

Creating an Environment for Transfer Student Success

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The Department of Electrical and Computer Engineering at Seattle University offers an undergraduate-only program focused on professional formation of each student. Small class sizes provide opportunities for individualized instruction and personal attention, while faculty-led advising helps students navigate the many options of our programs and encourage them to think about their future beyond the time spent at the university. 50% of our current students are transfers from 2- or 4-year institutions. Formal agreements between community colleges and universities in our state inform the transfer process and ensure that potential transfer students are aware of which courses they should be taking at the community college-level.

In this paper, we investigate the success of our transfer students as compared to freshmen. The hypothesis we test is: "**When studying at an institution with high levels of support services, transfer students are no less academically successful than freshmen.**" We track students who majored in our program between years 2000 and 2016, and provide data about their success as measured by the time to graduate and their major and cumulative GPAs. We contrast the performance of transfer students with that of freshmen, and compare students across the 11 local community colleges and a 4-year university. We also study the students' preparation for the transfer process and how it differs depending on which 2-year institution they are coming from. We compare our findings to nationally available data.

It has been our experience that, typically, transfer students are more mature than first-year students and therefore more motivated to study engineering. However, research also shows that many transfer students face academic, social, and/or psychological challenges leading to low GPAs in their first year after transferring¹. We believe that any recruitment strategy should start with analyzing the success and motivation of current students. Our exploration provided us with several approaches, which, we hope, should yield increased enrollment and improve the overall process of recruitment, admission, and first quarter advising. Finally, as expected, support services have a tremendous role in helping students be successful. We discuss some of the most common student support services and provide recommendations for optimizing their effectiveness.

Background

According to the US Bureau of Labor Statistics, employment in STEM occupations grew by 10.5 percent between May 2009 and May 2015, compared to a 5.2 percent net growth in non-STEM occupations; the electrical engineering industry is projected to grow by 11 percent from 2014 to 2024². This growth rate provides an opportunity for universities to draw on new sources of talent to feed the pipeline to STEM careers; a popular choice being community colleges, which are uniquely positioned to provide a talented and diverse pool of transfer students. Historically, two-year public community colleges have provided accessible and affordable postsecondary education to a wide variety of student populations, including but not limited to non-traditional students, students from underserved and underrepresented groups, and those from low-income families³. Studies by the National Student Clearinghouse Research Center (NSCRC) estimate

that 49.82% of part-time and 18.4% of full-time students attended two-year public colleges in Fall 2016. Their estimated national enrollment rates by age group was 29.99% for students under 24, and 30.29% for students over 24; enrollment by gender was 30.31% for men and 29.93% for women⁴. While these numbers look promising, this study also indicates that only 3.72% of students at two-year institutions are enrolled in engineering, engineering technology, or other engineering-related programs, when compared to 35% overall enrollment in STEM related fields. These statistics vary widely by state, and are largely dependent on transfer policies and agreements that facilitate seamless transition from 2-year colleges to public and private baccalaureate institutions.

The State of Washington has enforced an agreement that allows completion of most math and science prerequisites at a 2-year college, thus paving a pathway for direct entry to the junior year, for a chosen major⁵. Institution-specific information related to transferability of courses and other program requirements are communicated to all participating colleges, and advising resources are made available to prospective students. Students who enter community colleges with clear intentions regarding transfer to a baccalaureate college are encouraged to follow a plan of study that is aligned with the specific degree requirements of a target institution. Most importantly, universities are expected to treat freshman and transfer students on an equitable basis; all students are expected to meet equivalent standards for regular admission to programs. Not only have these regulations ensured a smooth transition for students from 2- to 4-year institutions, they have also established a platform for transfer student success.

