre-transfer supports to help improve the transfer pathway within engineering. Rather than waiting for students to transfer to Virginia Tech, this program is an example of how a four-year institution can actively participate in the education process during students' time at a community college. Pre-transfer support programs that we instituted included cohort-building sessions, intrusive advising, university visits, a study abroad experience, and undergraduate research. Our poster will highlight elements of each of those programs. In addition, we compared VT transfer students who engaged in VT-NETS from VT transfer students who did not. This comparison allowed us to understand how the program influenced the overall process. Our poster will highlight some of the practical recommendations that we gleaned from that study.

Unnecessarily complicated: Information asymmetries in the transfer of coursework process

Recent research that is forthcoming in Grote et al. [4] performed a network analysis to identify information pathways that enhance engineering students' accrual of transfer student capital [5] and other pathways fraught with information asymmetry [6]. We used semi-structured interviews with relevant faculty and staff to explore how engineering transfer students receive information about transfer of coursework. We found that, according to advisors who serve transfer students, community college web resources (e.g., course catalog), university admissions, and university registrar's offices can have inaccurate information regarding transfer. We also found that advisors have mixed opinions on the quality of advising given by other advising offices, and transfer students are often stuck in the middle trying to navigate those differences—advisors sometimes have different perspectives of what constitutes "good" advice, hence the mixed findings on these sources. In examining information pathways, we found several processes to reduce information asymmetry (e.g., referrals, forwarding), whereas others contributed to increased asymmetry (e.g., deferring, delaying). The combination of information sources and the processes that link them are relatively unexplored domains when trying to understand how students attempt to accrue transfer student capital. Our poster will include a visualization of these networks to show both the complexity of the information system as well as the places that could be improved.

Magnitude and Sources of Credit Loss

Our ongoing research examines credit loss experienced by engineering transfer students. While most transfer students experience at least some credit loss, little is known about the factors that contribute to this loss [7]. We used VT-NETS students' transcripts and degree audit reports from the sending and receiving institutions to identify sources of credit loss. In addition, we created Sankey diagrams for each student to visualize how pre-transfer credit is applied to the associate degree, accepted at the receiving institution, and applied to the degree at the receiving institution. The accumulation and use of credit for a transfer student is quite complex. The Sankey diagram visualizes this complexity to deepen our understanding of credit loss, which we will display on

our poster. We found that pre-college credits, such as AP and Dual Enrollment, may not entirely satisfy degree requirements at the community college or in the student's intended major. In addition, many students lose credits because of the credit discrepancy for individual courses. For example, Multivariable Calculus (Calculus III) is three credits at the receiving institution and four at the community college. Similarly, there are other sources of credit loss for engineering transfer students that may not necessarily be negative but provide an alternate route to earn a bachelor's degree. Students taking ESL, developmental coursework, and precalculus, for example, would all have credit loss from those courses; however, such course taking would be necessary for those starting postsecondary education in a community college as a path to earning an engineering degree. Thus, we bring nuance to the situations that are typically referred to as "credit loss"—our work shows there is more complexity to this idea, and "credit loss" may be a misnomer. Our poster will include sample Sankey diagrams to allow practitioners at the sending and receiving institutions to address credit loss in more specific parts.

Some Key Lessons Learned and Future Work

Over the course of the VT-NETS program, we have identified a series of lessons learned. These include the following:

- When working across institutional contexts, it is important to have each institution describe their institutional processes/contexts from the get-go, particularly with respect to identifying constraints that either: a) can't be changed, or b) need to be changed. It took the community college teams and the university teams quite awhile to speak the same language.
- Collaborations can result in improved advising structures for engineering transfer at both sending and receiving institutions.
- Holding events such as college-specific articulation conferences with community college partners can facilitate critical conversations between institutions related to how courses translate (or not) across institutional contexts.
- Four-year institutions should consider the extent to which their curriculum is unnecessarily complex. Curriculum adjustments within four-year institutions should keep transfer students in mind.
- Universities need to consider how transfer students can get stuck in the middle of policies that are logical independently but in combination can have unintended consequences for students (e.g., articulation agreements and enrollment management policies).
- Elevating transfer student success metrics to College or university strategic plans keeps a focus on this student population throughout the organization.

Our continued work will focus on the following activities, and our poster will provide some updates on those efforts:

- Developing a greater understanding of decision-making processes of students who had initially considered transferring via VT-NETS but ultimately chose a different path.
- Developing a greater understanding of differences between transfer students' and first-time-in-college students' perceptions of student supports.
- Identifying what elements of our program could be possible without a large grant as well as which elements were still challenging even with the presence of a large grant.

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