From Cooperation to Alliance: Transforming a Transfer Partnership to Promote Engineering Degree Pathways for Underrepresented Students

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Abstract

Students who transfer from one institution to another face a variety of challenges as they explore transfer pathways and acclimate themselves to their new institution's policies and practices, including lack of sense of belonging, navigating degree requirements and developing engineering identity. These challenges represent significant barriers to students, negatively impact their retention, and disproportionately affect low-income and underrepresented minority students in STEM. We report on our initial efforts to establish a successful transfer partnership between a minority-serving 2-year college and a 4-year degree granting institution to promote engineering degree pathways that have a high potential for providing economic mobility opportunities to underserved student populations. Our effort is part of a larger initiative that aims to establish an engaged community of practice of 10 transfer partnerships between 2- and 4-year institutions state-wide. The goal of the broader STEM Transfer Partnership program is to increase bachelor's degree completion of low-income transfer students.

Our initial efforts focused on identifying shared data needs around student success barriers, establishing inter-institutional data sharing protocols, and developing a framework to significantly increase, diversify, and enhance our existing outreach, recruitment and academic advising practices in support of these students. We present a holistic data model for transfer pathway (Academic Success, Career Preparation, College and Transfer Navigation, Basic Needs and Funding, and Psychological Factors) to build on the Transfer Student Capital model [6] to obtain a more complete understanding of educational barriers as they interplay with each other.

BIPOC, low-income, and older graduates are more likely to be transfer students than other students [11]. Thus two-year colleges provide a critical pathway for diversifying the engineering workforce. Highline is both an AANAPISI and an MSI, with over 70% BIPOC students. Over half of UWT's undergraduate student population are transfer students, with 54% first generation learners and 34% underrepresented minorities, most from 2-year institutions. As such the practices that we establish in our partnership will have significant potential for institutional scale-up of DEI practices to positively impact the educational experience of underrepresented students in engineering.

Introduction

Challenges faced by transfer students

According to the 2019 National Survey of College Graduates (NSCG), over 50% of bachelor's degree recipients between 2008 and 2017 attended some community college, and 25% earned an associate's degree in their path to achieve educational attainment goals and pursue career advancement [4]. Reasons for attending a community college vary, but the primary reason is to earn credits towards a bachelor's degree.

Many STEM careers now require a 4-year degree [1]. Over the past two decades, the National Research Council (NRC) has called on community colleges to broaden participation and expand pathways to STEM degrees to meet the goal of the President's Council of Advisors on Science and Technology [8] of an additional one million STEM professionals to be produced in the United States by 2025.

Research on transfer students shows that different groups of transfer students need different kinds of assistance in order to succeed at their new college or university ([10] and references therein). Factors affecting transfer student success include:

- Emotional factors (feeling of isolation, transfer shock, lack of sense of belonging),
- Financial factors (cost),
- Educational planning factors (credits earned, time to completion, clarity on credit transfer),
- Academic factors (GPA, academic preparedness, required remedial courses),
- Institutional factors (size of school, distance of school).

Research on the STEM transfer pathway involves two sides of efforts: On the side of community colleges, they mainly focus on factors that can influence the transfer progress for aspiring STEM majors. A survey for Massachusetts STEM transfer students in 2013 emphasized the role of advising in the growth and diversification of the STEM workforce [9]. Advising from internal personnel (major advisors, transfer office staff, professors, etc.) might be restricted, so resourcefulness is a key skill and collaborating across the institution and community college stakeholders is highly expected.

On the side of 4-year institutions, a survey of over one thousand engineering transfer students across four Texas institutions [7] found that the top problems identified by transfer students were cost of attendance, followed by the transfer credit process, and high academic expectations.

