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# Transfer Students' Recommendations for Enhancing Success and Easing the Transition into the Middle Years of Engineering at Receiving Hispanic-Serving Institutions

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## ABSTRACT

To make the transfer student pathway viable to meet workforce needs, it is essential to think beyond simply linking two institutions and getting students in the door—students need to be supported throughout the adjustment period. In this article, we address the "support" aspect of the problem by reporting findings from 306 engineering transfer students' responses to open-ended survey items that focused on factors that helped students adjust and how their sending and receiving institutions could have helped ease the transition; our sample, which is largely Hispanic/Latino (88%), includes both vertical and lateral transfer students who proceeded to enroll in 4-year Hispanic-Serving Institutions. Six themes emerged related to elements that helped students make the adjustment: individual/self, personal network, familiarity with the environment, polite/helpful atmosphere, institutional resources, and student involvement. Student recommendations on how sending institutions could have helped ease their transition focused on information, academic curriculum, and institutional process, and recommendations for receiving institutions included students' requests for more assistance with getting involved on campus, building personal networks, and understanding institutional resources. While themes were consistent across sub-groups within the sample, in this article we highlight some of the few observed differences based on type of transfer pathway and student status as Hispanic/Latino. Within the current system and operating structure of higher education, statewide and/or system wide efforts to collaborate and coordinate between institutions must occur at the college level, and more often at the department or program level, to properly address many of the long-standing issues that appear to be more acute for degree plans in engineering disciplines and for transfer students who pursue these pathways.

**Key words:** transfer students, persistence, student experience

## INTRODUCTION

For decades, there has been a strong demand for STEM professionals in the U.S. workforce, and based on national discourse, the demand for such professionals will continue to increase for the foreseeable future. To meet both current and future workforce needs, the President's Council of Advisors on Science and Technology projects that the United States will need to produce 1 million more STEM professionals by 2025 (PCAST 2012). As we think creatively about how to identify and train human talent to meet this demand, great potential exists among the growing population of students who begin their pursuits of higher education within the community college system. In addition, leveraging transfer pathways from 2-year institutions holds positive implications for equity and social justice (Dowd 2012, Jaggars et al. 2016, McLoughlin 2012, Terenzini et al. 2014,) because it expands opportunities for a broader spectrum of students (e.g., first-generation, ethnic/racial minorities, veterans, older students, students with disabilities) to participate in STEM fields and reap the financial benefits that often are associated with those kinds of careers (Dowd 2012).

According to the National Center for Education Statistics, 40% of first time in college (FTIC) students and 41% of all U.S. undergraduates during Fall 2015 were enrolled in 2-year public colleges; the headcount total for that academic year was 12.2 million students (AACC 2017). Although more than 80% of those students beginning at a 2-year public college intend to earn a bachelor's degree (Jenkins and Fink 2015), recent reports on transfer and mobility indicate that only 20–25% will actually transfer to a 4-year institution within a six year timeframe (Hossler et al. 2012, Shapiro et al. 2015). Even more disappointing, educational researchers posit that the transfer pathway into STEM is even narrower (Dowd 2012). Current literature on transfer students in STEM disciplines suggests that common barriers in their transitions from 2-year to 4-year institutions include: 1) inaccurate and/or passive transfer advising; 2) weak transfer/articulation policies; 3) lack of course transferability; 4) the sudden shift from a supportive environment to one with more competitive classrooms; 5) unfamiliarity with academic rigor and expectations at 4-year institutions; 6) feelings of isolation; and 7) poor experiences with financial aid (Blash et al. 2012, Dowd 2012, Laanan, Jackson, and Darrow 2010a, Lichtenstein et al. 2014, Packard, Gagnon, and Senas 2012).

Building on findings from these STEM-focused studies, our research (Ogilvie et al. 2017, 2016, 2015) seeks to expand the small body of literature on transfer students within engineering specifically (Ogilvie 2014). This particular study explores transfer students' experiences with transitioning into the middle years of engineering at their receiving Hispanic-Serving Institutions using a sample that is largely Hispanic/Latino (88%) and includes both vertical and lateral transfer students (i.e., vertical transfer connotes transitions from a 2- to 4-year institution, and lateral transfer connotes transitions between 4-year institutions). We aim to understand how students believed they were

supported in transitioning to these new institutions. More specifically, we report data and findings from 306 engineering transfer students' responses to open-ended survey questions that focused on how their sending institutions could have helped ease the transition, the elements that helped these students adjust to their new institution, and how their receiving institution could have smoothed their adjustments. Given that post-transfer transition experiences may vary across different groupings of transfer students (Ogilvie 2017, Ogilvie et al. 2016, 2015), we also explore and highlight a few of the differences that emerged between sub-groups (i.e., based on type of pathway, student status as Hispanic/Latino) within our study's sample of engineering transfer students who enrolled in Hispanic-Serving Institutions.

