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Unlocking STEM Talent: What Happens to Transfer Students at the Four-Year College?

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Acknowledgments

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Through transfer, community colleges already contribute tens of thousands of STEM bachelor's graduates to the workforce each year. Yet their potential to expand and diversify the STEM talent pool remains largely unrealized.

Too much talent is lost along the transfer pathway. Community college transfer students are less likely than students who begin at four-year institutions to complete a STEM bachelor's degree. Those who do graduate take longer to earn their degrees and are less likely to pursue graduate education—despite evidence that their post-transfer academic performance is comparable to that of their non-transfer peers.

Focusing on the trajectories of community college transfer students who complete bachelor's degrees, this report argues that expanding STEM degree attainment requires close collaboration among community colleges, four-year institutions, and state systems. The goal should extend beyond improving transfer efficiency to strengthening and diversifying the STEM talent pipeline through broader access and sustained support for community college students.

Explore this report's accompanying **data dashboard**.

Introduction

Community colleges offer a major opportunity to expand and diversify the STEM workforce, but many community college students get lost in the transfer pathway to a STEM bachelor's degree. Transferring in STEM is challenging because STEM pathways are highly sequential and require precise alignment across institutions. Small missteps early on can compound into delayed transfer, credit loss, excess credits, and ultimately, lower rates of bachelor's degree completion.

Using National Student Clearinghouse data on bachelor's completers who first enrolled in a four-year institution in the 2015-16 academic year, this report examines the trajectories of community college transfer students who earned STEM bachelor's degrees and, in some cases, pursued graduate study. We examine three questions. First, to what extent do community college transfer students contribute to the broadening of STEM bachelor's degree attainment, and how likely are they to complete a STEM degree relative to non-transfer students at four-year colleges? Second, among community college transfer students, how do trajectories differ between those who complete STEM and non-STEM bachelor's degrees, particularly with respect to time to bachelor's completion? Third, among students who earn a STEM bachelor's degree, how likely are those who transferred from community colleges to continue into graduate school compared with those who did not transfer? Throughout the report, we examine how these outcomes vary across STEM disciplines, student demographic groups, states, and prior dual enrollment participation. We close with recommendations for states and colleges on how to improve transfer pathways to STEM bachelor's and graduate degrees.

This report is the first to provide a national and state-by-state breakdown on the trajectories of community college transfer bachelor's completers in STEM fields and to provide evidence on the extent to which such students pursue graduate education. The findings in this report are aimed at helping college and state leaders assess challenges and opportunities in expanding STEM talent through community college transfer pathways.

Key Takeaways

1. **Community college transfer students (or "transfers") already make a substantial contribution to the STEM talent pipeline, but greater potential remains.**
    - Community college transfers accounted for nearly 56,000 STEM bachelor's graduates in our study's 2015-16 four-year college entry cohort, representing 15% of all STEM bachelor's degree earners.
    - Community college transfers broaden the socioeconomic and, to some extent, the racial diversity of STEM bachelor's completers. They contribute graduates across every major STEM discipline in proportions similar to those of non-transfer graduates.
    - Despite these contributions, among those who completed a bachelor's in any subject in the entry cohort, community college transfers were less likely than non-transfers to complete a bachelor's degree in STEM (17% vs. 23%).
    - If community college transfers were represented among STEM bachelor's completers in the same proportion as in non-STEM fields, an estimated 18,400 additional transfer students in our sample would have completed a bachelor's degree in STEM rather than in non-STEM.

2. **STEM transfer bachelor's completers face a longer path to bachelor's completion than transfer students graduating in non-STEM fields.**
   - Among the community college transfers who completed a bachelor's in the entry cohort, those who completed in STEM were less likely to graduate on time than those completing non-STEM degrees (16% vs. 20%).
   - While STEM transfer bachelor's completers spent 0.3 years less as community college students compared to non-STEM transfer completers, once they transferred to the four-year institution, they spent on average 0.4 additional years to complete.
   - Community college transfers graduating in engineering were the least likely to graduate on time (13%) and spent the longest time enrolled after transfer, suggesting particularly difficult transfer pathways in engineering programs once arriving at the four-year institution.

3. **Community college transfer graduates are less likely to continue into graduate education, including graduate STEM programs.**
   - Among STEM bachelor's completers in the entry cohort, only 12% of community college transfers enrolled in graduate school in the year after bachelor's completion, compared to 17% of non-transfers.
   - Similar gaps are observed among non-STEM bachelor's completers (11% among community college transfers versus 14% among the non-transfers), suggesting that barriers to graduate education extend beyond STEM and affect transfer students more broadly.
   - Community college transfer STEM bachelor's completers were less likely to continue into STEM graduate programs than non-transfer STEM bachelor's completers (5% vs. 8%), with the largest gap observed in mathematics and statistics.

4. **Black, Hispanic, and low-income students face the greatest barriers along the STEM transfer pathway. Women are the least likely to complete in STEM, but those who do experience shorter times to degree completion and higher rates of graduate enrollment.**
   - Among transfer bachelor's completers in the entry cohort, Black (13%), Hispanic (14%), low-income (16%), and female (10%) students were all less likely than the average community college transfer student to complete in STEM.
   - Among STEM bachelor's completers, Black (12%), Hispanic (11%), and low-income (14%) transfer students were the least likely to complete on time, reflecting more years of enrollment both pre- and post-transfer.
   - Women had low rates of STEM bachelor's completion among both transfer and non-transfer completers. Yet among community college transfers, women who completed a STEM degree were the most likely to graduate on time, largely because they spent fewer years enrolled before transfer.

- Graduate enrollment rates were broadly similar across demographic groups, although female community college transfers who completed STEM bachelor's degrees were somewhat more likely to enroll in graduate education than transfer STEM graduates in general.
- We observe similar patterns in terms of racial/ethnic and gender gaps among non-transfer students, suggesting that improving transfer is necessary but not sufficient to address broad disparities in STEM.

5. Large variation in STEM transfer outcomes across states suggests that improvements are possible. We also observe that prior dual enrollment participation is related to higher STEM bachelor's completion and on-time graduation.

