

Understanding and Diversifying Transfer Student Pathways to Engineering Degrees: An Update on Project Findings

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The President's Council of Advisors on Science and Technology (PCAST) documented the need to prepare more than 1 million additional STEM professionals in the U.S. workforce over the next decade, primarily through efforts focused on increasing retention rates and diversifying pathways. To meet this need, we must tap the entire domestic talent pool, including underrepresented minorities. According to data collected by the National Center for Education Statistics, 57% of Hispanic students and 52% of African American students in undergraduate education during Fall 2014 were enrolled in 2-year public colleges. Given that more ethnic/racial minorities begin their pursuit of higher education at schools other than 4-year institutions, it is critical that we improve transfer pathways into engineering.

The purpose of this mixed methods, National Science Foundation funded research was to develop a clearer understanding of transfer student pathways as a means to increase engineering degree production and broaden participation in engineering careers.

The study sites for this research are 4 of the top 10 producers of U.S. Hispanic engineers, and all are based in Texas: The University of Texas at El Paso, Texas A&M University, The University of Texas at Austin, and The University of Texas Rio Grande Valley. Our study expands the small body of literature on engineering transfer students and sheds light on specific policies and practices that impact transfer.

Specifically, our investigation addresses the following research questions:

1. How does transfer student capital relate to academic achievement and degree attainment for transfer engineering students at 4-year institutions?
2. How do Hispanic and non-Hispanic transfer students compare on measures of transfer student capital and its relation to academic achievement and degree attainment?
3. How do students decide to transfer into engineering at a 4-year institution?
4. What institutional policies facilitate success and enable transfer pathways into engineering at 4-year universities?
5. How do institutions hinder transfer students in their transitions into engineering at 4-year universities?

To address these research questions, we organized the project in two concurrent phases: a quantitative phase that drew on student performance data merged with cross-sectional survey data (collected specifically for this project) and a qualitative interview-based phase. The following sections provide a summary of our data collection processes (all data are in hand and analyses are ongoing). Our objective for this executive summary is to introduce the engineering education community to this new, rich data set on engineering transfer students. Surveys and protocols that were developed as a part of this project can also be shared with other institutions seeking to understand their own transfer student population; we hope to continue building this data set by adding new institutional contexts. Major findings to date will be presented on the poster during the ASEE annual meeting.

Overview of Project Methods

Quantitative Phase Design

The quantitative aspect of the project consisted of a cross-sectional survey that was administered to students and recent alumni who enrolled in engineering between 2007 and 2014 at four Texas four-year institutions who were identified by each institution as “transfer students.” Following the survey administration period, four-year partners gathered student record data for each survey respondent (i.e., major, academic performance, retention in engineering, demographic variables), which was merged with the survey responses in subsequent analyses.

The survey for this study is an adaptation of the Laanan-transfer students' questionnaire (L-TSQ)^{1,2,3,4} plus a compilation of survey items extracted from the following multi-institutional research studies that investigated transfer student experiences in STEM: Prototype to Production: P2P⁵ and Measuring Constructs of STEM Student Success Literacy: Community College Students' Self-Efficacy, Social Capital, and Transfer Knowledge.^{6,7}

The final survey instrument, the “***Engineering Transfer Student Survey***”, was developed specifically for this project and is comprised of six sections that include a mix of multiple choice and open-ended questions. Multiple survey items are embedded in 16 of the 45 questions. A high level summary for each section of the survey is provided as follows:

- *Personal Information* (19 questions). Captures participant background information, including: gender, race/ethnicity, citizenship, age, education attainment, future degree aspirations, parent/guardian education attainment, mode of admission at receiving institution, identification of primary sending institution, and expected/actual time to degree completion.
- *Transfer Pathway* (2 questions). Captures students' reasons for starting their education at a different institution and factors that influenced their decision to transfer to the receiving institution.
- *Experience with the Transfer Process* (8 questions). Captures students' perceptions of the transfer process and usefulness of information sources on how to transfer. This section also captures data on student experiences prior to transfer, including: experiences with academic advising at both sending and receiving institutions, and use of student resources at the receiving institution.
- *Experience at Sending Institution* (1 question). Captures students' perceptions of preparation received at the sending institution with respect to learning and study skills.
- *Comparing Experiences at Each Institution* (8 questions). Captures data that allow us to compare student experiences at the sending and receiving institutions before and after transfer, respectively. In this section, questions focus on student experiences with faculty, coursework, and time management at each institution.
- *Experience at Receiving Institution* (7 questions). Captures students' perspectives on transfer challenges and general perceptions of the receiving institution. This section also captures students' perceptions of the adjustment process and social support available at the receiving institution.

To address validity, our survey was developed using input and feedback from content experts on the project advisory board and representatives from the participating 4-year institutions and their local partner community colleges. Representatives included a combination of administrators, faculty, and staff from 8 institutions with working knowledge of policies and practices in Texas that impact students who transfer to 4-year institutions as new engineering students. In working with the full project team, we quickly recognized the need for local customization for the survey because of varying terminology and practices. During survey development, we defined key terms to increase clarity for study participants and stakeholders and dedicated careful attention to appropriate use of terminology. The final versions of the instrument have been customized to accommodate the following: alternative transfer pathways, local and sensitive terminology, and unfamiliarity with upward transfer policy jargon. The customized Engineering Transfer Student surveys were vetted by each four-year institution in Spring 2015.