The Washington Student Achievement Council (WSAC) submits a biennial progress report to the state legislature that examines transfer associate degree effectiveness over time. An update in 2021 [11] indicated that students who earned a transfer associate degree were more likely to transfer and successfully complete a bachelor's degree program, but this trend did not hold for Black, Indigenous, and People of Color (BIPOC) and there were race/ethnicity disparities in transfer and completion rates. This is especially concerning since BIPOC, low-income, and older graduates are more likely to be transfer students than other students. Furthermore, engineering transfer students are more likely to have excess credits compared to their peers in other disciplines, ranging from 9 to 55 credits above that of direct entry students. Excess credits potentially represent wasted investment of time and money, which is a particular concern for

low-income students.

The update concluded that more equity-based, longitudinal analysis is needed to understand the factors that elevate or reduce transfer success rates. We propose to address this gap by conducting a series of intake and exit surveys, supplemented with occasional interviews, to track the transfer experience of cohorts of students over time. Our specific long-term research questions are:

1. How do engineering students learn about and experience the transfer process?
2. What are the disparities in transfer experience and access to resources such as advising and funding across low income status and race/ethnicity?
3. Why do students leave the transfer pipeline?
4. What are the factors leading to engineering transfer students having excess credits toward an engineering bachelor's degree?

Continuum of transfer partnerships

Some of the challenges faced by STEM transfer students can be mitigated through an active partnership between the origin 2-year institution and the destination 4-year institution. A successful transfer event requires, at minimum, information sharing between institutions and development of articulation agreements for credit transfer. Institutional pairs that develop their partnership further by committing shared resources and coordinating program objectives increase the likelihood that a successful transfer event will lead to successful degree completion. A possible model to achieve this is outlined by Yeh and Wetzstein [12] who define a continuum of transfer partnership ranging from passive cooperation to intentional alliance:

Table 1: Continuum of transfer partnerships identified by Yeh & Wetzstein [12].

	Cooperation	Coordination	Collaboration	Alliance
Characterized by:	Cooperative information sharing	Coordinated or aligned tasks	Collaborative strategies	Integrated programs or structures
	Shared students	Compatible transfer goals	Shared purpose around transfer goals	Seamless transfer experience
Example:	Advisors direct students to look online for information about the partner institution	Advisors direct students to a particular advisor at the partner institution	Advisors from the 4-year institution visit the 2-year institution for pre-advising	Joint advising staff work with students at both institutions.

Yeh and Wetzstein identify 5 dimensions of transfer partnership: (1) Advising, (2) Recruitment & enrollment, (3) Financial aid, (4) Faculty practice, and (5) Data sharing. Successful transfer partnerships usually do not reach the level of Alliance across all five dimensions; rather, the institutions develop intentional priorities based on identified needs and opportunities. We used this model to develop our institutional partnership to support low-income engineering transfer students in our region.

Engineering transfer partnerships in Washington State

To elaborate on the context that our partnership is situated in, it is important to note that the general transfer student landscape is fairly unique and advanced in Washington State. Here we specifically focus on existing support for engineering transfers. The Washington Council for Engineering and Related Technical Education (WCERTE), established in 1969 [2], is a statewide organization designed to provide a platform for ongoing communication and collaboration between 4-year and 2-year higher education institutions that offer engineering and related technical academic degree programs such as computer science, on issues related to transfer students. Members of WCERTE include faculty and staff from both 2- and 4-year institutions with wide participation from across the state. The group allows effective information sharing on academic program updates, curricular changes, and staffing updates. The organization also enables the formation of statewide working groups tasked to study shared engineering education related problems ensuring that these problems are addressed in a holistic way, representing all relevant perspectives. The work of this group helped establish successful engineering transfer pathways between 2- and 4-year institutions in the state, with WCERTE playing a significant role in creating clear, mutually agreed on transfer articulations between these institutions. This type of higher educational landscape makes the state an excellent study area to investigate issues related to transfer pathways, including barriers associated with transfer student success, and it was part of the motivation for launching our partnership effort within a broader project called "STEM Transfer Partnerships" led by the Community College Research Initiatives (CCRI) research group at the University of Washington Seattle (UWS).