- Among bachelor's completers in the entry cohort, transfer students with prior dual enrollment were more likely to complete in STEM than transfers in general (20% vs. 17%), and they were substantially more likely to earn their bachelor's within four years (24% vs. 16%). Our findings suggest that on-time completion among prior dual enrollees was due to fewer years enrolled pre-transfer and not because they progressed more quickly after arriving at the four-year college.
- In several states, strong representation of transfer students among STEM bachelor's completers aligns with strong transfer representation overall and higher transfer completion rates. This suggests that these states have conditions that support community college transfers more broadly, benefiting STEM participation.
- Across all states, transfer bachelor's completers are less likely to complete in STEM than non-transfer bachelor's completers. But the size of this gap varies, suggesting that the transfer disadvantage in STEM completion observed nationally is not equally pronounced across state contexts.
- While across all states, years spent post-transfer were relatively large compared to pre-transfer years, in some states, increasing on-time completion will require efforts to reduce both pre- and post-transfer years in college.
- Washington consistently stands out with strong outcomes across multiple measures, with a high representation of community college transfers among STEM bachelor's graduates, one of the highest STEM shares among transfer completers, and a relatively small gap in STEM share between transfer and non-transfer completers. It is also among the states with the highest rates of on-time completion.
- California and Florida also performed well on several measures. California combines strong community college representation in STEM with relatively short time to bachelor's completion after transfer, while Florida combines strong transfer representation with above-average graduate school enrollment among STEM transfer graduates.
- States that performed well across STEM transfer outcomes did not necessarily perform equally well on graduate school enrollment rates, suggesting that stronger transfer systems do not automatically translate into stronger graduate education pathways.

Motivation for the Study

Community colleges enroll nearly 40% of all undergraduate students, including a disproportionate share of students from historically underrepresented groups (Brock et al., 2025). As four-year colleges and universities seek to expand the pool of students pursuing higher education in STEM, especially among Black, Hispanic, and low-income students, they can look to community colleges as a largely untapped source to achieve these gains.

Despite this potential, transfer and bachelor's degree completion rates among community college students remain low, especially in STEM fields. Within six years, only one third of community college entrants transfer to a four-year institution. Just half of these transfer students go on to complete a bachelor's degree. And only 16% of these bachelor's degree completers graduate in a STEM field. These low transfer and completion rates, which have remained unchanged for more than a decade, are even lower among Black, Hispanic, and low-income students (Velasco et al., 2024a). The low rates also affect graduate degree completion in STEM: In 2016-17, only 9% of science and engineering master's degree recipients had ever enrolled at a community college (National Student Clearinghouse Research Center, 2017).

For most transfer students, four-year colleges do not accept all community college coursework for credit. An estimate using data from the National Center for Education Statistics (NCES) showed that only 58% of community college transfer students were able to transfer over 90% of their community college credits (Monaghan & Attewell, 2015). Furthermore, even when courses are accepted for transfer credit, they frequently are not accepted as prerequisites for upper-level courses. Because STEM programs are often tightly sequenced and require mathematics courses like calculus to be taken early on, the loss of major-applicable credits can delay academic progress, propagate through the curriculum, and hinder timely degree completion (Bahr et al., 2017; Fink, Myers, et al., 2023). These delays can be exacerbated by placement into remedial courses below what students' high school achievements warrant, which is not uncommon at community colleges (Park et al., 2021).

Thus, to plan a transfer pathway, STEM-aspiring students must identify their intended major well before transferring so they can complete the appropriate prerequisite sequence. But many STEM undergraduate programs have selective admissions and strict requirements about the courses that count toward a degree. Transfer agreements can help students understand what community college courses might transfer. Yet, even when transfer agreements exist, they can vary considerably across institutions and even across majors within the same institution, with university departments holding autonomy in deciding which courses to accept and apply toward a given program of study (Schudde & Jabbar, 2024). Ultimately, STEM-aspiring students are exposed to a high-stakes transfer "maze" (Burdman et al., 2025), as students face uncertainty about where they can transfer and which courses they can take with them.

Because of complications in transfer pathways, STEM-aspiring students need effective advising for successful transfer. But these students often end up navigating a complex transfer system on their own because community colleges lack the capacity to provide timely and individualized guidance (Burdman et al., 2025; Wang, 2020). And after transferring, students often continue to encounter barriers, including advising that is not tailored to the needs of transfer students, credits that are not transferred and applied toward their degrees, scheduling conflicts among required courses, and misalignment between community college and four-year coursework (Schudde & Jabbar, 2024; Sithole et al., 2017; Wyner et al., 2016).

Yet, even in the face of these barriers, transfer students in general—and those seeking STEM degrees—perform as well academically as their non-transfer peers after enrolling at four-year institutions. Transfer students have higher first-to-second-year retention rates than non-transfer students (81% vs. 76%) (Velasco et al., 2024c), and they exhibit comparable bachelor's completion rates as non-transfer students (Melguizo et al., 2011; Monaghan & Attewell, 2015; Xu et al., 2018). Evidence from Michigan shows that transfer students who pursue STEM majors perform similarly to native STEM students, with no evidence of weaker academic outcomes following transfer (Bahr et al., 2023). These findings point to the potential of community colleges and their students as a source of STEM talent—both for more advanced training and ultimately for meeting the needs of regional labor markets.

Data Description

This report seeks to characterize the pathways to STEM bachelor's degrees and graduate school enrollment of community college students and to identify where women, Black, Hispanic, and low-income students fall behind. To do so, we use National Student Clearinghouse (NSC) data on all students who started at a four-year institution in the academic year of 2015-16, including those who transferred from a community college.[1]

We focus on students who completed a bachelor's degree within six years from entry to the four-year college. Our focus on bachelor's completers is driven by higher reliability of field-of-study data for degree completion relative to declared major. Note that by including only students who successfully transferred and earned a degree, we are unable to include outcomes for STEM-seeking transfer students who did not earn a STEM bachelor's degree relative to their non-transfer or non-STEM peers.

We use National Student Clearinghouse data on all the students who started at a four-year institution in the 2015-16 academic year, and we focus on students who completed a bachelor's degree within six years from entry to the four-year institution, regardless of transfer status.

Our primary analytic sample includes data from **1,965 four-year institutions** that enrolled at least one student who started in the 2015-16 academic year and received a bachelor's degree within six years of four-year college entry. It also includes data from **919 community colleges** that enrolled at least one student within six years prior to academic year 2015-16 who transferred to a four-year institution in 2015-16. We provide definitions of student and institutional characteristics in the Appendix.