Institutional Population/Sample and Data Collection. The four-year student population was defined as students who transferred as new engineering students between 2007 and 2014. The definition of transfer student used in this study matched language employed by each participating institution’s Office of Admissions. Research partners at each site accessed student and alumni records to retrieve a current email address for each individual eligible for the study (total n=7,608). The online Engineering Transfer Student Survey was sent to 7,380 engineering transfer students with working email addresses at four 4-year institutions in Texas (all among the top-10 producers of Hispanic engineers) (see Table 1, which includes community college partners that participated in the survey vetting, but students enrolled at those institutions did not receive the surveys). We received responses from 1,102 current transfer students or alumni (with 1,070 usable responses, which constitutes a response rate of 14.5%, consistent with other online research surveys). The sample is unique because it is comprised of a large percentage of Hispanic students, which is a fast growing U.S. demographic and a subpopulation that engineering is seeking to attract and support.

Table 1. Project four-year institutions and partner community colleges.

Four-Year Institution	Community College Partner Institution
Texas A&M University	Blinn College
The University of Texas at Austin	Austin Community College
The University of Texas at El Paso	El Paso Community College
The University of Texas Rio Grande Valley	South Texas College

Data Treatment. After all survey responses were in hand, weights were developed to adjust for response bias within each institution and account for different institutional response rates. Responses from each institution were weighted to be representative of its engineering transfer student body with respect to gender and ethnicity/race. Missing data were imputed to address potential systematic biases that are inherent when missing data are present.

Qualitative Phase Design

The study has also produced qualitative data that were collected via 18 semi-structured focus groups with 84 students, administrators, faculty, and staff who were either transfer students or whose university roles require interaction with and support of transfer students. Focus groups were held at all eight of the project partner institutions, which allow for investigations of the system from both the 4-year and community college perspectives.

Protocols used Laanan's transfer student capital framework (shown in Figure 1, which also organized sections of the quantitative survey) to frame interview questions. A context-specific extension of social and cultural capital theories, this framework assists researchers in identifying the variables to take into account when studying transfer students. As shown in the "Background" portion of the framework, students can have multiple motivations or reasons for transferring to a different institution; an important aspect of our study is to untangle those reasons for engineering transfer students in Texas. Students accumulate transfer student capital, or knowledge about the transfer process, at sending institutions (i.e., the place(s) where students begin their degree paths), receiving institutions (i.e., the final degree-granting institution), and potentially from non-institutional sources. The development of transfer student capital may come from experiences related to learning and study skills, course learning, perceptions of the transfer process, academic advising and counseling, and experiences with faculty. Upon arriving at the receiving institution, students must adjust to the new environment academically, socially, and psychologically, all of which may influence a variety of educational outcomes.

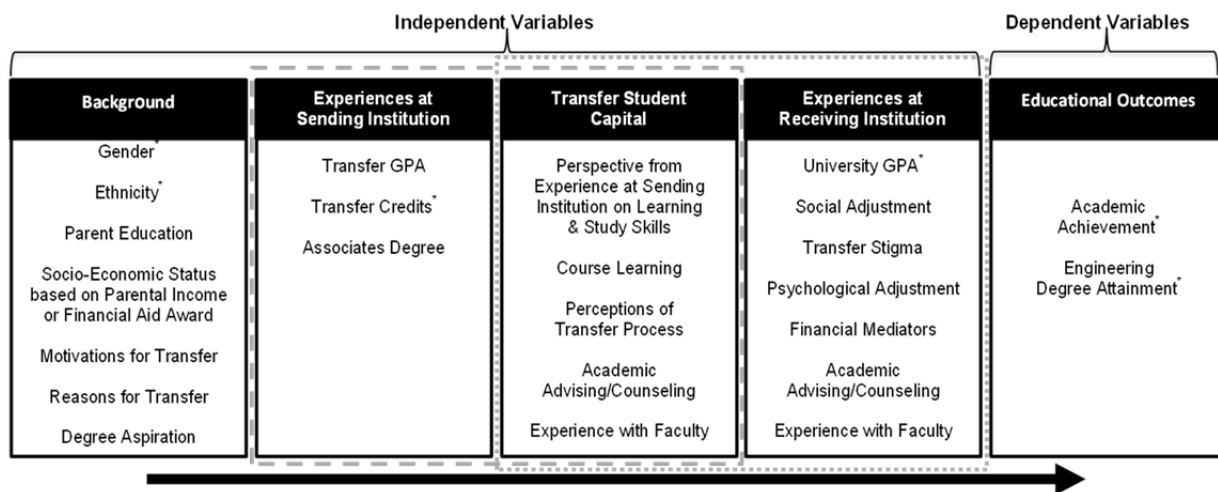


Figure 1. Modified/adapted from Laanan et. al.'s framework for Transfer Student Capital.^{8,9}

The objectives of these interviews were to identify: 1) institutional policies and practices that facilitate success and enable transfer pathways into engineering at 4-year universities for transfer students, 2) ways institutions hinder transfer students in their transition to engineering at 4-year universities, and 3) ways institutions help students accumulate and leverage their transfer student capital. All interviews were audio recorded and transcribed. High-level summaries of those focus groups were provided to each participating institution, and data analysis of those focus groups—and mixing results with the quantitative data—are ongoing. Thus far, early findings have been disseminated at multiple conferences.^{10,11,12,13,14}

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