According to NSCRC, two among several other metrics for transfer student success are persistence and retention rates, and understanding the distinction between the two is crucial; Persistence rate refers to the percentage of students who continue their postsecondary education at any institution for their second year, while the retention rate is the percentage of students who return to the same institution⁶. Studies show that overall persistence rates are higher than retention rates, specifically for community college students. A snapshot of enrollment trends in Fall 2014 indicated that persistence rate for students at 2-year colleges was 60%, i.e., a year after starting at a community college, six out of 11 students are either retained at the same institution, or they transfer to other 4- or 2-year institutions; the retention rate for these students was 48.5%. On the other hand, for students who started college in four-year public institutions, the persistence rate was 82.3%, and the retention rate was 70.2%. This snapshot also indicated that persistence and retention rates saw a sharp decline with an upward shift in the age group i.e., persistence rate for age groups less than 20, 20 to 24, and greater than 24 were 78.1%, 54.9%, and 50.5%, respectively. Another factor that contributes towards transfer student success is certificate or degree completion at the community college level. A snapshot of graduation trends in 2009-10 indicated that 64% of associate degree holders went on to enroll in a four-year institution within the next six years, and over 40% earned bachelor's degrees; for students who earned the Associate degree when they were 20 years old or younger, the graduation rate increased to 61%⁷.

While these statistics point towards the influence of prior enrollment and preparation on transfer student success, they are certainly not the only factors that contribute towards transfer

student success. Research shows that most transfer students experience difficulty with their transition from 2-year to 4-year institutions. This phenomenon is most commonly referred to as ‘transfer shock’, a term coined by J. R. Hills in 1965⁸. A review of literature indicates that academic performance of transfer students at 4-year institutions is a widely-researched area, and studies suggest that in addition to social and psychological barriers, a perception of higher academic rigor, and lack of support services at the new institution could contribute to transfer shock.

Transfer Students in the Electrical and Computer Engineering at Seattle University

Among the 539 students who were admitted to our program and confirmed their desire to study at Seattle University between the years of 2000 and 2016, 340 or 63.1% were transfer students from community colleges and other 4-year institutions. **Table 1** below shows the trends over the years. The percentage of transfers among students admitted to our program varies from 45% to 78%.

Table 1. Percentage of transfers among students who were admitted to the Electrical and Computer Engineering Department and expressed their desire to study at Seattle University.

Year	Total Number of Students Admitted to ECE	Number of Transfer Students	Transfer Students (%)
2000	38	24	63.2
2001	30	23	76.7
2002	19	13	65.0
2003	20	13	65.0
2004	33	26	78.8
2005	19	11	57.9
2006	26	17	65.4
2007	21	13	61.9
2008	21	12	45.2
2009	31	14	45.2
2010	36	20	55.6
2011	25	13	52.0
2012	43	34	79.1
2013	47	33	70.2
2014	43	27	62.8
2015	54	27	50.0
2016*	33	20	60.6

*Academic year in progress; data incomplete.

The Seattle city metro area has an impressive network of 2-year colleges that prepare their students for transfer to 4-year institutions. Most of our transfer students come from eleven 2-year institutions, all within 45 miles from Seattle University. In addition, we have a group of students who transfer from the University of Washington (UW). University of Washington admits most freshmen to the university without guarantee that they will be admitted to their choice of engineering major. Students take science and general education courses and apply to an

engineering department. Some UW engineering majors such as the electrical engineering program are very competitive. Students who are not admitted to the Electrical Engineering Department at the University of Washington often transfer to the Electrical and Computer Engineering department at Seattle University. (Note that starting in fall 2018, University of Washington is moving to direct-to-college engineering admissions.)

In this paper, we are testing the hypothesis that **"When studying at an institution with high levels of support services, transfer students are no less academically successful than freshmen."** We will compare the success of transfer students with that of students who started in our program as freshmen. We also want to compare the level of preparation and the eventual success of students who transfer from a particular institution. As **Table 2** shows, majority of our transfer students come from eleven 2-year institutions and from the University of Washington. To protect the privacy of the 2-year institutions involved in our study, instead of using their actual names, we have given them identifying numbers.

Table 2. Number of students who transferred from particular 2- and 4-year institutions and their average transfer GPA.

Name of Institution	Number of Admitted Students (2000 – 2016)	Average Transfer GPA
University of Washington	37	2.90
College 1	36	3.17
College 2	34	3.22
College 3	34	3.38
College 4	26	3.38
College 5	25	3.26
College 6	18	3.24
College 7	13	3.20
College 8	13	3.46
College 9	10	3.24
College 10	6	3.24
College 11	6	3.30

It is important to analyze the level of preparation of our transfer students. **Table 2** lists the average transfer GPA for students from each 2- and 4-year college. The average GPAs for students transferring from junior colleges are moderate; they range from 3.17 to 3.46 with an average of 3.28. Students transferring from the University of Washington have a much lower average GPA (2.90). It should be noted that all junior colleges considered here have a learning environment similar to Seattle University. Small class sizes are combined with personal attention from instructors and transfer advisors. University of Washington – Seattle is a large Research I campus. Classes at the University of Washington are much larger and students may not get as much personal attention and individual help as they would at a teaching-focused smaller institution.