CCRI and the STEM transfer partnerships initiative

The CCRI research group was established in 2016 to further scientific knowledge related to higher education in community and technical colleges, with a particular focus on applying knowledge to promote equitable access of underserved student populations to educational opportunities. Improving the experiences and success of transfer students is a critical aspect of this work and to advance this goal CCRI launched its 3-year "STEM Transfer Partnerships" initiative in January 2022. This project seeks to positively impact the success of low-income STEM transfer students across Washington state by establishing a community of practice initially comprised of 10 partnerships between 2- and 4-year institutions. In this paper we report our initial efforts in forming our partnership, 1 of the 10, between the pre-engineering pathways program at Highline College (Highline) and the School of Engineering and Technology (SET) at the University of Washington Tacoma (UWT).

The overarching goals for partnering institutions are to share data, identify barriers to student success (based on the data shared and on student input), and create solutions to remove those barriers with the goal of increasing low-income transfer student retention and degree completion at the bachelor's level. The aim is to create lasting institutional practices and culture that will result in sustainable partnerships and expertise both within and between institutions as well as in the larger community of practice in the state.

Local context: UWT and Highline College

Reviewing our existing institutional data on student enrollments, it became evident that while many community college students were interested in pursuing an engineering career, they were less aware of engineering degree offerings such as the BS in Computer Engineering and BS in Electrical Engineering programs compared to undergraduate degrees in Computer Science and Information Technology at UWT. Specifically, over the past 10 years, only 2 to 9% of students transferring from Highline to a STEM major at UWT chose engineering. Given the significant market need for engineering graduates in the State of Washington, and that UWT just added two new engineering majors to its offerings (mechanical engineering and civil engineering) to address this need, it became even more urgent that students learn about these career pathways and the academic degree options available at UWT.

Furthermore, given the closer proximity of UWT to Highline as compared to other 4-year college campuses and the closer alignment in institutional characteristics such as class size, transfer to UWT was seen as a more attractive option for students who may be hesitant to transfer or who may be intimidated by a drastic change in culture and environment from a 2-year to a 4-year college. With the increased challenges faced by students with the onset and continuation of the pandemic such as needing to care for family members [5], more options for students who may otherwise drop out of school after completing their Associates degree was seen as critical to boosting student attainment.

All of these reasons motivated us to review our current transfer student support practices and to establish a direct partnership between our institutions specifically in support of students navigating the engineering transfer pathway.

UWT engineering programs

UWT's unique educational model: Transfer students play a significant role in UWT's undergraduate educational system. Undergraduate academic degree programs at the institution follow a 2+2 year model, in which students complete prerequisite courses in their first two years and then pursue their major in their junior and senior years. Some students spend all 4 years of their undergraduate education at UWT but over 50% of undergraduate students transfer in from 2-year community colleges. The proportion of undergraduate engineering transfer students in SET is similar to what is observed at the campus level. Given that a significant percentage of our students are transfers, it is imperative that we build a holistic and sustainable system to support these students' needs. As Highline is in the top four 2-year colleges in terms of number of students transferred to UWT and SET, this partnership has the potential to positively impact the educational experience of many students. In addition, we hope that the processes that we establish through our work will also have a lasting impact on the experiences of transfer students coming from other institutions.

SET engineering programs: There are currently four undergraduate engineering degree programs offered in SET. The BS in Computer Engineering and BS in Electrical Engineering programs are both well-established, ABET-accredited programs. Most recently, the school added the BS in Mechanical Engineering (AY 2021/2022 start) and BS in Civil Engineering (AY 2022/2023 start) majors to its mix of academic program offerings. Currently (in the 2022-2023

academic year), there are a total of 150 students enrolled in SET's four undergraduate engineering degree programs (junior and senior students combined), over half of whom transferred from a 2-year institution. Our programs are relatively small with a planned maximum cohort size of 45 students.