Transfer Status

We distinguish between three mutually exclusive groups of students by transfer status:

- **Community college (CC) transfers:** Students whose last enrollment prior to their start at a four-year institution in the 2015-16 academic year was at any community college and whose community college enrollment was within six years prior to four-year college entry. Among students who

entered a four-year institution in the 2015-16 academic year and completed a bachelor's degree within six years, 326,355 (19%) were community college transfers. For brevity, we sometimes refer to community college transfers simply as transfers.

- **Non-transfers:** Students who entered a four-year institution during the 2015-16 academic year with no previous postsecondary enrollment in the prior six years. Among students who entered a four-year institution in the 2015-16 academic year and completed a bachelor's degree within six years, 1,201,888 (70%) were non-transfers.
- **Lateral transfers:** Students whose last enrollment prior to their start at a four-year institution in the 2015-16 academic year was at another four-year institution and who started at that four-year institution within six years prior to transferring. This report does not focus on this particular group of students. Among those who entered a four-year institution in 2015-16 and completed a bachelor's degree within six years, 195,104 (11%) were lateral transfers.

STEM Classification

To classify students in STEM and non-STEM categories, we use NSC reports of six-digit NCES Classification of Instructional Program (CIP) codes for bachelor's degree awards and graduate school programs; we classify the CIP codes in the following fields of study as STEM:

- **Biosciences:** Includes programs in biology, genetics, and chemistry, encompassing programs under the two-digit CIP code 26 and some related programs under two-digit CIP code 40.
- **Computer and information sciences:** Includes programs in computer systems, computer science, data science and analytics, and information technology classified under the two-digit CIP code 11 and some programs under two-digit CIP code 30.
- **Engineering:** Includes programs in engineering technologies and industrial technologies, classified under two-digit CIP codes 14 and 15, as well as programs in automobile and aeronautical technologies under two-digit CIP code 47.
- **Mathematics and statistics:** Includes programs under two-digit CIP code 27.
- **Physical sciences:** Includes programs in geosciences, atmospheric sciences, ocean sciences, physics and astronomy, and earth sciences classified under two-digit CIP codes 40 and 41.

In our analyses, we combine all of the above categories into one STEM category and separately present findings broken down by STEM field. We classify students as non-STEM if the reported six-digit CIP code of their bachelor's degree does not fall into the above categories. A small number of students are missing a CIP code on their bachelor's degree (10,180 students, 0.59%) or have a CIP code value on their bachelor's degree that does not map to an NCES CIP code (9,198 students, 0.53%): We classify these students under the non-STEM category. Our results are very similar when we exclude them from analysis.

STEM Transfer Outcomes

We use the following metrics to describe the trajectories of students, focusing on STEM bachelor's completion and graduate enrollment among community college transfer students:

- **Share of bachelor's completers who complete in STEM:** Percentage of bachelor's completers who completed a STEM bachelor's degree. We compute this measure by transfer status group.
- **Time to completion:** To ensure comparability, we focus our analysis of time to completion on community college transfer students only, emphasizing differences between STEM and non-STEM transfer bachelor's completers. All time-to-completion metrics are measured in calendar years.
    - **On-time bachelor's completion among community college transfer completers:** Percentage of bachelor's completers who completed a bachelor's degree within four calendar years from the date of first enrollment at the community college, where first enrollment is at any time within six years prior to four-year entry.
    - **Years pre-transfer:** Calendar years between first enrollment at the community college and four-year entry. Note that this may include periods in which a student was not enrolled if they did not enroll continuously throughout the period.
    - **Years post-transfer:** Calendar years between four-year entry and bachelor's completion date. Note that this may include periods in which a student was not enrolled if they did not enroll continuously throughout the period.
- **Graduate enrollment:** The NSC data allow us to capture enrollments in graduate education occurring shortly after bachelor's completion. We focus on students who enrolled in graduate school in the academic year following their bachelor's degree award date. For simplicity, we refer to this as graduate enrollment in the year after bachelor's completion.
    - **Graduate enrollment rate in the year after bachelor's completion.** The percentage of bachelor's completers who enrolled in graduate school in the academic year following their bachelor's degree award date. In our analysis, we differentiate between graduate enrollment of community college transfer and non-transfer completers and between STEM and non-STEM bachelor's completers.
    - **STEM graduate enrollment rate in the year after bachelor's completion:** The percentage of bachelor's completers who enrolled in a STEM program in graduate school in the academic year following their bachelor's degree award date. In our analysis, we differentiate between graduate enrollment of community college transfer and non-transfer completers, and we focus on the graduate enrollments of STEM bachelor's completers.

When measuring graduate enrollment rates, we exclude bachelor's completers who graduated in the 2021-22 academic year, as our data do not allow us to observe such students for a full academic year after bachelor's completion. We distinguish three graduate levels: master's, doctoral, and professional.[2]

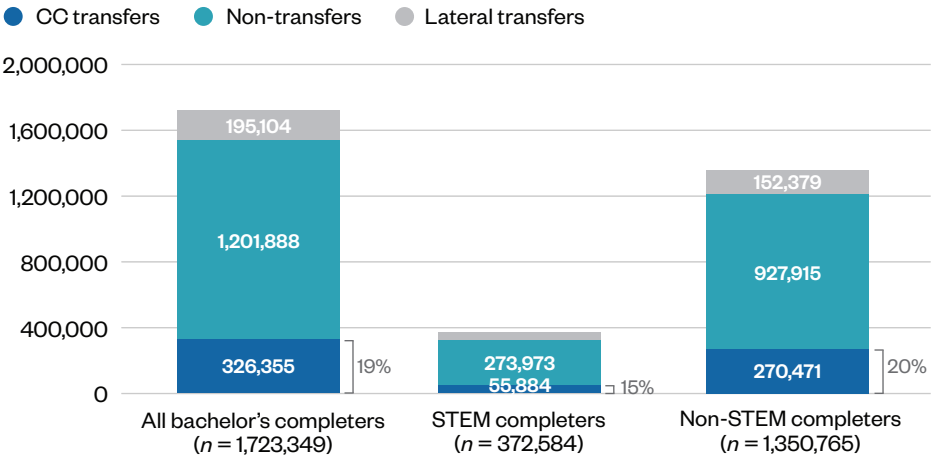
Findings

How much do community college transfers contribute to the STEM pipeline?