The average GPA of all students who transferred to our program in 2000-2016 is 3.21. The GPA of students who transferred from junior colleges and 4-year institutions that are not part of the group studied here is 3.18. The average GPA for all transfer students considered in this paper (11 2-year colleges and University of Washington) is 3.23. Finally, the average GPA of students admitted to the ECE Department at Seattle University as freshmen was 3.52. However, it is impossible to make conclusions based on the admission GPA because these are calculated on very different courses for transfer and freshmen students. The GPA values are quoted here to indicate that they are all in a similar range.

The Electrical and Computer Engineering at Seattle University awarded 298 degrees between 2004 and 2016. The average GPA of all graduating students was 3.275. The average number of credits completed by all graduating ECE students was 201 (The BSEE degree at Seattle University requires a minimum of 180 credits). **Table 3** presents detailed statistics for students who graduated from our program in recent years. It should be noted that the highest graduation GPA belongs to students who transferred from the University of Washington. These are the students who transferred to Seattle University with the lowest GPA of all transfer students. It is unclear why these students improved their GPA the most but we can guess that the change of environment was very influential for this group of students. They moved from large class sizes, limited personal attention, and minimal advising to an institution focused on teaching that offers plentiful personal attention and individualized education. It seems that students who decided to transfer from the University of Washington were especially ready to take advantage of the teaching focused environment and extra support services offered at Seattle University.

Among students graduating from our program after transferring from a community college, students from College 4 have the highest graduation GPA. This is not surprising as, over the years, we have found that students from this institution are well prepared for transfer. They are aware of what courses they should take during their first two years in order to optimize their transfer to Seattle University. They are engaged in extra-curricular projects and have opportunities to be mentored and given extra support from faculty at College 4. Finally, it should be noted that the average GPA obtained at graduation by transfer students considered in this paper (3.29) is relatively close to the GPA obtained by students who came to Seattle University as freshmen (3.30). It can be concluded that students who graduate from Seattle University are as successful in terms of their GPA as students who started their studies at Seattle University as freshmen.

Students who transferred from College 4 have also completed less credits by the time of graduation. As mentioned above, the BSEE program requires students to complete a minimum of 180 credits. Students who graduate with a significantly higher number of credits are often those who transferred with classes that do not count toward their major at Seattle University. Some of these students were preparing to transfer to a different university (often the University of Washington) and therefore, they took courses that would count toward their admission there. Often, however, it is an indication of a student not being advised properly and coming to Seattle University without such essential courses as Linear Algebra, Multivariable Calculus, programming, or Electrical Circuits I. In addition to missing some math and science courses, some transfer students do not understand how to manage their general education credits. For example, they may transfer with a high number of courses in humanities but no courses in social studies. Such issues can be easily remedied with a more focused transfer advising.

Months to graduation is a measure of transfer success that is related to the number of credits at graduation. Again, students from College 4 graduate the fastest. This indicates their high level of preparation for transfer to Seattle University.

Overall, about 30 percent of students transferring from the 11 target community colleges and the University of Washington to Seattle University achieved honors at graduation (Cum Laude, Summa Cum Laude or Magna Cum Laude). Students transferring from other institutions are not as successful. However, students who entered Seattle University as freshman have a similar success rate of obtaining graduation honors.

In summary, data shown in **Table 3** prove that students who transferred to Seattle University are no less successful than students who enrolled as freshmen. Next, we describe the support services offered in our program and indicate how they may help transfer students.

Table 3. Number of degrees awarded, graduation GPAs, number of credits, time to graduation, and honors information for students who transferred to Seattle University from the 11 colleges and the University of Washington and for students who enrolled at Seattle University as freshmen.

