Easing engineering transfer students' transitions: Recommendations from students who successfully navigated the transfer pathway

Kirsten A Davis, Virginia Tech

Kirsten is a PhD student in Engineering Education at Virginia Tech, where she also completed her master's degree in Higher Education. She has previously worked in industry in the field of IT analytics and has experience with corporate recruiting. Her primary research interests are engineering study abroad, developing intercultural competency in engineering students, and international higher education.

Dr. Andrea M. Ogilvie P.E., Virginia Tech

Andrea M. Ogilvie, P.E. is a Postdoctoral Associate in the Department of Engineering Education at Virginia Tech. Currently, she is investigating "Transfer Student Pathways to Engineering Degrees" through a multi-institutional study based in Texas and funded by NSF (EEC-1428502). Prior to joining Virginia Tech, Andrea served as the Director of the Equal Opportunity in Engineering (EOE) Program at The University of Texas at Austin for 11 years. During her term, she raised $3.7 million-plus in private and public grants to support the EOE program and its mission. Andrea holds multiple degrees in engineering and public affairs from UT Austin (BSCE, MPAff) and Virginia Tech (MS ISE, PhD ENGE). Her expertise includes: program management, program assessment, university-industry partnerships, grant writing, and student development in the co-curricular learning environment with a special focus on recruiting, supporting, and graduating students from groups historically underrepresented in engineering.

Dr. David B Knight, Virginia Polytechnic Institute and State University

David Knight is an Assistant Professor and Director of International Engagement in the Department of Engineering Education and affiliate faculty with the Higher Education Program, Center for Human-Computer Interaction, and Human-Centered Design Program. His research tend to be at the macro-scale, focused on a systems-level perspective of how engineering education can become more effective, efficient, and inclusive.

Easing Engineering Transfer Students' Transitions:
Recommendations from Students
Who Successfully Navigated the Transfer Pathway

I. Introduction

In 2012, the President's Council of Advisors on Science and Technology documented the need to prepare more than 1 million additional STEM professionals in the U.S. workforce over the next decade. To meet this demand, leveraging the transfer pathway between two-year and four year institutions is an approach that has garnered increased interest. In addition to adopting guided pathways model to move students logistically from one institution to another, it is critical for 2-year and 4-year institutions to offer multiple kinds of support for students to facilitate their smooth and successful integration into their new educational environments during the post-transfer transition process.

The current body of literature on engineering transfer students' experience with the post-transfer transition process is limited but growing.[1,2] However, a larger and more substantial body of literature on post-transfer transition processes exists for transfer students in general.[3] Critics of this larger body of literature argue that prior research on transfer students' adjustments to four-year institutions is focused primarily on linking student characteristics to academic performance outcomes, and much of it is dominated by conversations around Hills' concept of transfer shock.[4] This phenomenon is when a student experiences a decrease in grade point average when they transfer from a two-year to a four-year institution. To move beyond transfer shock and further enhance transfer pathways as a more efficient and effective mechanism to attain baccalaureate degrees, education researchers are calling for a shift in future research—less emphasis on input/output models (e.g., student characteristics / performance outcomes), and more focus on processes or what happens to transfer students' between entry and exit.[5] This study seeks to fill this need.

The purpose of our research is two-fold: (1) to increase understanding of factors that helped engineering transfer students' make the adjustment to their new receiving institutions; and (2) to increase awareness of opportunities to enhance transfer receptivity at four-year institutions for transfer students in engineering programs. More specifically, we explore the following research questions:

RQ1: When engineering transfer students are asked to reflect on their transitions to their receiving institutions, what themes emerge regarding:
   a. Factors that helped them adjust to the receiving institution?
   b. How the *sending* institution could have enhanced their success or eased their transition?
   c. How the *receiving* institution could have enhanced their success or eased their transition?

RQ2: What are the differences, if any, between vertical (i.e., from two year to four year institutions) and lateral (i.e., between four year institutions) transfer students?

To answer these questions, we draw on data collected from a larger mixed methods research project funded by the National Science Foundation to explore transfer pathways to engineering degrees. Studies designed to explore transfer students' experience with post-transfer processes at four-year institutions, such as the one presented herein, hold great potential to yield findings that can be used inform policies and practices that can ease the transition process for future transfer students.

II. Relevant Literature

In the *Higher Education: Handbook of Theory and Research,* Bahr, et al.[3] provide an in-depth summary and critique of prior research that focuses on post-transfer transition processes for community college students who transfer to four-year institutions.[3] 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*. In the following paragraphs, we briefly introduce each concept, explain its relevance to transfer student persistence, and point to a small number of relevant studies for readers who seek a more in depth review.