## RELEVANT LITERATURE

In the quest to understand transfer students' experiences with adjusting to their new institutions, researchers (e.g., Townsend and Wilson 2006, 2009, Owens 2007, Berger and Malaney 2003) often draw on theories of student integration (Tinto 1993, 1975) and student involvement (Astin 1984) for guidance. These theories have proven to be useful in understanding and explaining why some students persist in higher education and why others depart. Tinto's theory of student integration (1993) elucidates the importance of students' perceptions of fit with an institution—both academically and socially. Astin's theory of student involvement (1984) focuses on the importance of student effort with an emphasis on quantity and quality of that effort. In addition to these theories of integration and involvement, researchers have also drawn on theories of capital (Bourdieu 1986, Coleman 1988, Laanan, Starobin, and Eggleston 2010b, Lin 2001) to understand and explain differences in how transfer students navigate and experience adjustment processes at their new institutions (Laanan, Starobin, and Eggleston 2010b, Packard et al. 2011, Reyes 2011, Wolf-Wendel et al. 2004). Informed by Bourdieu's theories of cultural capital and social capital (Bourdieu 1986), researchers have designed studies to explore potential relationships that exist between transfer students' socioeconomic status and differences in their educational experiences and outcomes (Packard et al. 2011, Reyes 2011, Wolf-Wendel et al. 2004). Others, inspired by the explanatory power of these early forms of capital, have developed a much more specific "transfer student capital" – defined as an accumulation of knowledge about higher education that develops in a student as he or she interacts with faculty, receives academic advising and counseling, studies for coursework, navigates through university transfer policies to fulfill academic requirements, and proceeds through the transfer process from a 2-year institution to a 4-year institution (Laanan, Starobin, and Eggleston 2010b). In the following paragraphs, we highlight salient findings from research that has applied

these conceptual frameworks to understand post-transfer transition processes for transfer students in general, in STEM, and within engineering specifically.

In the *Higher Education: Handbook of Theory and Research*, Bahr et al. (2013) describe the body of work on post-transfer transition processes as "sporadic and unsystematic" (461). To begin addressing this issue, the authors provide an in-depth overview of prior research that focuses on post-transfer transition processes for community college students who transfer to 4-year institutions. In their review, the authors identify, define, operationalize, and synthesize findings for five concepts that most frequently emerge in the existing body of literature; among them include: integration, involvement, environmental pull, capital, and transfer receptivity. Studies focused on transfer students in STEM (Packard et al. 2011, Packard, Gagnon, and Senas 2012, Reyes 2011), and more specifically focused on transfer students in engineering (Blash et al. 2012a, Brawner and Mobley 2014, Laanan, Jackson, and Darrow 2010a, Laanan, Jackson, and Rover 2011, Mobley and Brawner 2013, Mobley, Shealy, and Brawner 2013, Young and Litzler 2013), have yielded important findings that span across one or more of the common areas/concepts identified by Bahr et al. (2013).

For example, Packard et al. (2011) interviewed 30 women on the transfer pathway in STEM, pre- and post-transfer, to explore their experiences with transitioning from community colleges to 4-year institutions. Findings from the study highlighted participants' challenges with integration (perception of fit) and environmental pull (competing priorities) during the post-transfer transition process. Participants encountered: 1) negative experiences with courses because of increased pace and rigor and less access to instructional faculty; 2) unwelcoming campuses where it was difficult to make friends and break into previously formed study groups; 3) feelings of marginalization when transfer students were left to sign-up for courses during late registration; 4) poor advising that lacked adequate detail to be helpful; and 5) financial pressures requiring them to work while going to school. Despite these challenges, Packard et al. (2011) found that participants' sense of belonging increased when they were able to connect with helpful faculty, advisors, and peers. With increased access to social capital on campus and participation in programs designed to create a receptive culture for transfer students, participants were able to make the adjustment and persist in their majors at their 4-year institutions.

In a smaller qualitative study on post-transfer transition experiences for women of color in STEM, Reyes (2011) identified similar challenges centered on integration, environmental pull, limited access to social capital, and lack of transfer receptivity. These women of color encountered "attitudes and treatment signaling that they [did] not belong because of age, ethnicity, and gender" or perceptions that transfer students lacked adequate preparation (Reyes 2011, 241). Participants reported that they lacked access to mentors that could help them navigate the post-transfer transition process, and they also struggled to "balance familial and cultural expectations" while attending college. Based

on the findings from the study, Reyes (2011) called for increased financial support to help students overcome environmental pull factors as well as pointed to the need for customized programs to support transfer students and enhance transfer receptivity on the receiving campus.

Within an engineering specific context, prior studies on post-transfer transition processes also have identified findings that reflect a culture where transfer receptivity may be lacking. For example, during post-transfer transition processes, engineering transfer students reported the need to adapt to and/or navigate a system designed primarily to serve traditional first time in college students directly out of high school (Brawner and Mobley 2014, Mobley and Brawner 2013). Researchers also noted that engineering transfer students would draw on multiple forms of capital to make up for inaccurate, inadequate, and/or passive academic advising and for orientation sessions that did not meet their needs (Blash et al. 2012, Mobley and Brawner 2013, Mobley, Shealy, and Brawner 2013); this reality could disadvantage some students more than others because of variations in accumulation of cultural, social, and transfer student capital (Mobley, Shealy, and Brawner 2013).