Name of Institution	Number of EE Degrees Awarded	Graduation GPA	Average Number of Credits at Graduation	Average Number of Months to Graduation	Honors
University of Washington	24	3.45	201	25	10
College 1	29	3.25	204	28	7
College 2	15	3.17	197	28	3
College 3	20	3.40	202	30	9
College 4	9	3.42	191	22	5
College 5	17	3.28	201	30	5
College 6	12	3.03	198	29	1
College 7	10	3.22	210	28	4
College 8	7	3.18	199	28	2
College 9	3	3.40	196	26	1
College 10	4	3.13	198	26	1
College 11	4	3.32	198	26	2
Total/Average	154	3.29	201	28	50
Other	35	3.30	204	27	3
Freshmen	109	3.30	201	48	33

Support Services at Seattle University

The Electrical and Computer Engineering Department at Seattle University offers numerous student support services. The Chair of the ECE Department keeps in touch with engineering transfer advisors at the local community colleges. Any changes to the BSEE curriculum are immediately communicated and the consequences for transfer students are discussed. For

example, several years ago, Seattle University made significant changes to its core curriculum (general education). These changes were discussed at length during the meetings of the Washington State Council for Engineering and Related Technical Education (WCERTE) which is the body that facilitates communication, cooperation and coordination between engineering transfer coordinators in community colleges and faculty in 4-year institutions. As a result, students are aware of the type of general education courses they should take before transferring to Seattle University.

We participate in many recruitment activities. We visit community colleges and present about our scholarly interests, give students an overview of electrical and computer engineering, and provide details about our program. Participation in such recruitment activities is essential because many potential transfer students are not even aware that Seattle University offers a program in ECE.

Potential transfer students are encouraged to meet with the department chair long before they apply for transfer. They are advised on what courses they should take in their last year before transfer. Their transcripts are evaluated by the chair and they are given a draft plan of studies so they know how long it will take them to complete their BSEE degree after they transfer in. Once transfer students are admitted and confirm their desire to study at Seattle University, they have an advising appointment with a professional College Advisor who works in collaboration with the department chair on creating a detailed plan of studies based on the latest information from the student's transcript. Because Seattle University is a small institution, many courses are offered just once per year. Careful attention to scheduling courses is essential in ensuring transfer student success. This is especially important for students who transfer while still missing some important courses such as Linear Algebra, Multivariable Algebra, programming courses, or Electrical Circuits I. These courses have to be scheduled among all the other junior-level courses typically taken by transfer students.

Advising is an important student support service offered at Seattle University. Every quarter, students are required to meet with their faculty advisor before they can register for courses for next quarter. Advising appointments typically last a half an hour and include conversations about student performance in the previous and current quarters, need for extra support services such as tutoring, plans for the following quarter, and career advising. Often, summer internships are discussed or advice is given regarding graduate school. Clearly, advising goes beyond simple course scheduling. Instead, more of a mentoring relationship is developed between the student and their faculty advisor.

Teaching is at the center of all activities at Seattle University. All faculty members care about their students and make sure that students in their classes receive personal attention and are given all what is needed to be successful. We pride ourselves in creating a challenging but supportive learning environment. Long office hours or even an "open-door policy" are the standard in our department. All faculty members take students' end-of-quarter feedback about their classes very seriously. Everybody reflects on what they can do better when they teach the course again. We discuss course outcomes in our faculty meetings and adjust them if they do not reflect the needs of our constituents.

Most of our junior-level courses have a peer tutor assigned to them. The peer tutor is responsible for holding office hours in our conference/student room to offer advice to students working on their homework assignments. Tutors often organize problem solving sessions or review sessions before midterm or final examinations.

Students organize their own study groups. We believe that this is a direct result of the community we have strived to create in the department. We have an open lab policy: students can study in the laboratories if no class is being offered there. We encourage students to work on their assignments together. We believe that collaboration is a key to successful learning. Because students are admitted directly into the department, they never compete against each other. We want all of them to be successful.

We frequently organize social events that bring students, faculty, and staff members together around potluck or other food. We have tea time every Friday afternoon open to all members of the department. We encourage students to mentor each other and take interest in their well-being.

ECE Ambassadors is a group of 13 students selected to represent the department at outreach and recruitment events. In addition to participating in such events, ECE Ambassadors are responsible for maintaining a community within the department. They celebrate faculty and staff members' birthdays and help organize social events. They solicit feedback from other students about potential improvements that they would like to see implemented in the department.