In this context, the concept *integration* is inspired by Tinto's theory of integration which draws attention to the relationship between students' perception of fit – academically and socially – within the institution and their persistence.[6] Guided by Tinto's theory of integration, multiple studies have been designed to explore and identify factors that contribute to or hinder transfer students' academic and social integration at large, public universities.[7-9] An example of a finding on integration is that certain institutional characteristics (e.g., size of institution, research focused mission, classes held in large lecture halls, student body primarily full-time traditional age college students) can serve as hindrances to transfer student integration in terms of their perception of fit academically and socially.[7]

The concept of *involvement* is inspired by Astin's theory of involvement which keys in on student effort and links the quantity and quality of students' effort directly to their learning and outcomes.[10] Studies informed by Astin's theory of involvement have focused on measuring and comparing the quantity and quality of transfer students' actions dedicated to studying, interacting with faculty and academic advising staff/ peers, and participating in student organizations and other extra-curricular activity at both the sending and receiving institution.[11,12] Berger and Malaney explored relationships between measures of transfer student involvement both at the community college and university, academic performance, and satisfaction with the university.[11] In their regression analysis, they found that transfer students who reported higher levels of engagement with their university peers were more likely to report higher levels of satisfaction with the university but less likely to have a higher university GPA. Relationships between performance and satisfaction with other measures of student involvement (e.g., studying/homework, clubs/activities) were not statistically significant.

The concept of *environmental pull* is a term used to describe external factors and/or competing demands that detract students from pursuing their academic goals or commitments. Multiple studies have explored and identified pull factors that affect transfer students.[7-9,13,14] Findings from these studies indicate that environmental pull (e.g., financial concerns, need to

work while going to school, living/working off-campus, family responsibilities) can impede transfer students' integration (their perceptions of fit) and involvement (their quality and quantity of effort).

The concept of *capital* originates from Bourdieu's[15] theories of cultural capital and social capital and has been expanded on by other theorists over the years.[16,17] Theories of capital have proven to be useful in understanding and explaining differences in students' educational experiences and outcomes. Informed by theories of cultural and social capital, researchers have conducted studies to investigate how students' socioeconomic status affects their experiences with navigating and adjusting to the receiving institution and how they access information in their network.[13,18,19] Prior research indicates that transfer students draw on multiple forms of capital to navigate post-transfer transition processes. Moreover, institutional agents (e.g., faculty, academic advisor, peer mentor) with access to information and resources that facilitate student integration and involvement can play a significant role in easing the transition process for transfer students with limited and/or varying levels of capital.[13,18]

Finally, the concept of *transfer receptivity* is a term used to describe the culture at four-year institutions with respect to the institutions' commitment to fostering a campus climate and designing policies and programs that facilitate transfer student integration and involvement. Studies focused on transfer receptivity have explored transfer students' perceptions of and experiences with transfer stigma at their receiving institutions.[13,20,21] Other studies have explored transfer students' perceptions of and experiences with programs and services offered at their receiving institutions to assist them with the post-transfer transition process.[1,2,7,9,18] Townsend and Wilson found that transfer students often wanted more help from receiving institutions than was offered, especially during the early weeks of the transition period.[7]

Guided and informed by theories and research findings presented in this review, our study responds directly to calls for more research on "students' experiences with post-transfer transition processes" that is multi-institutional and academic-discipline specific.[3] In this investigation, we focus specifically on engineering transfer students and their experiences with post-transfer transition processes at two, large, public, predominantly white, research-intensive institutions. By asking engineering transfer students to reflect on their post-transfer experiences at their receiving institutions and identify factors that facilitated their adjustments, we learned more about factors (e.g., *transfer receptivity*, *capital*, *environmental pull*) that affect transfer students' *integration* (perception of fit) and *involvement* (quantity and quality of student effort). Additionally, by asking engineering transfer students to make recommendations on what their sending and receiving institutions could have done to enhance their success or ease their transitions, we learned more about opportunities to improve *transfer receptivity*. Findings from this investigation further expand the small body of literature on engineering transfer students and their experiences with post-transfer transition processes.[1,2,19,22,23,24,25]

III. Methods

This study draws on data that were collected for a largescale study sponsored by the National Science Foundation (Grant No. 1428502). That project focuses on the transfer process in engineering and seeks to enhance the opportunities for this pathway to serve as an efficient,

effective, and inclusive mechanism for students to earn an engineering bachelor's degree.[26,27] 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 four-year Texas institutions between 2007 and 2014—two of those institutions are Hispanic-Serving Institutions, and two are Predominantly White Institutions (PWIs). These institutional sites include four of the top ten producers of U.S. Hispanic engineers,[28] three are universities with high research activity,[29] and each site is a large, four-year, public institution.