Also focused on the engineering context, Laanan and colleagues used a mixed methods research approach to identify factors that helped engineering transfer students adjust to their new 4-year institutions; students' responses spanned across multiple concepts of integration, involvement, capital, and transfer receptivity (Laanan, Jackson, and Rover 2011, Laanan, Jackson, and Darrow 2010a). Participants in their study (a sample that was predominantly traditional-aged, White, and male) most commonly cited: 1) using campus resources and participating in programs (involvement – quality of effort); 2) making friends with students in the same major (integration – perception of fit); 3) connecting with helpful faculty members/staff/advisors (expanded social capital network); and 4) support from family and friends who previously attended the institution (existing capital) (Laanan, Jackson, and Rover 2011, Laanan, Jackson, and Darrow 2010a). When asked what their sending institutions could have done to help them better prepare for the transition to their receiving institutions, participants recommended improved and more accurate advising, more rigorous and transferable courses, and more exposure to experiences and expectations that emulate what they could expect at the receiving institutions (Laanan, Jackson, and Rover 2011, Laanan, Jackson, and Darrow 2010a).

Although there has been some prior work focused on engineering transfer students, it has been quite limited and has just begun to scratch the surface in investigating how to support this diverse population of students. In their review and critique of the literature on post-transfer transition processes, Bahr et al. (2013) offered multiple recommendations to improve and advance future research in the area; among these include the need for more: 1) multi-institutional studies; 2) longitudinal studies; and 3) discipline specific studies. Our discipline-specific, multi-institutional study responds directly to two of those recommendations. Guided by theories of student integration (Tinto 1993), student involvement (Astin 1984), and capital (Bourdieu 1986, Coleman 1988, Laanan, Starobin, and

Eggleston 2010b, Lin 2001), this study builds on findings from prior research presented in this review and seeks to expand the small body of literature on engineering transfer students. Using student reflection data from survey research, we identify factors that helped engineering transfer students adjust to 4-year Hispanic-Serving Institutions as well as areas in which transfer students identify additional needed supported from sending and receiving institutions. By asking engineering transfer students to reflect on their post-transfer transition experiences, we learn more about factors (e.g., transfer receptivity, environmental pull, cultural/social/transfer student capital) that affect transfer students' integration and involvement.

## RESEARCH QUESTIONS

To enhance understanding of how to better integrate transfer students into the middle years of the undergraduate engineering experience within the specific context of Hispanic-Serving Institutions, this investigation explores the following: When engineering transfer students are asked to reflect on their transitions to their receiving institutions, what themes emerge in regard to: (1) Factors that helped them adjust to the receiving institution?; (2) How the *sending* institution could have enhanced their success or eased their transition?; (3) How the *receiving* institution could have enhanced their success or eased their transition?

## DATA AND METHODS

This article draws on data that were collected as a small piece of a largescale study sponsored by the National Science Foundation (NSF) (award number EEC - 1428502) that seeks to better understand the transfer process in engineering to enhance the transfer student pathway to an engineering bachelor's degree (Ogilvie et al. 2016, 2015). Following a mixed methods research approach and using the transfer student capital conceptual framework to organize the study (Ogilvie et al. 2016), the project incorporates survey data linked to academic records from a sample of engineering transfer students who successfully transferred as new engineering students to one of four 4-year Texas institutions between 2007 and 2014—two of those institutions are Hispanic-Serving Institutions, and two are Predominantly White Institutions. These institutional sites included four of the top ten producers of U.S. Hispanic engineers (ASEE 2012), three are universities with high research activity (CFAT 2010), and each site is a large, 4-year, primarily non-residential, public institution. The larger NSF study also includes qualitative data from 18 semi-structured focus groups

with 84 students, administrators, faculty, and staff who represented those four 4-year institutions as well as their partner community colleges.

This article focuses on the study's two Hispanic-Serving Institutions (HSIs) with undergraduate profiles classified as medium-sized, full-time, 4-year, and inclusive (CFAT 2010). To increase understanding of transfer students' experiences with transitioning into the middle years of engineering at receiving Hispanic-Serving Institutions, we analyze the following three open-ended items from the cross-sectional survey data that were collected in Summer/Fall 2015; each survey item maps onto a research question:

- What might your sending institution have done to enhance your success or ease the transition to [receiving institution]? [Maps to RQ2]
- What factors helped you adjust to [receiving institution]? [Maps to RQ1]
- What might [receiving institution] have done to enhance your success or ease the transition from your other institution? [Maps to RQ3]

These items were spread throughout the full survey (described in (Ogilvie et al. 2015))—the first followed a series of Likert-style items, and the second and third appeared sequentially following a separate section of Likert-style items.