Community colleges produced about 56,000 STEM bachelor's graduates who were part of the 2015-16 transfer cohort. While this is a substantial contribution, untapped potential remains, as community college representation is larger among non-STEM than STEM bachelor's completers. Figure 1 presents the participation of community college transfer students among bachelor's and STEM bachelor's completers. Of the roughly 372,000 students who completed a STEM bachelor's degree within six years of their start at a four-year institution, about 55,800 had transferred from community college, representing 15% of all STEM bachelor's completers. This is a significant number, but based on what we observe among non-STEM bachelor's completers, the contribution could be larger: Of the 1.3 million students who completed a non-STEM bachelor's degree, just more than 270,000 were community college transfers, representing 20% of non-STEM completers. If the proportion of community college transfers were the same (19%) among both STEM and non-STEM completers, the number of community college transfer STEM bachelor's completers would increase by a third—to about 74,300—or about an additional 18,400 STEM bachelor's completers via the transfer pathway.[3]

Community colleges contributed about 56,000 STEM bachelor's graduates to the 2015-16 four-year college entry cohort and increased the diversity of STEM completers. But improving transfer pathways could further boost STEM talent in the workforce: If community college transfers were evenly represented among STEM and non-STEM bachelor's completers, an estimated additional 18,400 community college transfer students in that cohort would have completed a bachelor's in STEM rather than in non-STEM fields.

Figure 1.
Number of Bachelor's Completers in STEM and Non-STEM Fields, by Transfer Status

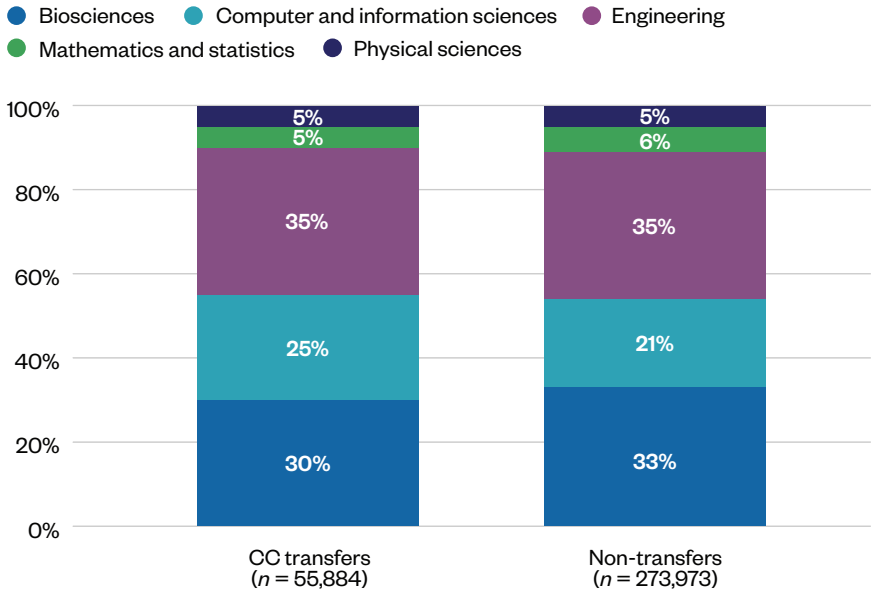


Note. Sample consists of students who entered a four-year institution in the 2015-16 academic year and completed a bachelor's degree within six years of four-year entry.

Despite their underrepresentation among STEM completers, community college transfers remain an important source of STEM bachelor's degree holders across the full range of STEM disciplines, with a field distribution that closely resembles that of non-transfer students. Figure 2 shows the fields of STEM study among transfer and non-transfer students in our sample who completed a STEM bachelor's degree. Engineering was the largest field for both groups, accounting

for 35% of STEM completers regardless of transfer status. Biosciences was the second largest, representing 30% of transfer STEM completers and 33% of non-transfer STEM completers. Transfer and non-transfer STEM completers were also similarly likely to complete in mathematics and statistics (5% and 6%), and physical sciences (5% each). Community college transfers were slightly more likely than non-transfers to complete in computer and information sciences (25% vs. 21%).

Figure 2.
Share of STEM Bachelor's Completers in Each STEM Field, by Transfer Status



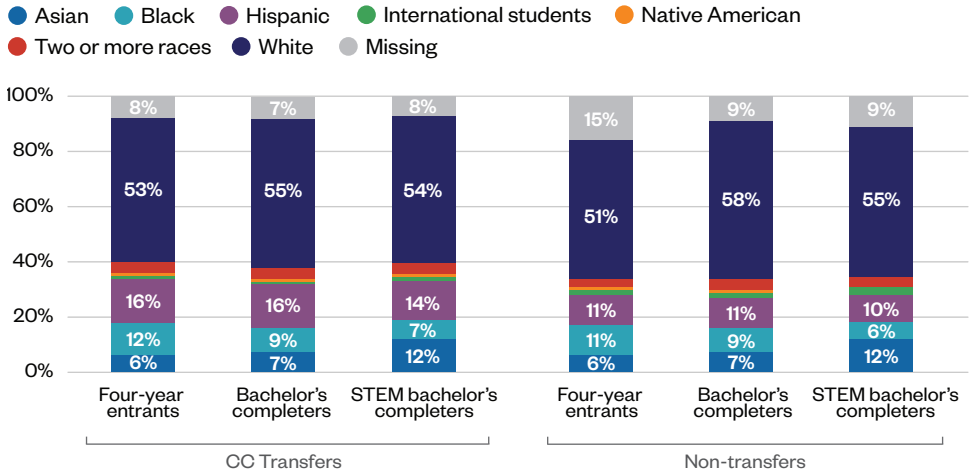
Community college transfers substantially broaden the socioeconomic diversity of STEM bachelor's completers and, to a lesser extent, the racial and ethnic diversity of such degree holders. Figure 3 compares the characteristics of four-year entrants to those of bachelor's completers and STEM bachelor's completers, for transfer and non-transfer students separately. At the time of four-year entry, 50% of transfers in our sample were from low- or middle-income neighborhoods, compared to 42% of non-transfers—and this higher diversity among transfer students persisted among bachelor's and STEM bachelor's completers. Transfer students also exhibited a stronger representation of Hispanic students than non-transfers. It is worth emphasizing that female representation was low among all STEM bachelor's completers and that it was even lower among transfer students. Only 31% of transfer STEM bachelor's completers were female, compared to 38% of non-transfer STEM bachelor's completers.

Among community college transfers, some STEM fields were more diverse than others. As shown in Figure 4, biosciences tended to be more diverse and was the only field where women were overrepresented (57% of biosciences completers were female). Engineering was the least diverse field in terms of gender, and computer and information sciences was the least diverse in terms of income.