This investigation focuses on transfer students who matriculated at the study's two predominantly white, research-intensive 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 previous institution have done to enhance your success or ease the transition to [receiving institution]? [Maps to RQ1b]
- What factors helped you adjust to [receiving institution]? [Maps to RQ1a]
- What might [receiving institution] have done to enhance your success or ease the transition from your other institution? [Maps to RQ 1c]

These items were spread throughout the full survey of students (more detailed descriptions of the survey can be found in previous papers on the project[26])—the first open-ended item 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 for these two institutions. At each institution, students and alumni (who transferred to each PWI 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 14% 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 investigation focuses on the open-ended, qualitative responses from 715 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 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,[30] 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.[31] Nationwide, 40 states have experienced a more than 50% change in Hispanic population between 2000 and 2011 U.S. Census,[31] 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.[32] 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. In addition, as shown in Table 1, 59% of the students in this sample would be classified as "vertical" transfer students having spent all or most

of their time at a community college or two-year institution prior to making the transfer to the receiving four-year institution.

Table 1. Characteristics of the student sample

Sample size	n=715
Response Rate	14%
Gender	
Male	84%
Female	16%
Race/Ethnicity	
American Indian or Alaskan Native	0.7%
Asian	15%
Black or African American	4%
Native Hawaiian or Other Pac Isl.	0.4%
Caucasian	54%
Hispanic or Latino	21%
Multi-racial	2%
Foreign or International	4%
Enrollment Status	
Current Student	45%
Completed bachelor's at [RI]	51%
No Longer Enrolled	4%
In addition to [RI], attended:	
A community of two-year college	48%
A four-year institution	34%
More than one institution, mostly at a community or two-year college	11%
More than one institution, mostly at a four-year institution	7%

To analyze students' responses, we followed an inductive, constant comparative method.[33,34] 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. One researcher coded each response individually and the other team members provided peer auditing of the results to enhance the validity of the resulting themes. We also present representative quotes of each theme in the Results section so that the reader can determine the alignment between the textual data with the resultant themes.[35] Moreover, to address RQ2, we investigated differences in responses across students' type of transfer pathway (i.e., vertical versus lateral transfer).

IV. Results

We present the results for each of the three open-response questions in separate sections below. Within each section we discuss the themes, codes, and sub-codes for that question and compare the responses of vertical and lateral transfer students.

A. Factors that Helped Students Adjust

In their descriptions of factors that helped with their adjustment to their receiving institutions, transfer students' responses fit into four main themes: personal network, institutional resources, individual/self, and campus environment.

Personal Network. By far the most common factor cited by students in helping them adjust to their receiving institution was their personal networks, with nearly half of respondents describing resources in this category. One fifth of students described making friends at the receiving institution as a key part of their transition process. For example, one student stated:

> *I think the students and friends that I made along the way formed the best support system. At times I felt as though I couldn't keep up but I would always have someone recognize this and extend help.*

Along similar lines, many students discussed getting involved in student organizations on campus or religious organizations in the community as important factors in their success. Other responses in this theme focused on receiving support from family members, having friends from high school at the receiving institution, and connecting with other transfer students.

Institutional Resources. Around one fifth of respondents cited institutional resources as significant in their adjustment processes. Two main sources were described as resources: support offices on campus and faculty members. In discussing how meaningful campus support offices can be, one student said:

> *The [Student Services] building is the most wonderful place on campus. When I felt like I had no place to turn with my negative experiences, I received incredibly friendly and personal advising from the [Student Services] counselors.*

Similarly, students described faculty members who provided exceptional assistance to transfer students as "supportive," "approachable," and "the biggest help." One student described their experience with such faculty this way:

> *Dr. A and Dr. B in civil engineering department also did an incredible job working with me in advising meetings to let me know what credits I would need to retake and how my schedule could be best built.*

A few students mentioned other institutional resources including financial aid, orientation, being able to get a job on campus, and receiving support from their receiving department. A small minority discussed the importance of co-enrollment and concurrent enrollment programs in helping them adjust to their receiving institutions, although the number of students who were enrolled in such programs was limited in our sample.