Table 1 describes the final student sample from these two HSIs, which is largely Hispanic/Latino and includes both vertical and lateral transfer students. At each institution, students and alumni (who transferred to each HSI between 2007 and 2014) received an email with a link to the survey from an administrator at the institution. Administrators sent two to three follow-up emails to encourage participation in the study, and 12% of the population of transfer students from within the period of record completed the survey. Although a higher response rate is always desired for quantitative analyses, this article focuses on the open-ended, qualitative responses from 306 transfer students, which is a sufficient sample size for qualitative analyses.

The gender breakdown approximates the national average within undergraduate engineering, and the sample includes an overrepresentation of Hispanic/Latino students. While we do not seek to generalize our results to all institutions nationwide because of this demographic discrepancy, we do believe this research has the potential to guide institutions as they seek to adopt new pathways into engineering for this underrepresented group – a fast growing minority group in America. Based on 2013 data from the U.S. Census Bureau (2014), Hispanics represented 17.1% of the population in the United States; by 2050, it is projected that this figure will grow to more than 30% of the U.S population (U.S. Census 2012). Nationwide, 40 states have experienced a more than 50% change in Hispanic population between 2000 and 2011 (U.S. Census 2012), and the top 10 fastest growing Hispanic states experienced a more than 100% change in Hispanic population during the same period, ranging from a 103% change in Georgia to a 158% change in Alabama (Pew 2013).

***Table 1. Characteristics of the student sample.***

| **Sample size** | **n=306** |
|---|---|
| **Response Rate** | **12%** |
| Gender | |
| Male | 82% |
| Female | 18% |
| Race/Ethnicity | |
| Asian | 1.0% |
| Black or African American | 1.0% |
| Caucasian | 6.2% |
| Hispanic or Latino | 81.0% |
| Multi-racial | 0.3% |
| Foreign or International | 9.8% |
| Preferred not to report | 0.7% |
| Enrollment Status | |
| Current Student | 75% |
| Alumni | 21% |
| No Longer Enrolled | 4% |
| Type of Transfer Pathway | |
| Vertical Transfer (2yr to 4yr) | 63% |
| Lateral Transfer (4yr to 4yr) | 37% |

Findings from our study may be most relevant and applicable to institutions located in fast growing Hispanic states that are strategically planning for the future of higher education and a shift in student demographics.

To analyze students' responses, we followed an inductive, constant comparative method (Patton 2002, Robson 2011). As the nature of this particular analysis was exploratory and did not seek to test an existing framework, we did not impose a coding scheme but instead allowed codes and higher-level themes to emerge from the responses. The lead author maintained a code book to guide the coding process and coded each response individually. The second author provided peer auditing of the results to enhance the validity of the resulting themes. We also present representative quotes of each theme in the Findings section so that the reader can determine the alignment between the textual data with the resultant themes (Creswell 2009). Finally, recognizing that post-transfer transition experiences may vary by sub-group (Ogilvie 2017, Ogilvie et al. 2016, 2015), we also explored differences between sub-groups within our study's sample based on type of transfer pathway and student status as Hispanic/Latino.

## FINDINGS AND DISCUSSION

### Factors that Helped Engineering Transfer Students Adjust to the Receiving Institution

Following our coding process of the transfer students' open-ended responses, six themes emerged about factors that students pointed to as helping them adjust to the receiving institution: individual/self, personal network, familiarity with environment, polite/helpful atmosphere, institutional resources, and student involvement. The sections that follow define and describe each of those themes.

*Individual/self*: Within this theme, students identified themselves as the primary factor that helped them adjust to the receiving institution, often describing themselves as self-directed, self-motivated, or driven by specific personal and/or academic goals. Some identified specific individual actions and behaviors that helped with the adjustment such as being focused and committed to the task at hand, spending time on campus, or attending classes regularly. Others pointed to having the personal knowledge regarding where to go for help as being critical in their ability to adjust to the receiving institution. This theme also encapsulated students who pointed to having prior experience from work, the military, or a previous institution that helped ease the adjustment to the new institution. As described by one participant:

> "I attended one community college and two other 4-year universities before attending [receiving institution]. I already knew what to expect."

Finally, some respondents indicated that they did not feel like an adjustment was required and did not need to rely on any external factors to facilitate this transition.

*Personal network:* Respondents also pointed to relying on their personal networks to help with their adjustment to receiving institutions. Students cited multiple forms of personal networks comprised of family, friends, faculty members, and staff. In terms of frequency of mentions and depth at which they were described, personal networks that incorporated faculty members and academic peers appeared to carry more weight or value to students as they reflected on their adjustments.

When it came to academic peers, students indicated that peers who shared similar experiences with them played a key role in their adjustments to their new institutions. At one of the two study sites, students pointed out that some of these peer relationships had formed at their sending institutions and were carried over with them to the receiving institution. Students described several ways that their peer networks helped them adjust, such as learning and working in study groups and/or having academic peers (both transfer and non-transfer) introduce them to the local landscape and show them how things worked at the receiving institution. The following example

statements from participants illustrate both prior and newly formed peer relationships that they deemed valuable:

> "The fact that most of the classmates I met at [sending institution] transferred to [receiving institution] with me and that helped a lot."

