

## The Community College STEM Pathway: A Study of Women in Engineering and Computer Science

Roberta M. Rincon, PhD

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### What We Studied

This study was undertaken to gain a better understanding of the success of students who choose to pursue a baccalaureate degree in engineering or computer science (ECS) and begin their postsecondary education at a community college. Using the data obtained from the Texas Education Research Center, researchers analyzed the persistence and baccalaureate completion rates of students who declare an ECS major in Texas, at both two-year and four-year colleges, disaggregating the data by gender and race to highlight gaps that are often masked when looking at STEM as a whole. Texas was chosen as the focus of this report because of ease of access to student-level transfer data, the diversity of the population, and the fact that the majority of bachelor's degree earners in the state had prior enrollment in a two-year community college (NSCRC, 2017).

Despite efforts to improve transfer success and increase diversity in STEM, the data show that we have not seen significant gains in successful transfer and ECS baccalaureate degree completion among students who begin at a two-year college. Considering the underrepresentation of women and minorities in STEM, coupled with the need to better support students who choose to pursue a STEM baccalaureate degree and start at a two-year college, more attention must be devoted to ensuring the success of these students to promote increasing diversity in STEM fields.

Little research to date has been conducted specifically on students who choose the community college pathway towards ECS degrees. Given that approximately 1 in 5 engineering bachelor's degree earners begin at a community college, as well as the need to improve the diversity of the engineering profession through broadened participation of underrepresented groups in engineering, organizations must understand this population better before attempting to implement interventions. The Society of Women Engineers conducted this study to analyze data around the transfer pathways of underrepresented students in ECS, including women and students of color.

Women have consistently made up the majority of college enrollments and bachelor's degree recipients in the U.S. for over a decade. In contrast to the growing female representation in higher education, female enrollment has been stagnant at around 20 percent of total enrollment in engineering baccalaureate degree programs since 1995. Female enrollment in computer science baccalaureate degree programs has actually decreased in the last decade in both actual headcount and proportion of total, hovering at approximately 18 percent of the total enrollment in computer science (NSF, 2017). Meanwhile, the percentage of ECS baccalaureate degrees earned by women has hovered around 18 percent for over a decade (U.S. Department of Education, 2017a).

Community colleges are an increasingly popular route toward a baccalaureate degree. Almost 40 percent of undergraduates in the U.S. attended a public two-year college in 2015-16 (U.S. Department of Education, 2017b). Underrepresented minority students are overrepresented in community colleges, where over half of all Hispanic and Native American/Alaskan Native undergraduates are enrolled, and half of all Black undergraduates are enrolled (U.S.

Department of Education, 2016). Among women, 44 percent of undergraduate students were enrolled in community colleges in 2012 (Ibid).

The community college pathway toward an ECS baccalaureate degree has the potential to help us increase the diversity of the ECS fields, given that approximately 15 percent of two-year college students declare a major in ECS, and over 80 percent of first-time community college students indicate that they want to complete their bachelor's degree or higher (U.S. Department of Education, 2014; Horn & Skomsvold, 2011). Unfortunately, only 33 percent of community college students, regardless of major, successfully transfer (Jenkins & Fink, 2016).

The purpose of this study was to identify demographic and contextual factors of women who transfer from a community college to a four-year university to complete their bachelor's degree in engineering or computer science (ECS) and determine if differences among these factors impact success. The following research questions were studied:

- How successful are women who transfer from a community college to a four-year university to complete their bachelor's degree in ECS?
- Does success vary by race, enrollment status, major concentration, institution, and other contextual factors?
- Which institutions have high rates of successful female transfer and degree completion, particularly among underrepresented minority women?

## **How We Analyzed the Data**

This study utilized longitudinal datasets beginning with the 2002/03 school year from the Texas Education Research Center housed at The University of Texas at Austin. The Texas Education Research Center imposes strict requirements on the release of data and results from the Center to ensure the confidentiality of student data; hence, this report includes disaggregated data by gender and race/ethnicity when sufficient numbers of students were available for a given outcome.

Researchers conducted a descriptive analysis to understand the transfer success of underrepresented students in ECS in Texas. Due to low student counts in subpopulations among transfer students in ECS, the scope was expanded to include the success of women and underrepresented minorities who choose to major in ECS, regardless of the type of institution they first enrolled in (two-year college or four-year university). The study focused on transfer student success and disaggregated subpopulations as data availability permitted. All analyses were disaggregated by FTIC cohort where allowed, and were collapsed across cohorts when required to avoid data suppression.

## **What We Discovered**

The following are some of the major findings from the descriptive analysis of student enrollment, transfer, persistence, and baccalaureate degree attainment in ECS in Texas.