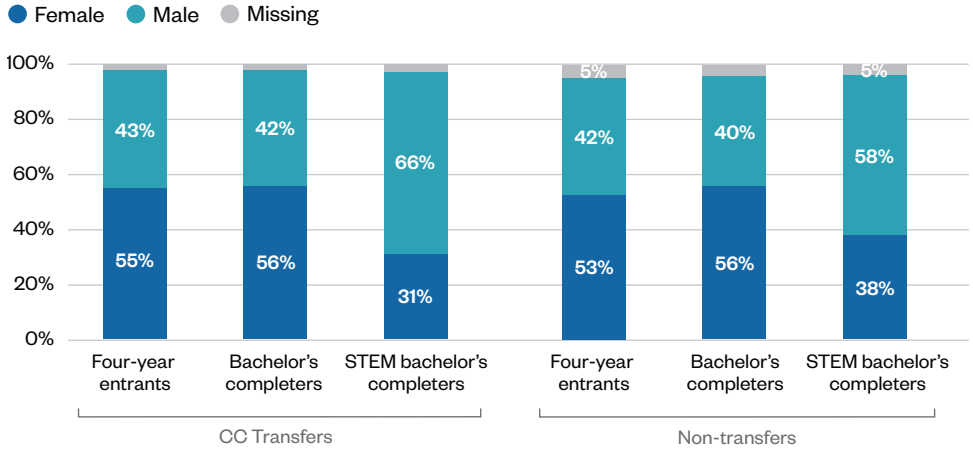
Figure 3.

Characteristics of Four-Year Entrants and Completers, by Transfer Status

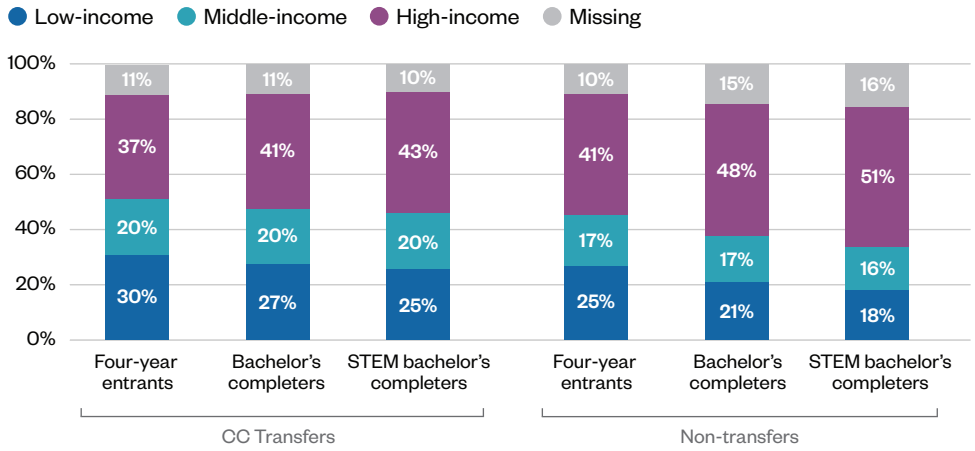
A. Racial/ethnic representation



B. Gender representation



C. Income representation

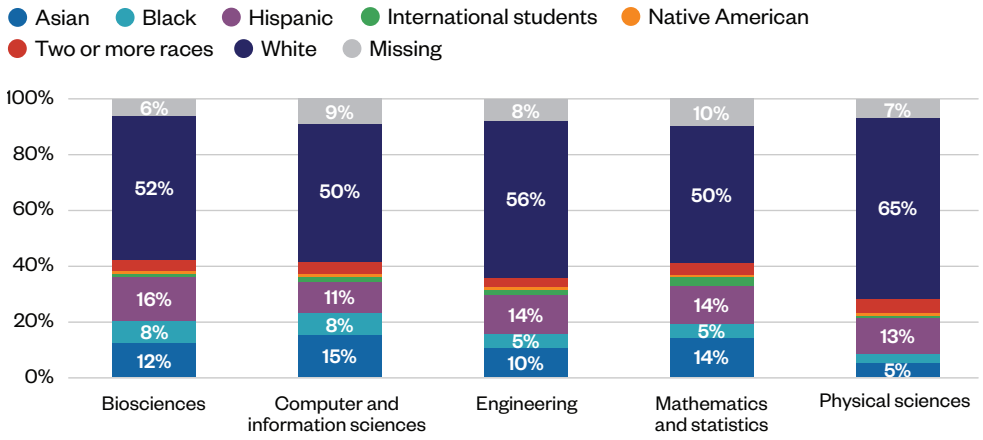


Note. Four-year entrants is the sample of students who entered a four-year institution in the 2015-16 academic year. Bachelor's completers are those who completed a bachelor's degree within six years of four-year entry, and STEM bachelor's completers are those who completed a STEM bachelor's degree within six years of four-year entry.

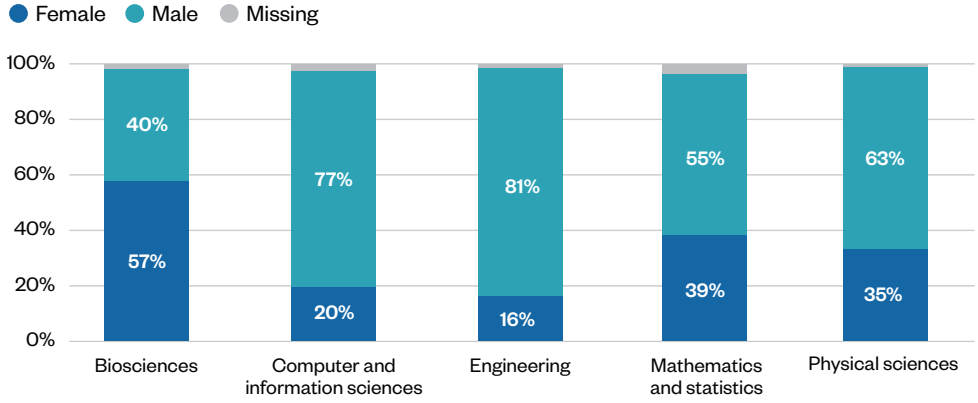
Figure 4.