> "…having someone who [could] help me for the first semester on places to study [and] do homework in."

> "…meeting new people that helped me understand how things worked around campus."

For engineering transfer students at both study sites, personal networks with faculty members surfaced as a common factor in their adjustments to the receiving institution. One participant shared the following observation of faculty members' desire to facilitate student success:

> "The professors seemed to enjoy teaching and concerned themselves with helping the students learn and progress toward their future goals."

At one of the two sites, students went a step further and identified a select group of faculty members who took more active roles in helping students through their adjustments:

> "When the admissions department declined a lot of my transfer credits because of vague course descriptions given by the previous institution, the [Engineering Department Director] helped in determining which courses were equivalent to the ones offered by [receiving institution]. [He/She] also referred me to a professor for a research opportunity that aligned with my interests."

Such individualized interactions appeared to make a difference as students adjusted to their new educational environments. Students also acknowledged personal networks with staff, however, this kind of interaction was cited less often than interactions with faculty members.

*Familiarity with environment:* Participants also described familiarity with the environment, defined broadly, as a factor that helped them adjust to their new institutions. Areas commonly cited by students can be organized into two primary groups: 1) familiarity with the physical location and region and/or proximity to home and family; and 2) familiarity with the ethnic group or culture in the region, the language(s) spoken in the region, and the institutional culture at the receiving

institution. A short elaboration, followed by example statements, is provided for each of these two primary groups.

First, participant responses that focused on familiarity with the physical location and region and/or proximity to home and family included comments such as, "I am from [the area] so it wasn't a big adjustment for me" or "my family is located here [and] that has been a huge factor to [help me] adjust." Others more simply stated "being close to home" or "having family close to me" was helpful for the transition.

Second, culture and language emerged together (more often than not) in participants' responses that focused on familiarity with the ethnic group or culture in the region, the language(s) spoken in the region, and the institutional culture at the receiving institution. At both study sites, participants identified special characteristics unique to these regions (e.g., ethnic group, culture, and particular use of language), that also permeated through the institutions. Participants explained that familiarity with the ethnic group, culture and particular use of language in the region helped them adjustment as they transitioned to their new institutions. As described by multiple participants in the following example statements:

> "..people speaking Spanish and having the same culture. The Latino culture is something I am a part of and allowed me to connect my thoughts and actions with other people."

> "...the [regional] community and the language that [receiving institution] faculty and students have."

> "...Mexican-American culture, the Spanish speaking students, classmates' similar backgrounds."

*Polite/Helpful Atmosphere:* Under this theme, students' responses focused on their campus environment – describing it as friendly, welcoming, and non-competitive. Students pointed to the institutional culture or atmosphere that was created by friendly and welcoming people as facilitating their transitions. Some responses used the general term "people" and others were more specific – citing faculty members, staff, students, and/or the student body as whole. As an example, one participant expressed that "the faculty and staff were extremely welcoming and helpful." While this experience did not hold across all survey respondents, the sentiment was common across a large number of responses from engineering transfer students at both study sites.

*Institutional resources:* Student responses in this theme identified specific offices that were instrumental in their adjustments to the receiving institutions. Offices that students pointed to included

engineering discipline specific offices (e.g., Electrical Engineering Department), college-wide offices (e.g., Engineering Student Services), and university-wide offices focused on unique student populations (e.g., students in the military, students with disabilities). The following example statement is from a participant describing the importance of student services:

> "The [student services] office was instrumental in making me feel like I could succeed. I would rate them 10/10 for being caring, considerate, prompt, friendly, and generally all-around wonderful. Though I had only a few different engineering professors, they were understanding and helpful as I figured out where I fit."

In this theme, students also identified physical spaces (e.g., study room, computer lab) and tutoring services provided by the receiving institution that were important factors in their adjustment.

*Student involvement:* Students also pointed to involvement opportunities that enabled them to adjust and integrate into the receiving institution. Beyond the traditional curriculum, these involvement opportunities, often sponsored or facilitated by the receiving institution, lowered the barrier for integration by providing transfer students with added reasons to engage with faculty members, staff, and academic peers outside of the classroom. Some students identified "opportunities on campus" more broadly and others specifically asserted that involvement in student organizations, undergraduate research, work study or on-campus employment, and living on campus were key factors that helped them integrate into the institution. As described by one participant:

> "There were also various organizations and social activities offer[ed] to the students free of charge all year round, which created a fun social environment for students unfamiliar with the area."

Student responses in this theme also identified enrollment in core engineering and/or major-specific courses as a form of "involvement" that enabled them to establish a network of peers for support. By enrolling in major-specific courses, students indicated that they "finally found a group of students that would also be in their other classes" during the immediate and subsequent semesters.