Individual/Self. One fifth of students discussed how a personal characteristic or adjustment of their personal expectations was a key factor in their successful transition to their receiving

institution. A common idea for these students was that their internal strength, grit, and determination is what helped them adjust during a challenging transition. One student said:

> *My pure will to succeed and earn my degree has been the only helpful factor in my transition to [receiving institution].*

Other students suggested that becoming familiar with the new environment helped them adjust their internal expectations. Some students described how they needed to learn new study skills and time management strategies to be successful at the receiving institutions. A few students discussed prior life experiences (e.g., being a part of the military) that they felt gave them the skills needed to succeed in the new environment.

Campus Environment. Student responses within this theme focused on aspects of the campus environment that made them feel welcome at their receiving institutions. The main code in this theme was that the campus had a helpful or welcoming atmosphere. Students discussed how faculty, staff, and students were ready to answer their questions and wanted to make them feel at home on campus. One respondent described their receiving institution this way:

> *[Receiving institution] is an environment unlike any other. Everyone is friendly and helpful. You immediately feel like a family.*

It is notable that this code in particular captures one of the biggest differences between the two campuses in this study: one campus was twice as likely to be described as helpful and welcoming by our student sample compared to the other. Other comments in this theme noted that the academic atmosphere of the campuses was motivating and that the diversity of the campuses helped students feel like they fit in.

Differences Between Vertical and Lateral Transfer Students. Although there were differences between vertical and lateral transfer students' responses for this question, the differences were relatively small. Nevertheless, it is notable that vertical students were more likely to cite factors in the personal network and individual/self themes, and lateral students were more likely to discuss the campus environment theme. Looking at specific codes, the biggest area of difference was that the lateral students were more likely to suggest the helpful/welcoming campus environment as a factor in their success. They also seemed to have more high school friends at their receiving institutions to help support them after they transferred. The vertical students were slightly more likely to discuss personal strength and determination as a part of their success strategy and were also more likely to highlight the support offices on campus.

B. How Sending Institutions Could Have Eased the Transition

When asked how their sending institutions could have eased their transition process, approximately one quarter of respondents said that they had no suggestions or were happy with their experiences. The remaining student suggestions can be grouped into three themes: academic curriculum, information about transfer process, and high touch support.

Academic Curriculum. Nearly a quarter of respondents made suggestions in this theme, and by far the most common suggestion was that the classes at sending institutions should be more rigorous. One student voiced this perspective this way:

> *Offer more opportunities to be challenged, such as providing honors classes. The increased difficulty of [receiving institution's] engineering program, relative to my previous institution was very difficult at times. Although this transition was easier than it would have been straight out of high school, I feel that more opportunities to be challenged would have further eased this transition.*

Along the same lines, students also suggested specific technical skills (e.g., programming, lab techniques) that they would have liked to learn before transferring. Some students felt that the format of classes was drastically different between sending and receiving institutions and suggested that the sending institutions should adjust to align better with the receiving institutions. A few students simply suggested that more transferrable classes should be offered, or that engineering classes should be made transferrable. Others called for a restructuring of the curriculum so that it was building toward vertical transfer instead of being focused towards a two-year degree.

Information About Transfer Process. This theme captures areas where students felt more information could have been provided. The most common suggestions were that advisors at the sending institutions should be knowledgeable about the transfer process and that it should be easier to identify which specific classes will be transferrable. One student stated:

> *The advising at [two-year sending institution] was abysmal. I've taken 7+ classes that don't count towards my degree because the [two-year sending institution] advisors told me I needed them when I didn't. In order to enhance the transition to [receiving institution], the [two-year sending institution] advising office should have set course plans for incoming freshmen to gauge their classes off of.*

More generally, some students wished that the transfer process could have been laid out clearly at the start of their time at their sending institution. Others suggested that the sending institution could help students build a network at their intended receiving institution by connecting them to students, advisors, and faculty there prior to their transfer. Similarly, some students wanted more information about program and course requirements at the receiving institution.

High Touch Support. Around ten percent of respondents made suggestions in this theme, which encompasses ideas for helping students prepare for their transition. The most common suggestion was that the sending institution could provide training in study skills and time management skills and in general help set students' expectations for what it would be like at their receiving institutions. An example of this type of suggestion is:

> *Understanding the coursework difference was probably my biggest deficit coming into [receiving institution]. At [two-year sending institution], I rarely spent much time outside of class working on projects/homework. Once I got into engineering at [receiving institution], my entire week was spent either in class or*

> *studying/doing homework. I had no idea how unprepared I was for the workload of engineering at [receiving institution].*

Other students suggested that faculty at their sending institution could provide more support, while others felt that career advising would have helped them prepare to transfer. A small number of students also suggested creating a community of likely transfer students so that they could walk through the process together.