Characteristics of Community College Transfer STEM Bachelor's Completers, by STEM Field

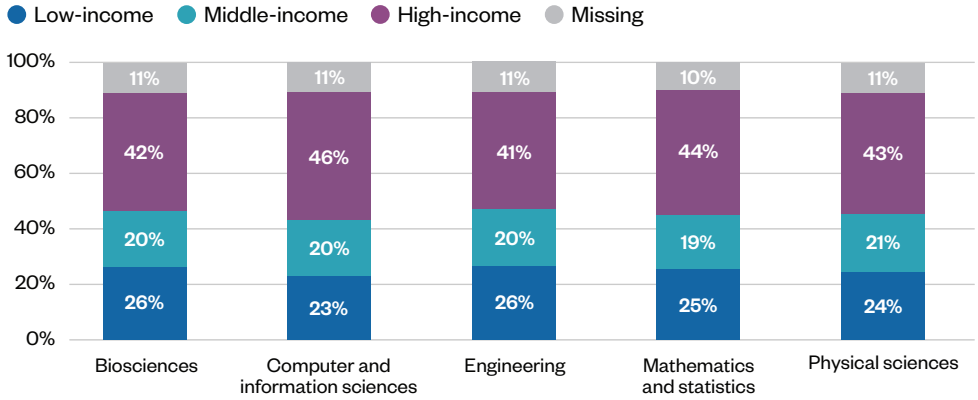
A. Racial/ethnic representation



B. Gender representation



C. Income representation

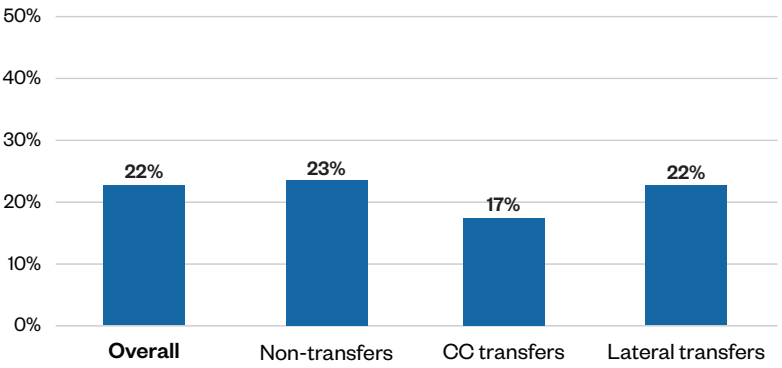


Note. Sample consists of students who attended a community college prior to the 2015-16 academic year, entered a four-year institution in the 2015-16 academic year, and completed a STEM bachelor's degree within six years of four-year entry.

What happens after transferring to the four-year institution?

Our findings, which focus on the trajectories of community college students post-transfer, suggest that four-year institutions are an important intervention point in the transfer pathway to increase STEM completion among community college students. Even among community college transfer bachelor's completers—who by definition have demonstrated their ability to earn a bachelor's—the share in our sample who earned degrees in STEM is small compared to that of non-transfer completers. Figure 5 shows the STEM share of bachelor's completers among those who earned a bachelor's within six years of their start at a four-year institution. Seventeen percent of community college transfer bachelor's completers earned a STEM degree, compared to 23% among non-transfer completers. In a supplementary analysis, we found that while community college transfers who declared a STEM major post-transfer were as likely to complete a bachelor's as transfer students overall, 14% of those who did complete a bachelor's did so in a non-STEM field.[4] To further characterize the trajectories of community college transfer students who earned degrees in STEM, we proceed to examine a key indicator: on-time completion and time to bachelor's completion among completers.

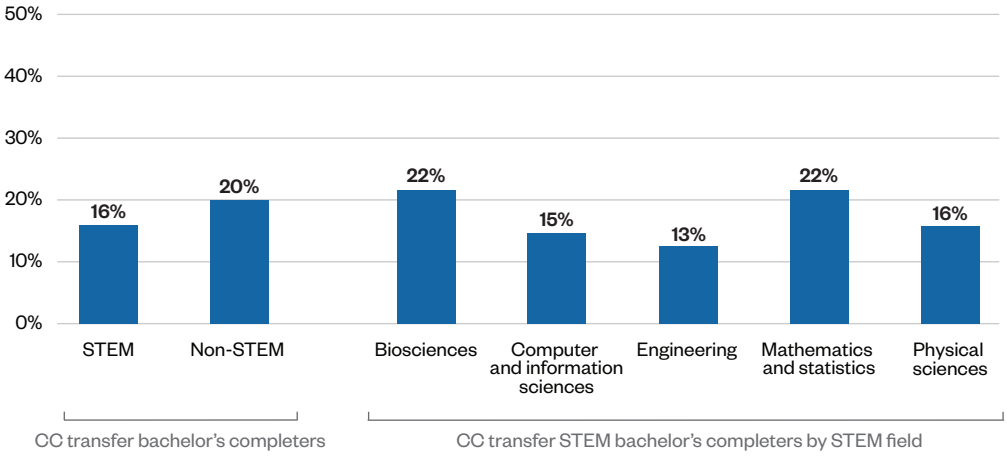
Figure 5.
Share of Bachelor's Completers Who Completed in STEM, by Transfer Status



Along the pathway to a STEM degree, there is room for intervention to broaden the pool of STEM graduates, especially post-transfer. Among bachelor's completers, community college transfers in our sample were less likely than non-transfers to complete in STEM. Additionally, transfer STEM bachelor's completers struggled to graduate on time, particularly due to more years spent at the four-year institution.

Even compared to other community college transfers who earned bachelor's degrees, on-time completion was low among STEM bachelor's completers, particularly for those in engineering and computer and information sciences. Figure 6 shows the share of bachelor's completers who earned their degree within four years of their start at a community college, which we refer to as on-time completion.[5] Among transfer students, only 16% of STEM bachelor's completers finished on time, compared to 20% of non-STEM completers. The time penalty is uneven across STEM fields. Engineering completers were the least likely to finish on time, with only 13% completing within four years. Computer and information sciences completers show similarly slow trajectories, with only 15% finishing within four years. By contrast, biosciences completers fared better, with 22% completing on time.