Finally, we work closely with the Office of Career Services at Seattle University. It is important for students to establish professional contacts before they graduate. These contacts may result in summer internships, co-ops, or even permanent positions after they graduate. In addition to reviewing resumes, the Office of Career Services hosts information sessions with companies interested in hiring electrical and computer engineering students.

The Department of Electrical and Computer Engineering organizes career seminars for its students. Every two weeks, we invite a local professional who presents about their career focus and area of expertise and gives introduction to the specific company they come from. Such events connect students with local industry representatives and offer extra motivation for their studies.

Our student clubs are very active. The Society of Women Engineers (SWE) club organizes yearly trip to the national conference for 8-11 students. Students often come back from the conference with in an internship or job offer. The same club organizes a Resume Night which is a resume review night for all students in the College. Students come in with copies of their resume and receive feedback from several local professionals on how to improve it. The IEEE Student Club organizes a mock interview night. Students have the chance to practice their interview skills with local professionals. In addition to the feedback they receive and the opportunity to practice their skills, students have the chance to network with the professionals who attend these events.

The hallmark of the engineering curriculum at Seattle University is our senior design project. It is a year-long design project sponsored by local industry. Faculty coordinators, Project Center

director, and potential sponsors discuss the scope of the project in advance before they agree to a project. Students are divided into groups of 4 and assigned a faculty advisor and an engineering liaison. They work on a solution to a “real-world” problem for three quarters. They have frequent oral presentations followed by feedback from their faculty advisor and course coordinator. They also submit a project proposal at the end of the fall quarter, white paper at the end of winter quarter, and final report at the end of spring quarter. Projects Day, held at the end of May, is the senior design culminating event. Students showcase their projects through PowerPoint presentations, participate in poster session, and demonstrate the prototypes of their solutions.

Our curriculum has been redesigned over three years ago. The focus of the redesign was on responding to the needs of industry and graduate schools, and facilitating the implementation of the latest pedagogical innovations in engineering education. We have increased the opportunities for active learning by adding more lab experiences to our already very hands-on curriculum. We pride ourselves on blending practice with theory and empowering students to engage in their learning. For example, our three separate junior laboratories in circuits, electronics, and signals and systems have been combined into one three-quarters long junior lab experience. The junior lab is centered on a large design project that combines knowledge learned in circuits, electronics, and signals and systems into an exciting and challenging project parallel to the senior design experience in students’ last year. Again, teamwork and communication are at the center of the course.

Finally, we recognize the need to provide our students with space and equipment to work on their own, extra-curricular projects. We now have a MakerSpace lab where students can work with the latest technology. The lab is designed to support two types of projects: student-driven extra-curricular projects and projects incorporated into the first two years of our curriculum. We recognize that freshmen and sophomore students need extra motivation during these important years to stay engaged in electrical and computer engineering. This is where hands-on design projects in wearable electronics or Internet of Things have the opportunity to excite students about their studies and provide the extra motivation needed to persist through their freshman and sophomore years.

Improvements to the Existing Transfer Process

Improvements to the current transfer process will focus on ensuring that all transfer students are aware of our current support services and are invited to take advantage of them. For example, currently, we are experiencing a rather high number of students who transfer to our department without completing a course in Electrical Circuits I. Without this course, students are not ready to start their junior year. As long as we are made aware of it early enough, we try to remedy it by advising the students to take the Circuits I course during the summer, before they start at Seattle University in the fall. In many cases however, it is too late and students have to take one additional year to complete their studies in our department.

Similarly, some students transfer without programming courses. This does not prevent them from enrolling in our program. However, as above, they are potentially facing a delay in obtaining their degree because they have two more courses to complete at Seattle University. This lack of knowledge about courses to take prior to transferring to Seattle University can be traced to transfer advisors unaware of the details of our program or, more likely, students not targeting

Seattle University as one of their schools to transfer to. Often, students make last minute decisions to include Seattle University in the schools they apply to transfer. We will work with transfer advisors to make them more aware of the details of our curriculum.

Conclusion

We have studied transfer student success in the Department of Electrical and Computer Engineering at Seattle University. It is our conclusion that transfer students are as successful as students who enrolled as freshmen. We believe that the numerous student support services offered in our department have a very positive impact on students' progress toward their degree.

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