Differences Between Vertical and Lateral Transfer Students. The biggest difference between vertical and lateral transfer students' responses to this question is that lateral transfers were more likely to leave the question blank – about one third of them did so compared to one quarter of vertical students. As a result, vertical transfer students were more likely to provide responses in all of the categories described above. Among the students who provided responses, the biggest difference was in the academic curriculum theme, although most codes were fairly equal between the two transfer paths. One exception was the suggestion to adjust course formats, which saw more comments among vertical transfer students, although this suggestion represents only a small percentage of respondents overall. For these themes broadly, there were no major differences between vertical and lateral transfer students in their suggestions for their sending institutions.

C. How Receiving Institutions Could Have Eased the Transition

One quarter of respondents said that they had no suggestions for their receiving institution, including a small portion who said they thought the school did a great job helping with their transition. The remaining responses can be grouped into five themes: navigating institutional resources, connection to other students, high touch support from the institution, information on the transfer and registration processes, and campus environment.

Navigating Institutional Resources. This theme includes suggestions for clearer communication of what resources are available on campus and the introduction of new resources to support transfer students. Many students emphasized that they did not know where to find resources on campus such as the tutoring center, computer lab, and financial aid office. Others simply asked for more help navigating the campuses, which tended to be much larger than their sending institutions. One student expressed it this way:

> *Make student services easier to find. The campus in general is not welcoming because it's very big and relatively difficult to navigate. The buildings look the same, generally speaking, which makes everything difficult to find.*

Other comments in this theme focused on ideas for new or expanded resources, including: holding a longer transfer-specific orientation, offering entrance advising for incoming transfer students to create their degree plans, and increasing tutoring resources.

Connection to Other Students. The next most common theme captures suggestions for how the receiving institution could help students start to build their personal networks on campus.

Several students suggested that there could be more encouragement for transfer students to get involved with campus organizations. One student explained it this way:

> *[Help me] become more involved in organizations earlier on in my career at [receiving institution]. I was unaware of many of the possibilities for involvement until recently. Transferring to such a heavy workload without a support system of friends was overwhelming, and this made me less likely to look for opportunities to get involved. In retrospect, getting involved would have provided me with the very support system I needed to make transferring less overwhelming, but I had no way of knowing that at the time.*

Other students felt that the introduction of a student organization for transfer students would help, or at least thought the institution should offer specific events for transfer students to meet each other and get connected. A few students suggested that a peer mentoring program would be helpful, where more advanced transfer students could give advice to those who were just starting.

High Touch Support from the Institution. Student responses in this theme suggested that they would like to have more direct guidance through the first semester or year of their time at the receiving institution. Two main suggestions fell into this theme: providing mentoring to transfer students, and helping set their expectations of the academic rigor at the university. While students in the previous theme suggested peer mentoring as a way to build their network, students in this theme wanted a faculty member or an advisor who could be their key point of contact and support during their transition. For example, one student suggested:

> *Assign someone to check in on me during my first semester. Maybe get a phone call and ask how my grades were doing. If bad, then provide resources that [receiving institution] has to offer their students for boosting students' grades.*

Similarly, students felt that there could have been more guidance about how to transition to a more academically rigorous environment and interpret information they received from professors and the university. These students emphasized that they were shocked by the high standards and speed of the classes and wished that someone had been available to support them as they learned to manage these changes. One student put it this way:

> *The drop in exam scores was a difficult reality. Increased academic expectations required real changes in study habits. I also had to understand the philosophically different approach to grading and academic evaluation used at [receiving institution]. [...] At community college a 'C' in Physics says "I probably won't be an engineer", while a 'C' in Physics at [receiving institution] says "I probably won't go on to a PhD at MIT but I will design bridges for a career."*

Other codes in this theme focused on the need for support for specific populations, including international students, minority students, and non-traditional/working students.

Information on the Transfer and Registration Processes. This theme specifically deals with how the processes for transferring and registering could be improved. The most common comments in this theme were that the receiving institutions could be clearer about what credits would transfer and should consider accepting more transfer credits. Similarly, students suggested that transfer agreements should be created, updated, and communicated clearly so that sending institutions can help students make wise decisions before they transfer. Several students also commented on the need for improvement in the registration process for transfer students. It seems that transfer students often register later than other students, which makes it hard for them to get the classes that they need. Students at both schools in this study requested earlier opportunities to register for classes.