UWT and SET undergraduate student demographics - Underserved populations make up a significant share of the undergraduate student population with 54% of them being first generation learners and 34% of them underrepresented minorities. The majority of students are also "place-based" with 93% of all UWT students coming from Washington state, with 72% from Pierce County (where UWT is located) and two neighboring counties: South King and Thurston. 8 out of 10 alumni stay in Washington after graduation. This educational model provides unique challenges as well as opportunities in terms of potential for impact on long-term student success.

Highline engineering preparation pathways

Engineering is the second largest program of study in STEM at Highline, with 88 students enrolled in AY 2021/2022. All students need to transfer after completing freshman and sophomore level math, physics and engineering courses in order to complete their Bachelor's degree, with the majority of students transferring to the University of Washington (all 3 campuses, which includes UWT). The pandemic has led to a decline in enrollment and persistence of engineering degree seekers as the number of students facing financial pressures to work and support family increased. Additionally, mental health related issues, which are known to disproportionately affect low-income students, spiked, further exacerbating the challenges that these students were facing. This reflects trends at the national level that show a decrease in students' financial security and well-being as indicated by employment status, academic engagement, and mental health [5].

Student demographics at Highline: Highline is a Minority Serving Institution (MSI) with over 70% of its students coming from underserved student populations. Part of Highline's and its Mathematics, Engineering, Science, Achievement (MESA) program's mission is to reduce barriers for low-income and minority students to pursue careers in STEM. Transfer students face multiple challenges before, during and after the transfer process. In order to undo the narrative where students struggle to navigate two completely different systems and often end up self-advising, we recognize the need for a collaboration at the institutional level that would ensure a seamless transition for students that not only addresses academic, transfer and financial aid planning, but also self efficacy, transfer shock and feelings of connectedness. As such, a partnership with UWT has great potential to increase the effectiveness of interventions initiated at Highline by leveraging the knowledge, data, and resources of both institutions and boosting student retention rates and reducing graduation timelines at the 2-year and 4-year levels.

Guided Pathways Implementation at Highline: In April 2019, Highline joined a cohort of Washington State Board for Community and Technical Colleges (SBCTC) in implementing Guided Pathways. As a student-centered framework designed to increase and diversify the students and communities accessing and earning high-value credentials, using data and soliciting student input into the development of the pathways is an essential element in the framework. The

Guided Pathways framework focuses on addressing key momentum areas including: alignment of learning outcomes to labor market and junior level (major ready) competencies for transfer, anti-racist and equity-minded pedagogy, clear pathways to achieve those outcomes through educational planning, first quarter experiences that foster a deep sense of belonging for each student and holistic supports to stay on a pathway to completion. The work being done on the above momentum areas complement the formation of transfer partnerships to extend the vision of a system that advances equitable student aspiration, access, and educational and career achievement.

Existing Highline-UWT partnerships

UWT and Highline have partnered on several events to support transfer students in recent years. Some of this partnership included attending college fairs, coordinating visits to the Highline Transfer Center, specialty transfer presentations, and maintaining a positive relationship with the Director of the Running start program. Events exposing Highline students to opportunities in SET was part of these efforts. Most recently prior to the start of the current project, our two institutions collaborated on an open house for prospective students to learn about admissions practices and opportunities at UWT. Previously, in 2019, there was also a Highline to UWT transfer advisor, who supported students transitioning between the institutions. Our institutions have also collaborated to create The HUB, which recently opened in 2021. This education center expands access to post-secondary education for Highline students in Federal Way, a town located midway between UWT and Highline.

Prior sharing of data: UWT and Highline have shared data about enrollment trends between our institutions through our transfer advising team. However, there has not been a formal data sharing agreement established between our institutions. We have shared broad information like trends in enrollment, and the most common majors students pursue at UWT after attending Highline. Information about specific student's academic records have been shared between the campuses. The shared data was used by academic advisors to support individual students as they navigated the transfer process. It has also been used to inform specific UWT admissions outreach events including specialty presentations for STEM students, classroom visits, and visits with the transfer center.