*Other:* This last theme includes students' responses that stated, for example, "it just took time" to make the adjustment. Relatively few students identified orientation as a factor that helped them adjust to the receiving institution. More often, students offered recommendations or suggestions on how the institution might modify orientation; specific recommendations are captured in the section titled *How the Receiving Institution Could Have Enhanced Success or Eased Transition*.

**How the *Sending Institution* Could Have Eased Transition or Enhanced Success**

When engineering transfer students were asked how their sending institutions could have enhanced their success or eased their transition, approximately one-third expressed that they were satisfied with the sending institutions' approach. Others indicated that they could not think of any specific changes or recommendations. More than half of the students, however, offered recommendations that focused on: information, academic curriculum, and institutional process.

*Information:* In this theme, students' responses focus on information that would help identify a clear path to an engineering degree. Most students wanted counselors and advisors at the sending institution to provide them with better and more accurate information about classes that would count towards an engineering degree at a 4-year institution. The following example statements from two participants captured these recommendations for improvement:

> "...[sending institution should] have more accurate information about the transfer process and the course requirements for the major."

> "I think if they had more help in advising that could be focused for potential engineering students then that could have possibly made the transition easier. I could [have] spent more of my time and focus on the important classes that pertained to engineering instead of wasting time on the classes that didn't pertain to engineering since I was told I needed to remain full time in order to get financial aid."

The students asked for more academic advising and wished that counselors and advisors had highlighted or warned them about multi-semester sequence requirements for Calculus in engineering degree plans. They also wanted more information and multiple training opportunities to learn how the transfer process works in general, and how to navigate a new institution and identify similarities and differences in institutional processes (e.g. registration, advising, degree plans, and transferable courses for engineering).

*Academic curriculum:* In this theme, students' responses included requests and recommendations that focused on the academic curriculum. Many students commented that they wanted the sending institution to do a better job of aligning the curriculum between the two institutions so that more courses would count towards an engineering degree at the receiving institution. A fraction of the students, primarily from one of the two study sites, suggested that the sending institutions could have increased the intensity and rigor of the curriculum so that they would be better prepared for courses at the receiving institution; two-thirds of those students attended the same sending institution. The

following example statements capture participants' reflections on the need for increased rigor in mathematics courses to prepare engineering students for future coursework:

> "...math courses could have been geared towards engineering course prep."

> "...been tougher on the calculus classes; especially calculus I since that's the basis for calculus II, III, and differential equations. It looked like and was mentioned that calculus I was made easier because a lot of the majors had [to take] it as the maximum amount of math needed for their degrees so it was easy to pass."

Other students provided more general comments on the need to improve quality and quantity of course content to more closely represent the courses offered at 4-year institutions, as demonstrated by the following example responses:

> "According to my transfer experience the quantity and quality of material offered at [sending institution] is lower than the one offered at [receiving institution]. Trying to [adjust] to [receiving institution] after my transfer was a little bit hard because I needed extra time to learn material by myself. An improvement in the quality of education at [sending institution] is needed to prepare students when they transfer to [a 4-year] college."

> "...closely approximate the difficulty of each class and have similar [a] syllabus."

> "...meet the same intensity and thoroughness in coursework and lecture."

Students also asked for more assistance out of class with course content and homework, and they wanted more preparation and review courses at the sending institution in the areas of mathematics and computer programming. In a few cases, students pointed out that improved instruction (i.e. "better/challenging instructors") at the sending institution would have helped them with their transitions to their receiving institutions.

*Institutional process:* This last theme captures a small number of student responses that commented on issues related to work processes at their sending institutions. Specifically, these students suggested that the sending institutions could improve timeliness and documentation to help students receive proper advising at the receiving institution based on completed coursework and earned transfer credits documented in their official student record. Having that student-level data waiting with the receiving institution upon their matriculation would have been one way to smooth the transition process.

**How the *Receiving Institution* Could Have Enhanced Success or Eased Transition**

When engineering transfer students were asked how their receiving institutions could have enhanced their success or eased the transition to their new institutions, student responses included requests for more assistance with: getting involved on campus, building personal networks, and understanding institutional resources. They stressed the importance of and desire to establish personal connections and expand their knowledge of resources within engineering and their specific major.

Approximately one-fifth of respondents expressed that they were satisfied with the receiving institutions' approaches, and less than one-tenth indicated that they could not think of any changes or recommendations to offer. Conversely, some students indicated feeling like an outsider, especially in environments where study groups were already established from previous semesters.

*Getting involved on campus:* Students expressed that they were trying to make up for lost time and felt that non-transfer students had more established relationships with faculty and staff. They felt that those established relationships enabled them to access more curricular and co-curricular opportunities. The following is an example of one participant describing how they felt alienated at the receiving institution:

> "One thing I disliked from being a transfer student…the non-transfer students had first pick at the research/projects/clubs because the staff already knows them. It made me feel alienated."

On-campus employment is one way to help students connect and get familiar with a new campus. As described by one participant, "getting a work study job helped me learn the in's and out's of the school and how it worked."