Campus Environment. This theme captures the negative experiences that students had with the atmosphere at their receiving institutions. Most comments in this theme suggested that there was an unfriendly attitude toward transfer students among faculty and staff, and that improving this attitude would have made a difference in their transitions. Some students had specific examples of comments made to them by faculty members, and others felt that it was a general attitude across the institution. One student put it this way:

> *The average student at [receiving institution] could care less if I was a transfer student, humble beginnings, prior military, etc; however, it was readily expressed to me by university staff that I was basically short changing the University by taking the general education classes elsewhere as these were the high profit margin classes for [receiving institution]. Since I wasn't paying to play that game, I became a second class citizen at [receiving institution].*

Other codes in this theme discussed the atmosphere in large classes and how it was hard to interact with faculty or ask questions. Some students also suggested that there could be a stronger environment around diversity and inclusion at both campuses. To improve the campus environment, students suggested emphasizing that transfer students can be as successful as traditional students, hiring enough faculty and advisors to allow one-on-one meetings with students, and simplifying processes to ensure common understanding across campus.

Differences Between Vertical and Lateral Transfer Students. The biggest differences between vertical and lateral students on this question were in the high touch support from the institution and campus environment themes. Vertical students were more likely to ask for high touch support than lateral students, specifically suggesting mentoring from faculty and staff and greater support for non-traditional students. They were also more likely to have negative environmental experiences, particularly in their interactions with faculty and staff and their experiences in large classes. Lateral students were slightly more likely to discuss challenges with the credit transfer process, which seems to be less structured for them than for vertical students coming from within the same state based on students' responses.

V. Discussion

There are several ideas that appear in responses across multiple questions. One common theme is that having or building a community or network of friends and family is an important

part of transferring successfully. Along similar lines, high touch support and resources can be meaningful at both the sending and receiving institutions. For this to be effective, however, it is essential that students be aware of these resources and feel comfortable using them. Lack of information or confusion about navigating complex processes was another common theme, resulting in students missing out on opportunities for career and academic support. Multiple responses also revealed that how a student experiences the campus environment can have a significant impact on their feelings of integration and willingness to seek out help. These overarching themes align with several of the ideas highlighted by Bahr, et al.[3] from prior studies, specifically the concepts of *integration*, *capital*, and *transfer receptivity*. Developing a local network of friends and support resources is a key part of *integration*, and our results support prior findings that students desire more help than is typically offered up front.[7] In particular, some students described making connections with an institutional agent,[13,18] or wishing that they could have had this type of *capital* available to them. Student comments about campus environment speak directly to the *transfer receptivity* they experienced at their receiving institutions.

In addition, we found that students going through the same transfer process at the same school can experience it differently from one another. Themes that some students highlighted as positive factors in their success were described as challenges and roadblocks by other students. For example, some students entered the transfer process with a support network already in place or found it easy to form one at their new school, while others struggled to find connections in a new environment. Possibly related to their differing networks, some students identified the support resources on their campuses while others did not know they existed for several semesters. The greatest contrast appears between students describing a campus as "welcoming" and "friendly," while others see the same school as "hostile" and "unapproachable." One possible explanation for such differences is that transfer students may be experiencing differing levels of *integration*, *involvement*, and *environmental pull* despite being at the same university, all of which affects their ability to navigate the process.[3] Because of the variation in student experiences, it is important that institutions be prepared to support students in each of these areas. Institutions should also recognize that just because some students had a positive experience does not mean that all students did, and therefore it is essential to seek out alternative perspectives and ensure all voices are heard.

Other differences highlighted in this study are those between the experiences of vertical and lateral transfer students. Looking across questions, campus environment experiences were one area that was consistently different between these groups. Lateral transfer students were more likely to highlight a positive campus environment as a factor in their success, while vertical transfer students were more likely to discuss negative environmental experiences. This discrepancy could be related to students' differing reasons for making a transfer for the two pathways. Our team is currently analyzing differences in reasons for starting at a previous institution as well as motivations for transferring to the receiving institution across the two pathways. Alternatively, the campus environment may be more similar between two four-year schools than between a two-year and a four-year, and so the vertical transfer students may have experienced a greater shift in the campus environment. Another common difference between these groups is that vertical transfer students were more likely to highlight support offices as a success factor and to ask for more high touch support from their receiving institutions. This

difference may be because faculty members at two-year institutions provide greater levels of support, and the transition from the two-year structure to the four-year structure is a bigger change in this area. It is important to note that lateral transfer students struggled more with the credit transfer process, probably because it is often set up for vertical transfer students, or at least students from within the same state. Overall, it seems that both vertical and lateral transfer students can find the transition challenging, but reasons for the challenges may be caused by different sources. As a result, institutions should recognize that different resources may be necessary to support these two groups of students—institutions should not consider "engineering transfer students" a monolithic group with one set of needs.