Figure 6.
Share of Community College Transfer Bachelor's Completers Who Earned Their Degree Within Four Years (On-Time)

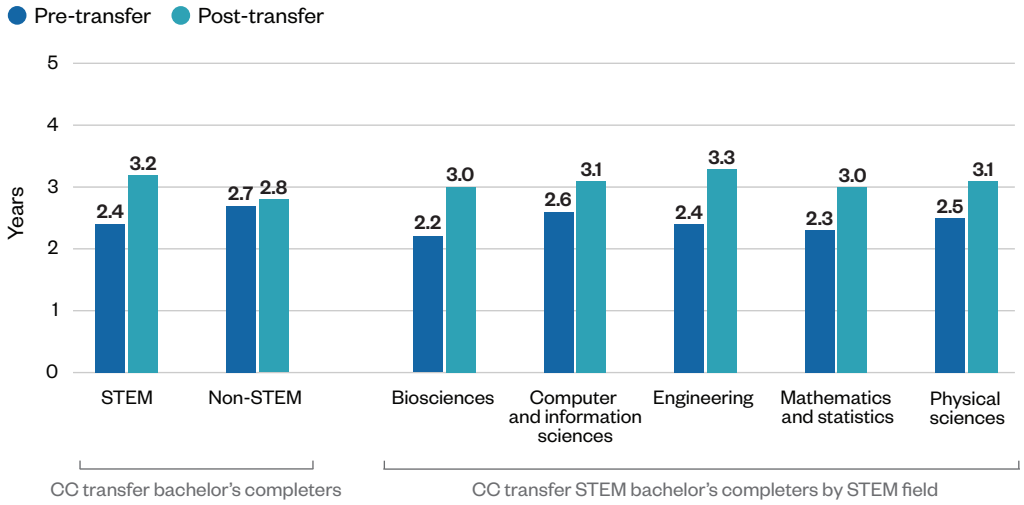


When we examine time to bachelor's completion among transfers who completed within six years, we observe that STEM bachelor's completers had a substantially longer period after transfer than before transfer, with engineering students spending the longest time at four-year institutions. Figure 7 breaks down the time to bachelor's completion in pre- and post-transfer years of enrollment. STEM completers spent, on average, fewer years than non-STEM completers at the community college before transferring (2.4 vs. 2.7 years), but they spent 0.4 additional years at the four-year institution post-transfer (3.2 vs. 2.8 years), resulting in a post-transfer penalty relative to their non-STEM peers of nearly five months. This penalty was especially large among engineering students, who spent, on average, 3.3 years at the four-year institution in addition to their 2.4 years of community college enrollment.

The fact that STEM transfer students spend more years of enrollment post-transfer speaks to the difficulties many STEM-aspiring students face at four-year institutions. Many such students face credit transfer and applicability barriers and course availability delays, preventing them from taking required sequence courses on time and delaying graduation.

Figure 7.

Average Years of Pre- and Post-Transfer Enrollment Among Community College Transfer Bachelor's Completers

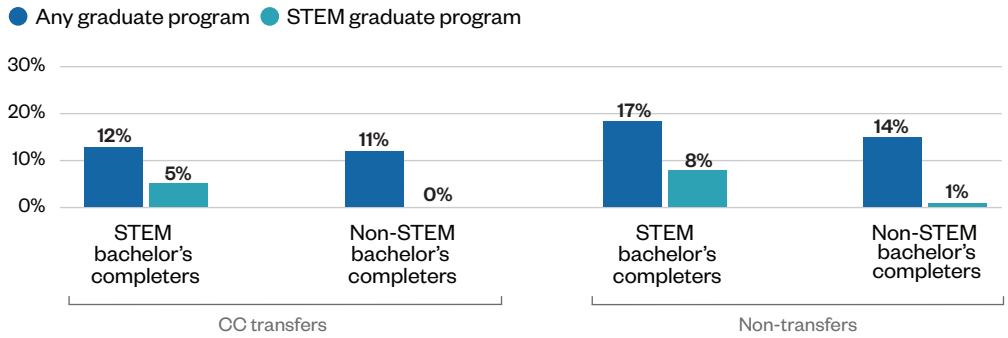


Where do community college transfer STEM bachelor's completers go next?

Barriers facing transfer students may extend beyond bachelor's completion into graduate education. Examining the rate at which bachelor's completers in our sample enrolled in graduate school shortly after finishing undergraduate college, we find that community college transfers were less likely than non-transfers to continue into graduate study. As shown in Figure 8,12% of community college transfer STEM bachelor's completers enrolled in a graduate program in the year after bachelor's completion, compared to 17% of non-transfer completers. The gap between transfer and non-transfer graduate school enrollment was not exclusive to STEM: Among community college transfer non-STEM bachelor's completers, graduate school enrollment was similarly low at 11%, compared to 14% among non-transfer non-STEM completers. Unsurprisingly, enrollment in STEM graduate programs (as opposed to enrollment in any graduate program) was also lower among transfer versus non-transfer STEM bachelor's completers (5% vs. 8%).

Figure 8.

Rates of Enrollment in a Graduate Program Among Bachelor's Completers, by Transfer Status