### **Declaration of an ECS Major**

Despite the fact that more women than men enroll in college each year, less than 4 percent of female students choose to major in ECS compared to almost 20 percent of men across all two- year and four-year colleges. The percentage of women among students who declare an ECS major has slightly decreased over time, from 20.2 percent in the 2002/03 FTIC cohort to 17.8 percent in the 2011/12 FTIC cohort. Less than 4 percent of White, Hispanic, and Black female students declared an ECS major in the 2010/11 FTIC cohort, compared to 8 percent of Asian female students. Only 15 percent of Black male students in the 2010/11 FTIC cohort declared an ECS major, compared to over 28 percent of Asian male students. Over the course of the ten FTIC cohorts analyzed, Black and Hispanic students of both genders experienced slight decreases in the percentage of students choosing to major in ECS.

## Persistence and Completion Rates in ECS

Women's persistence rates in ECS have risen almost 12 percent since the 2002/03 FTIC cohort, far outpacing the 3 percent increase in persistence that men have experienced over this same time. However, less than 30 percent of students who declared an ECS major at a public institution in Texas had persisted in ECS by 2015. A higher percentage of women than men completed an ECS baccalaureate degree from the 2008/09 FTIC cohort – a reversal from prior cohort years. However, women are switching out of ECS and earning a non-ECS baccalaureate degree at higher rates than men. Persistence and completion rates of ECS students by FTIC cohort were lowest among Black and Hispanic students, regardless of gender. Asian students of both genders have the highest ECS baccalaureate degree completion rates, while Black students have the lowest. Female ECS degree attainment has increased overall, but success has been concentrated among White females. Hispanic and Asian women have seen slight increases, while Black females have seen a decrease in ECS degree completion rates. More women than men switch out of ECS and into a non-ECS major at both two-year and four-year colleges, but major switching rates are high for both genders. Seven two-year colleges and six four-year universities in Texas saw over half of female ECS students switch to non-ECS majors. Only one four-year university experienced such high switching rates among male ECS students.

## Transfer Success in ECS

Irrespective of major choice, more women than men transfer from a two-year college to a four-year university. For students who transfer from a two-year college to a four-year university, less than 2 percent of female students select an ECS major, compared to 11 percent of male students. ECS baccalaureate completion rates among transfer students exceeded 60 percent for men and 50 percent for women from the 2005/06 FTIC cohort, the highest in this study. Female transfer students in ECS began seeing higher ECS baccalaureate completion rates than male students in later cohorts. Male transfer graduates in ECS consistently outnumber female transfer graduates for every cohort year included in this study, but male students are experiencing declines in transfers and degree completions. Less than 1 percent of all Black, Hispanic, and White female transfer students across all FTIC cohorts earned an ECS baccalaureate degree by Fall 2015.

Approximately 7 percent of White male transfer students earned an ECS baccalaureate degree by Fall 2015, more than double the rate of ECS degree attainment among Black male transfer students. Over 60 percent two-year colleges (sending institutions) included in this analysis had more than 100 male transfer graduates in ECS by Fall 2015, compared to only 3 percent that had more than 100 female transfer graduates in ECS.

## Policy Recommendations

With additional supports and encouragement for students who choose to major in ECS and start at a two-year college, the potential to increase diversity in ECS fields is significant because of the relatively high rates of success that transfer students are seeing after transfer. With this in mind, the following recommendations are offered:

### **Disaggregate and Analyze Data on Transfer Student Success in ECS**

Many institutions and government entities are concerned about increasing diversity in STEM, focusing on improving the ease of transfer from two-year to four-year colleges and supporting STEM students at various stages along the pathway. However, disaggregated data by gender, race, and major concentration to measure enrollments, persistence, and graduation rates at a more granular level are not easy to find. Encouraging institutions and government entities to look at this level of data will help shed light on specific subgroups in STEM who may be struggling along the transfer pathway toward an ECS degree. Unless we can identify where the problems are occurring, we will have difficulty addressing them.

### **Find Out What Community College Students Need to Be Successful in ECS**

All students pursuing an ECS baccalaureate degree are not alike. Though there are many programs and services in place to support university students in ECS, we need to understand what specific challenges and obstacles community college students are experiencing and develop programs and services to meet their needs. Areas of potential challenge

could involve acceptance of course transfer, financial aid options, effectiveness of advising, availability of internship opportunities, and access to role models and mentors.

### **Set Goals for ECS Transfer Student Enrollment, Success, and Completion**

Much of the resources allocated to supporting STEM students in higher education have been toward supporting university students. We measure what we value, and we invest in what is measured so we can meet the goals that have been set. If diversity in ECS is important, and we know that community colleges are enrolling high numbers of underrepresented students into ECS majors with intentions to transfer and complete an ECS baccalaureate degree, then setting goals, allocating resources to programs and services to help us meet those goals, and continuously measuring progress is the only way we will see the impact of our investment into ECS transfer success. Universities cannot do this alone: this effort requires a network of support from government, community colleges, universities, industry, professional associations, and other nonprofits interested in diversifying engineering and technical professions.

Full report available at [www.research.swe.org](http://www.research.swe.org).

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