VI. Conclusion

The transfer pathway is a critical growth area toward the goals of increasing STEM professionals and improving diversity in engineering. This study explored the experiences of engineering transfer students at two PWIs to understand what factors supported them in the transfer process and what they believe could be improved at both their sending and receiving institutions. Our results revealed that _integration_, _capital_, and _transfer receptivity_ all play key roles in both the positive and negative experiences of transfer students. We also saw differences between transfer student experiences within the same institution, particularly between vertical and lateral transfer students. These results indicate that institutions cannot view all transfer students as having the same experience or requiring the same support. Fostering a welcoming culture, helping students build networks, providing access to institutional agents, and ensuring easily accessible information are all ways that institutions can begin to improve the transfer experience.

References

1.	Ogilvie, A.M. and D.B. Knight, *Engineering Transfer Students' Recommendations for Enhancing Success and Easing the Transition into the Mid-Years of Engineering at Receiving Institutions: Preliminary Findings from a Multi-institutional Study Based in Texas*, in *Paper presented at the 2nd Mid Years Engineering Experience Conference, March 31-April 1, 2016*. 2016: College Station, TX.
2.	Mobley, C. and C.E. Brawner. *Engineering transfer students' views on orientation and advising*. in *120th ASEE Annual Conference and Exposition, June 23, 2013 - June 26, 2013*. 2013. Atlanta, GA: American Society for Engineering Education.
3.	Bahr, P.R., et al., *A review and critique of the literature on community college students' transition processes and outcomes in four-year institutions*, in *Higher Education: Handbook of Theory and Research: Volume 28*, M.B. Paulsen and SpringerLink, Editors. 2013, Springer Netherlands: Dordrecht.
4.	Hills, J.R., *Transfer Shock: The academic performance of the junior college transfer.* The Journal of Experimental Education, 1965. 33(3): p. 201-215.
5.	Bahr, P.R., *The Deconstructive Approach to Understanding Community College Students' Pathways and Outcomes.* Community College Review, 2013. 41(2): p. 137-153.
6.	Tinto, V., *Leaving college: Rethinking the causes and cures of student attrition*. Vol. 2nd. 1993, Chicago: University of Chicago Press.
7.	Townsend, B.K. and K.B. Wilson, *"A Hand Hold for A Little Bit": Factors Facilitating the Success of Community College Transfer Students to a Large Research University.* Journal of College Student Development, 2006. 47(4): p. 439-456.
8.	Townsend, B.K. and K.B. Wilson, *The Academic and Social Integration of Persisting Community College Transfer Students.* Journal of College Student Retention: Research, Theory & Practice, 2009. 10(4): p. 405-423.
9.	Owens, K.R., *Community college transfer students' adjustment to a four-year institution: A qualitative analysis.* Journal of The First-Year Experience & Students in Transition, 2010. 22(1): p. 87-128.
10.	Astin, A.W., *Student involvement: A developmental theory for higher education.* Journal of College Student Personnel, 1984. 25(4): p. 297-308.
11.	Berger, J.B. and G.D. Malaney, *Assessing the transition of transfer students from community colleges to a university.* NASPA Journal, 2003. 40(4): p. 1-555.
12.	Laanan, F.S., *Studying transfer students: Part II: Dimensions of transfer students' adjustment.* Community College Journal of Research & Practice, 2007. 31(1): p. 37-59.
13.	Reyes, M., *Unique challenges for women of color in STEM transferring from community colleges to universities.* Harvard Educational Review, 2011. 81(2): p. 241.
14.	Wolf-Wendel, L., et al., *From the barrio to the bucolic: The student transfer experience from HSIs to Smith College.* Community College Journal of Research and Practice, 2004. 28(3): p. 213-231.
15.	Bourdieu, P., *The forms of capital*, in *Handbook of theory and research for the sociology of education*, J.G. Richardson, Editor. 1986, Greenwood Press: Westport, CT. p. 241–258.
16.	Lin, N., *Social capital: A theory of social structure and action*. Vol. 19.; 19. 2001, New York; Cambridge, UK: Cambridge University Press.