*Building personal networks:* Students asked for more events and opportunities (both during and after orientation) to get to know faculty, staff, and students—both transfers and non-transfers—in their engineering departments. Respondents also encouraged departments and colleges to help transfer students identify one another and suggested offering a peer mentor program specifically designed for transfer students. They believed that having a peer mentor with the same major offered greater value than having a peer mentor who was a transfer student but did not share the same major. The following example statements from three participants captured these recommendations for improvement:

> "…[help me] look for a group of people from my same background (major) to understand how life at [receiving institution] works"

> "It might help if the engineering program assigns not only an adviser but, an engineering student as a mentor who could provide guidance to the student. In this way, the mentor could give advice to the student based on his/her experience as an engineering student."

> "Maybe have a mentorship program for transfer students. This would allow for transfer students to learn from the experiences of others."

They also expressed interests in discipline-specific study rooms and tutoring services to help integrate transfer students with non-transfer students in the department.

*Understanding institutional resources:* Many students requested a follow-up to orientation or a class/seminar for transfer students to provide more in-depth training and briefing on institutional processes, policies, expectations, and resources (e.g., registration, advising, learning management systems, academic policies, on-line tools, student organizations, career services). The following example statements capture participants' recommendations and personal experiences with learning new systems at their receiving institutions:

> "At first, it is very hard to understand which department is in charge of what and who to talk in order to get help."

> "[the receiving institution should offer] a class for transfer students."

> "Explain a lot of the standard processes such as registration. A lot of the processes were very different from my previous institution (which I expected), however, as I assumed a few key systems were similar (due to both institutions being part of the [university] system). It was fairly difficult to navigate [receiving institution's] system. Also parts of the transfer process proved to not be the most intuitive."

> "Outline every process that you must go through in detail for those who have never been to a "formal" educational institution. I had to learn how to register, file for financial aid, drop classes, and pay [receiving institution] for parking/fees all on my own with no help. Explain what is covered and what is not covered by financial aid. For example, I was charged a student services fee of 150 bucks or something to that effect, I thought my financial aid would cover it, but instead I got dropped from the class. I did NOT know that my financial aid would NOT cover it."

While many institutions offer such resources to incoming first-year students as introductory student success seminars, transfer students felt like those kinds of activities would also help meet their needs.

*Other:* Other recommendations from respondents included requests for more advising as well as having the receiving institution employ more academic advisors specially trained and designated for transfer students. Students expressed frustration with delays in getting transfer credits posted to their academic records/files, which mirrored some of the feedback for sending institutions. Additionally, respondents were frustrated that they were often bounced around the institution or sent back and forth between offices when trying to secure answers to academic and/or transfer credit questions. Clarifying the roles of different offices or communicating to students the proper outlets for certain kinds of questions would reduce the burden that these students face in navigating a new institution. In regions of Texas with established 2-year / 4-year institutional partnerships, students also recommended that specific professors be assigned to teach transition courses at both campuses to bridge gaps or minimize differences in expectations of academic rigor.

**Differences between Transfer Students Based on Pathway & Status as Hispanic/Latino**

We found that themes presented in the previous 3 sections were generally consistent across sub-groups of transfer students within the sample. Students tended to point to similar ideas for how these Hispanic-Serving Institutions could help with their transitions. However, we did identify some minor differences in response patterns based on type of transfer pathway and student status as Hispanic/Latino.

For example, with respect to factors that helped students adjust, a larger share of Hispanic/Latino students cited their personal network compared to non-Hispanic/Latino students (one-third compared to one-fifth, respectively). Similarly, a larger share of vertical transfer students cited their personal network compared to lateral students (one-third compared to one-fourth, respectively). With respect to how sending institutions could have helped ease the transition, a larger share of Hispanic/Latino students, compared to their respective counterparts, cited the need for more information (one-fourth compared to one-tenth) and enhancements related to the academic curriculum (one-eighth compared to one-twentieth). And finally, a larger share of vertical transfer students cited the need for enhancements related to the academic curriculum compared to lateral students (one-fifth compared to one-twentieth). We did not observe differences between sub-groups of transfer students with respect to how receiving institutions could have helped ease the transition. In summary, while we saw a few differences between subgroupings of students, it did appear that the transfer students in our sample at these Hispanic-Serving Institutions shared similar experiences with their transitions, regardless of their race/ethnicity or pathway.

## IMPLICATIONS FOR POLICY AND PRACTICE

In this study, we identified factors that helped engineering transfer students adjust to 4-year institutions. We also learned from students' recommendations of areas that could use additional support from the perspective of both sending and receiving institutions. Our results have multiple implications for policy and practice across institutional sectors.