While these efforts provide a great foundation to build on, several of us also became aware of existing deficiencies in these systems and practices through our direct work with students, which served as a strong motivation for forming our team and for this work.

Our team

Our existing transfer student support services at both of our institutions made it apparent from the very beginning that our project team will need to include several stakeholders from both academic staff and faculty for us to be successful. Therefore, we made sure that we have faculty representatives from each of our UWT undergraduate engineering programs and several from the Highline engineering preparation pathway program (in engineering and physics). We have faculty representation at different academic ranks and in terms of primarily teaching or mixed teaching and research focus. On the staff side, academic advising, institutional research, admissions, and

student success services are all represented.

It is important to note that different institutions might assign some of the previously described roles differently and therefore clear communication between partner institutions while establishing shared processes is essential. For example, in our case academic advising of students is organized in a different way at our institutions. At UWT, there is a staff academic advising team at SET, while at Highline faculty are responsible for both academic and transfer advising. Student success services might also take many different forms. We have a team member who is directing the MESA program at Highline. Finally, we also made sure that academic leadership is both aware of and in support of our project on both of our campuses. Building such a diverse team enabled us to combine our unique skill sets and perspectives to advance a shared goal as we develop our partnership to move beyond cooperation in the Yeh and Wetzstein [12] transfer partnership model that served as the basis of our framework.

Transfer Partnership: Moving from Cooperation to Alliance

Our initial efforts focused on identifying shared data needs around student success barriers, establishing inter-institutional data sharing protocols, and developing a framework to significantly increase, diversify, and enhance our existing outreach, recruitment and academic advising practices in support of these students. Here we present a holistic data model for the transfer pathway to build on the Transfer Student Capital model [6] to obtain a more complete understanding of educational barriers as they interplay with each other.

Using data to create an action plan

While there is much available data in the literature on transfer student success and barriers, part of our goal was to obtain data specific to engineering, especially qualitative data that highlights the student experience and goes beyond existing quantitative institutional data on degree and credit completion. From our initial team discussion, we identified a need to move from anecdotal evidence coming from advising and mentoring sessions to a holistic data model that captures both the completion and transfer rates, and educational and transfer experiences themselves. We understood that many students were unaware of academic and campus support services, had challenges in effective academic planning such as starting math sequences early enough in their degree plan, had many competing out-of-class obligations such as work and family, were facing stress from financial pressures, and were facing uncertainties in whether engineering was for them or what career options were available. As a consequence, we sought to create a holistic data model to better understand how we can better serve students, especially first generation college students and BIPOC students who face additional opportunity gaps. Our model is represented in Figure 1 and includes: Academic Success, Career Preparation, College and Transfer Navigation, Basic Needs and Funding, and Psychological Factors.

The necessity for a holistic data model was thrown into sharp relief by the pandemic, which brought to the forefront existing inequities in higher education. Data on the impact of the pandemic showed, for example, that 66% of students at 2-year institutions and 80% at 4-year institutions reported having trouble concentrating on their studies [5]. Many were caring for family members while pursuing their studies with the number as high as 48% (2-year) and 32%