17. Coleman, J.S., *Social capital in the creation of human capital.* American Journal of Sociology, 1988. 94(1988): p. S95-120.

18. Packard, B.W., et al., *Women's experiences in the stem community college transfer pathway.* Journal of Women and Minorities in Science and Engineering, 2011. 17(2): p. 129-147.

19. Mobley, C., E.G. Shealy, and C.E. Brawner. *First-generation engineering transfer students: A qualitative study of social and cultural capital*. in *43rd Annual Frontiers in Education Conference*. 2013. Institute of Electrical and Electronics Engineers Inc.

20. Alexander, S., D. Ellis, and R. Mendoza-Denton, *Transfer student experiences and success at berkeley*, in *Research and Occasional Paper Series: CSHE.24.09.* 2008, University of California at Berkeley, Center for Studies in Higher Education: Berkeley, CA.

21. Townsend, B.K., *"Feeling like a freshman again": The transfer student transition.* New Directions for Higher Education, 2008. 2008(144): p. 69-77.

22. Brawner, C.E. and C. Mobley. *Motivations and experiences of older transfer students in engineering*. in *44th Annual Frontiers in Education Conference*. 2014. Madrid, Spain: The Institute of Electrical and Electronics Engineers, Inc.

23. Blash, L., et al., *A Long & Leaky Pipeline: Improving transfer pathways for engineering students*. 2012a, The RP Group: Sacramento, CA.

24. Laanan, F.S., D.L. Jackson, and M. Darrow. *Experiences of engineering transfer students: From community college to university*. in *2010 ASEE Annual Conference and Exposition, June 20, 2010 - June 23, 2010*. 2010. Louisville, KY, United states: American Society for Engineering Education.

25. Laanan, F.S., D.L. Jackson, and D.T. Rover. *Engineering transfer students: Characteristics, experiences, and student outcomes*. in *118th ASEE Annual Conference and Exposition, June 26, 2011 - June 29, 2011*. 2011. Vancouver, BC, Canada: American Society for Engineering Education.

26. Ogilvie, A.M., D.B. Knight, A.A. Fuentes, M. Borrego, P.A. Nava, and V.E. Taylor, *Transfer Student Pathways to Engineering Degrees: A Multi-Institutional Study Based in Texas*. in *45th Annual Frontiers in Education (FIE) Conference*. 2015. El Paso, TX.

27. Ogilvie, A.M., D.B. Knight, M. Borrego, A.A. Fuentes, P.A. Nava, and V.E. Taylor. *Transfer student pathways to engineering degrees: Preliminary findings from a multi-institutional study based in Texas*, in *American Society for Engineering Education, June 26-19, 2016*. 2016: New Orleans, LA.

28. American Society for Engineering Education *Profiles of engineering & engineering technology colleges*. 2012.

29. Carnegie Foundation for the Advancement of Teaching. *The Carnegie Classification of Institutions of Higher Education™*. 2010. Accessed: 01/24/2015. Available from: http://carnegieclassifications.iu.edu/.

30. U.S. Census Bureau. *State and County QuickFacts*. 2014. Accessed: 1/24/2015. Available from: http://quickfacts.census.gov/qfd/states/48000.html.

31. U.S. Census Bureau. *Roberto Ramirez, Chief of the Ethnicity and Ancestry Branch, to Appear on C-SPAN's "Washington Journal" to Discuss Statistics on the Hispanic Population*. 2012 June 22, 2012 at 9:15 a.m. [cited 2015 January 24]; Available from: http://www.census.gov/newsroom/cspan/hispanic/.

32. Pew Research Center, *Mapping the Latino Population, By State, County and City*, in *Brown, A. Lopez, M.H.* 2013, Pew Research Center's Hispanic Trends Project: Washington, D.C.

33. Robson, C., *Real world research: a resource for social scientists and practitioner-researchers*. 3rd ed. 2011, West Sussex, United Kingdom: John Wiley & Sons Ltd.

34. Patton, M.Q., *Qualitative research & evaluation methods*. 2002, Thousand Oaks, CA: Sage Publications.

35. Creswell, J.W., *Research design: Qualitative, quantitative, and mixed methods approaches*. 3rd ed. 2009, Thousand Oaks, CA: Sage Publications.