First, improved coordination across 2-year and 4-year institutions of higher education could address multiple areas in which students requested more support. These areas for improvement included the need for: 1) more accurate advising (pre-transfer) that is engineering discipline specific (i.e., mechanical, electrical, civil), and in some cases institution specific; 2) better aligned curriculum that allows students to take more courses at 2-year institutions that actually count towards fulfilling requirements for engineering degree completion and not only for transfer credit; and 3) access to courses at 2-year institutions that reflect the rigor and intensity of engineering courses commonly offered at 4-year institutions. Statewide and/or system wide collaboration and coordination between institutions of higher education at the college and department levels may be required to properly address many of these long-standing issues that appear to be more acute for degree plans in engineering disciplines and for transfer students who pursue these pathways. A promising model that embodies the level of coordination necessary to meet the needs of prospective engineering students is Texas A&M's Engineering Academy (Cortez et al. 2015, Perez et al. 2016). This co-enrollment program employs an innovative approach to address precisely the areas in which students requested more support (i.e., improved/accurate advising, better aligned curriculum, early exposure to rigorous engineering courses). Program administrators work across multiple 2-year institutions to open and clear the transfer pathway to an engineering degree at a highly ranked, selective engineering program. Broadening access to such an educational opportunity holds important equity implications, especially for students from groups historically underrepresented in higher education and in engineering disciplines.

Second, receiving institutions could be more intentional in their efforts to create experiences (i.e., activities, events, programs, learning communities) for engineering transfers students to fast-track their integration into the institution. While standard orientation programs attempt to brief transfer students on the institution and get them registered for class, a one to three day intensive orientation experience falls short in areas where students requested more support. Engineering transfer students seek increased opportunities in which they can more quickly integrate into their department, connect to students with shared experiences, and form community within their major. Colleges and departments should consider offering an extended orientation in the form of a weekly seminar (perhaps over the course of a semester) to meet the needs of engineering transfer students. The seminar could

be designed to accomplish the following: 1) introduce transfer students to key faculty and staff in the college and/or department; 2) introduce transfer students to special services, programs, and opportunities that are offered in the co-curriculum by the college and/or departments; and 3) form a learning community where in which engineering transfer students can connect with peers and mentors in their same major. Creating opportunities for engineering transfer students to access and form connections with non-transfer students in their major is equally, if not more important. Non-transfer students who are already familiar with the culture and landscape of the institution can serve as invaluable funds of knowledge to transfer students who are new to the institution.

Finally, given that student mobility across institutions is likely to increase in the future rather than decrease, it will be increasingly important for institutions to identify and/or formalize the role of institutional agents at the college and department level who are trained and authorized to resolve issues unique to engineering transfer students (i.e., advising, identifying transferable courses, approving credits). Institutional agents at 4-year institutions who specialize in addressing the needs of engineering transfer students can play a critical role in easing their transitions into the middle years of engineering, which already pose challenges for many engineering students regardless of their transfer status (Lord and Chen 2014). These same institutional agents who focus on addressing issues unique to engineering transfers students also hold great potential to leverage even more human talent from students who currently reside in 2-year institutions and have aspirations to transfer into engineering programs at 4-year institutions. With more organized and intentional institutional support, a greater percentage of that potential talent might have the opportunity to become realized talent and earn a bachelor's degree in engineering.

## FUTURE RESEARCH

We recognize that the research presented in this article focuses on students who transfer into engineering at HSIs, which is a very specific and unique institutional context. These findings might not translate to the Predominantly While Institutions (PWIs) that enroll a very high percentage of the nation's engineering undergraduates. Thus, we recently completed a similar analysis for engineering transfer students who are enrolled in PWIs (Davis, Ogilvie, and Knight 2017). The next step in our research plan is to identify similarities and differences across institutional types (i.e., Predominantly White institutions versus Hispanic-Serving Institutions) and across sub-groups of students (e.g., vertical versus lateral transfer students). That research will determine the extent to which these ideas for facilitating successful transfer extend across contexts or whether certain practices are best suited for certain settings and student demographics. Although beyond the scope of our funded study

and likely challenging to build sufficient sample sizes of willing participants, future work should also consider students who wanted to transfer into a 4-year engineering program but were unable to navigate this pathway. Identifying pain points from their perspectives would provide invaluable ideas for enhancing this pathway so that more students can successfully reach their goals.

## CONCLUSIONS

To make the transfer student pathway viable to meet workforce needs, it is essential to think beyond simply linking two institutions and getting students in the door—students need to be supported throughout the adjustment period, and this study addresses that "support" aspect of the problem. Engineering transfer students' open-ended survey responses to three separate survey items were analyzed to gain ideas from individuals who have successfully navigated the transfer pathway. Elements that helped engineering transfer students adjust to the receiving institution comprise six themes: individual/self, personal network, familiarity with environment, polite/helpful atmosphere, institutional resources, and student involvement. Student recommendations on how sending institutions could have helped the students focused on information, academic curriculum, and institutional process. Recommendations for receiving institutions included requests for more assistance with getting involved on campus, building personal networks, and understanding institutional resources.

Within the current system and operating structure of higher education, statewide and/or system wide efforts to collaborate and coordinate between institutions must occur at the college level, and more often at department/program level, to properly address many of these long-standing issues that appear to be more acute for degree plans in engineering disciplines and for transfer students who pursue these pathways.

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