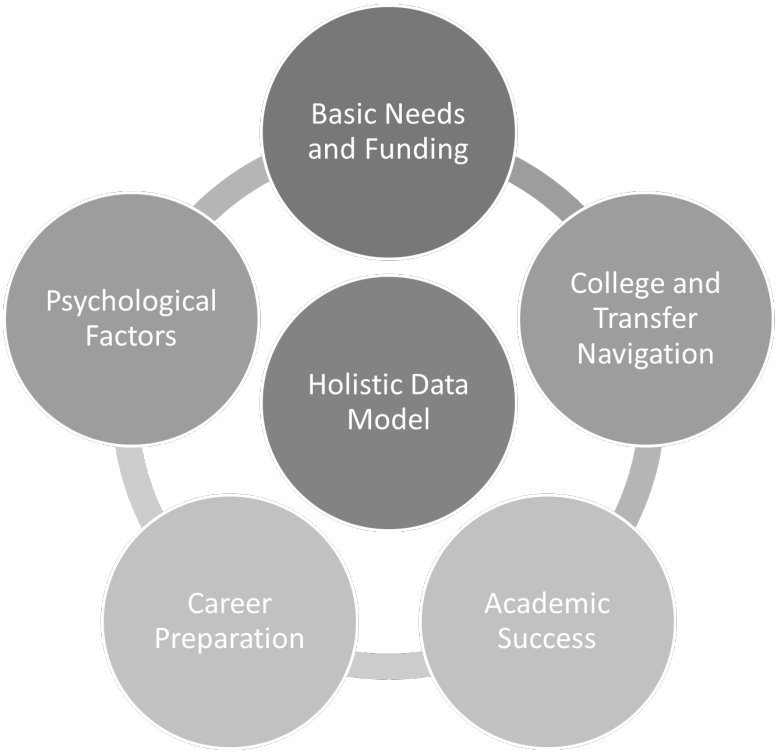

Figure 1: To better understand the barriers and supports students face in navigating college and transfer, we need a holistic data model that addresses the different factors affecting students both in and out of the classroom. How these different factors can be built on to have knock-on effects on other areas is critical to ensuring we approach student success in a culturally responsive manner.

(4-year). Furthermore, first-generation college students/Pell Grant recipients, and part-time students were 9% and 17% more likely to experience basic needs insecurity, respectively. Our partnership's focus on boosting low-income student transfer success rates and completion comes at a critical time to address these challenges and ensure that students are effectively and equitably served.

Focus areas and action plan

At the beginning of our project, we identified three of the five dimensions of the Yeh and Wetzstein [12] transfer partnership model as critical areas to work on: (1) advising, (2) recruitment & enrollment, and (5) data sharing. We have decided to focus on these areas because the literature indicates that poor academic planning is a major barrier for students completing a degree and transferring successfully [3], and both our institutions have experienced an enrollment decline during the pandemic. Furthermore, two of the engineering programs at UWT are brand-new and not yet well known yet in the region. Thus far we have not yet identified areas of growth for curriculum and faculty practice, and as a start we want to establish a strong partnership through mutual sharing of data to help identify focus areas for the next phase of our partnership. Data sharing is a prerequisite to better understanding where the specific challenges lie for students navigating our systems.

During the first convening of the CCRI "STEM Transfer Partnerships" project, we established the tangible goals listed in Table 2, one for each of our 3 chosen priority areas. Our plan outlines strategic actions and resources needed to achieve these goals, and clearly identifies the metric that will provide evidence of improvement.

To-date, we made progress in each of our action areas. In this paper, we are reporting on data obtained from our first intake surveys administered to students to gather feedback from them on their transfer experience.

Table 2: Action plan developed at the first convening of the STEM Transfer Partnerships grant recipients.

Goal Or Desired Measurable Outcome	**Strategic Action/Activity**	**Resources Needed**	**Evidence Of Improvement**
A decrease in credit loss by transfer students over the life of the grant.	Hire a joint advisor for UWT. Put together a checklist for a successful transfer Build a joint website for transfer process checklist and resources	Staff time for website updates More academic and transfer advisors UWT institutional funding for the joint advisor position Students to survey and staff time to analyze data	Decrease in excess credits compared to baseline data
Increase the number of students transferring from Highline to UWT to a 10 student cohort for all engineering disciplines.	Joint marketing campaign Quarterly UWT recruitment events at Highline Highline students visit UWT Engineering outreach in K-12	Staff time Student time Faculty time	Larger number of students transferring from HC into UWT engineering programs compared to baseline data
Continual and broad data sharing agreement in place	Develop data sharing/use agreement Create intake and exit surveys for both HC and UWT Access data from existing surveys such as Basic Needs survey to inform the transfer process.	Staff time Student time and sufficient student response rates for surveys Faculty time	Established data sharing process. Identification of transfer barriers. Institutionalized student survey processes for engineering.

Data sharing agreement

The fist step in our work was to establish a data sharing agreement to share student-level data between our institutions. In order to effectively comply with FERPA requirements around data sharing, as well as ethical obligations to students, we developed a data sharing agreement that enumerates each institution's roles and responsibilities for providing and protecting confidential information. Below are some lessons and recommendations from our experience developing and implementing this agreement.

Determining data needs: Creating the provisions of a data sharing agreement requires knowing what pieces of information will be used in analysis (at least in general terms), so that those items can be enumerated. We wanted to limit sharing to what was needed out of respect for student privacy. However, analysis evolves as it progresses, so being too specific about data items early on could hamper research effectiveness. Our solution was to provide specific examples and reasoning behind each data need (for instance, we included academic data such as grades, but mentioned a focus on relevant gateway courses), and to include a provision for making changes with mutual agreement.

Data security and Information Technology Services: Sharing confidential information across institutions requires following data security practices and utilizing secure systems. Team members focused on teaching, program administration, and data analysis do not have the required expertise, so consultation with both institutions' Information Technology offices has been necessary. We would recommend connecting with IT professionals early in the process, so that they can give advice on security-related elements of the data sharing agreement and find solutions acceptable for each institution. Bringing in IT later in the process can lead to delays in data provision.

Instructors and student privacy: Because instructors within the engineering programs are involved with the development of the project, there are additional ethical concerns when it comes to them seeing data for students whom they may grade or advise in the future. Therefore, raw data is seen only by non-instructor staff, who provide de-identified or aggregated data to other team members.

Preliminary Findings

Intake survey

An important goal in our project is to establish institutional processes that will enable continued and sustained collection of student input on their transfer experiences. We envision this to occur via a series of standardized surveys that will be strategically administered to students at critical time points in their education journey, to include times when they entered and exited the institution or a degree program. The structure of intake and exit surveys administered at both institutions addresses a need for pre/post model or longitudinal design that would provide insight into how student experiences change with time and address the limitation of single surveys where respondents show difficulty in recalling past experiences [6]. Here we report on the preliminary findings of the first such survey deployed in our project to incoming students.

We developed two surveys to help identify challenges faced by our transfer students: one to be

administered to pre-transfer students and another to be administered to post-transfer students. To increase our sample size, post-transfer surveys were administered to all engineering transfer students. Both surveys were developed in close collaboration between the two institutions. Both surveys were administered in Qualtrics. Students were sent a unique survey link to their school email address. The surveys were administered at the end of the Fall 2022 academic quarter. Emails were timed to arrive during class time, and engineering instructors were asked to set aside time in class for students to complete the survey on their phones or personal devices. Reminder emails were sent several days later to students with outstanding responses.

The pre-transfer survey included questions about the following topics:

- Sources of information about engineering careers
- Engineering identity and sense of belonging
- Academic plan and advising
- Financial and other challenges faced during pre-transfer studies
- Transfer plans
- Demographics

The post-transfer survey included questions about the following topics:

- Intended or current engineering major
- Sources of information about engineering careers
- Engineering identity and sense of belonging
- Academic plan and advising
- Financial and other challenges faced during transfer process
- Demographics

The survey data (n=11 for pre-transfer survey, n=33 for post-transfer survey) were anonymized by two of the non-faculty project members. Survey responses from different sections were separated and randomized so that demographic variables could not be connected with other responses. For the post-transfer survey, students came from a variety of 2-year colleges including but not limited to Highline. Many students have taken classes at multiple 2-year colleges. For this paper we will share some findings related to our initial focus areas on advising, and recruitment and enrollment including influences on students' decisions to pursue engineering as a major, whether students had an advisor-verified academic plan, and transfer success factors.

Significant challenges identified by post-transfer students

The two biggest sources of information about engineering students identified were a faculty/instructor at high school or college (42%) and engineering classes (59%). Online sources and other STEM classes were the next biggest factors (39%). In describing what drew them to engineering almost all students made some reference to being drawn to problem solving, liking the intellectual challenge and understanding how and why things work, being able to create or design solutions, and enjoying math. Some illustrative comments from students include: "The thing that attracted me most to engineering is the problem-solving skills required. I really love problem solving and math. Also the engineering salary was a bonus."; "Being able to give back to the community and also being able to fully engage my cognitive ability and learn how things

work and why they are made in specific ways."; "I want to learn to create, I find that as long as I can know I've created something in the day I feel fulfilled."

To obtain insights into transfer institution choices we asked students to share their reasons for transferring to UWT. In their comments, reasons most cited by students were the close distance of UWT to home (52%), the small class size and ability to get to know faculty and other students (36%) and the reputation of the program (30%). College/University engineering department and admissions and transfer websites were selected as the most important sources of information though at least two students commented there was not enough information and they did their own independent research.

We also asked students to comment on what they found to be the biggest challenge(s) during the transfer process and specifically what would have helped in overcoming those challenges. By far the most commonly mentioned reason was being unsure which classes would transfer from 2-year to 4-year colleges, and understanding what the transfer prerequisites were. Some students mentioned that they attended multiple 2-year colleges and had greater difficulty figuring out what classes would and would not count toward their 4-year degree.

A majority of post-transfer students (68%) reported having an academic plan for finishing their bachelor's degree, and almost all students (84%) had an academic plan at least for at least the first year of their major program. Most (77%) students have checked their academic plan with an adviser at UWT. The most commonly-cited reason for not checking in with an adviser was that the standard academic plan was already well mapped out. At least one respondent reported getting information about academic planning from peers instead of from an advisor.

Next Steps and Conclusions

To summarize, we seek to increase: a) knowledge of engineering programs and careers, b) successful outcomes for graduation and transfer, and c) a greater sense of belonging and community for our underserved and low income students. Hence, our focus on advising, recruitment and enrollment, and data sharing.

From our preliminary data, we've identified several areas for future work and analysis. UWT engineering programs generally have low visibility among local high school and community college students. An area of opportunity is to build collaborations with high schools to introduce engineering topics into other STEM classes, and create outreach events focused on solutions to problems relevant to students' lives and interests. There is a need to reach students who are not meeting with advisors, and to investigate equity gaps in access to advising. To this end, we already have a first draft of a comprehensive transfer checklist to help students navigate the transition. At Highline, a majority of class offerings will remain online. Therefore, we plan to continue to study the short and long-term effects of the pandemic on our transfer students.

With our institutions and team members representing a wide array of perspectives and priorities, we found that clear, open and intentional communication is essential for our partnership to thrive. This helped us define shared goals that all of us can invest in and work towards in support of our students. We also found that working on breaking down silos between academic affairs and student services is critical for success. Our traditional academic structures often do not create

opportunities to share insights into student success factors leading to many initiatives working in isolation. Breaking silos and sharing knowledge gained through different forms of interaction with students (teaching, advising, navigating, admissions, recruitment) allows for these initiatives to be more successful by building on each other's work. It also allows for better design of continuous, long-lasting student support and avoids "handing off" students at each stage of their journey which may result in students feeling lost and defaulting to self-advising and self-support. Overall, holistic educational planning requires strong communication channels to avoid situations with students receiving contradictory information or feeling unsupported in the transfer process and their overall academic journey.

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