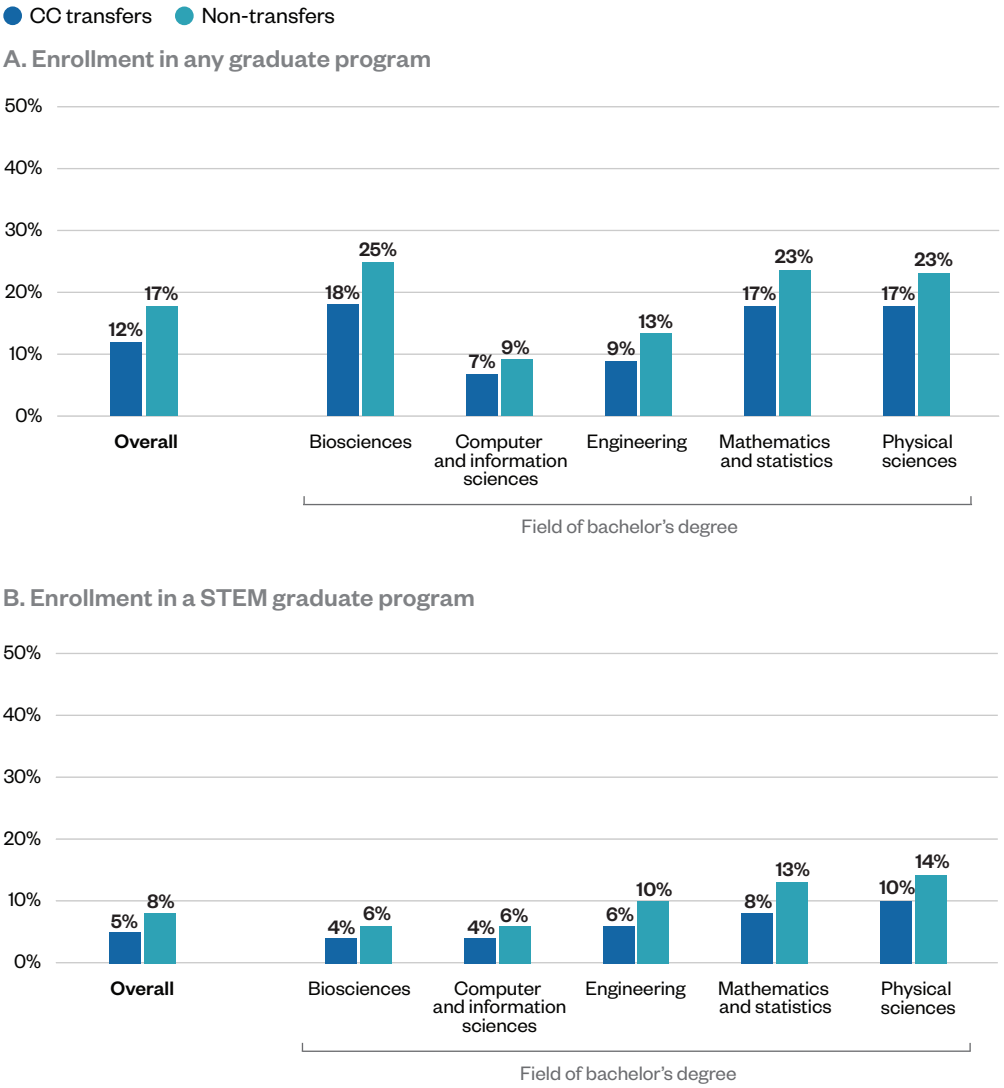


Only 12% of community college transfers in our sample who earned a STEM bachelor's degree enrolled in graduate school, compared to 17% of non-transfer STEM completers. The gap in graduate school enrollment rate between transfers and non-transfers was prevalent among non-STEM completers as well, suggesting that there may be systemic barriers to graduate school access for transfer students in general.

Though community college transfer bachelor's completers consistently enrolled at lower rates than their non-transfer peers, graduate school enrollment rates differed considerably within STEM disciplines. Figure 9 shows graduate school enrollment rates and STEM graduate enrollment rates by undergraduate STEM field for transfer and non-transfer bachelor's completers. Gaps in overall graduate enrollment were the largest in the biosciences (18% for transfer completers versus 25% for non-transfer completers), mathematics and statistics (17% vs. 23%), and physical sciences (17% vs. 23%). Similarly, STEM transfer completers were less likely than their non-transfer peers to continue into STEM graduate education after earning a bachelor's degree in mathematics and statistics (8% vs. 13%) or physical sciences (10% vs. 14%).[6]

Figure 9.

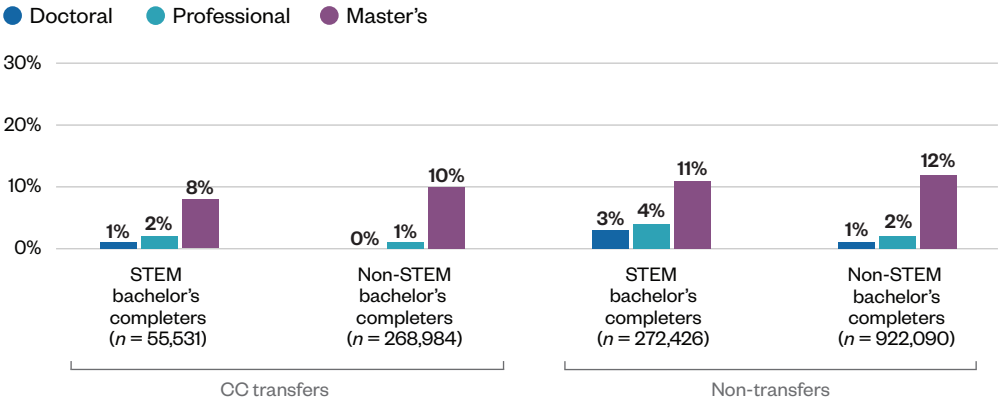
Rates of Enrollment in Any Graduate Program and in a STEM Graduate Program Among STEM Bachelor's Completers, by Transfer Status



Notably, once they enroll in graduate education, community college transfers pursue similar levels of graduate credentials as non-transfer students, with master's programs accounting for the majority of enrollments. As shown in Figure 10, most bachelor's completers in our

sample who enrolled in graduate education did so in master's programs. It is also worth noting that STEM bachelor's completers were more likely than their non-STEM peers to enroll in professional programs. The latter finding is driven by graduates in biosciences, who were more likely to pursue professional programs in health.

Figure 10.
Rates of Enrollment in Graduate Program Levels Among Bachelor's Completers, by Transfer Status



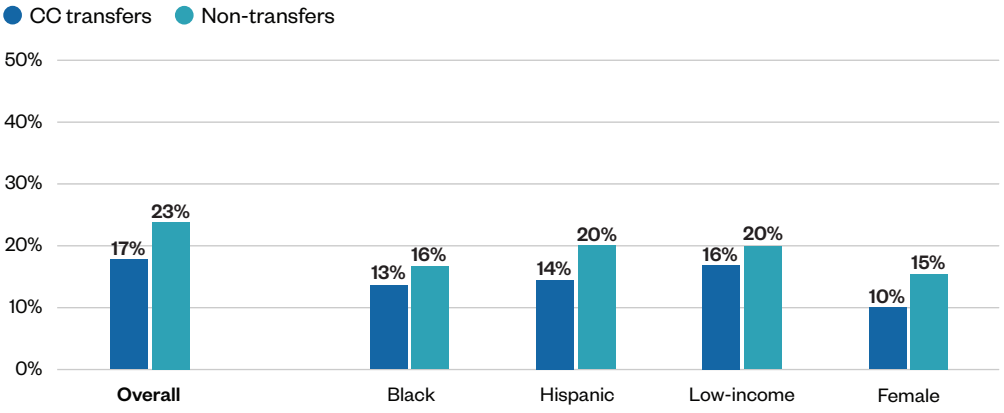
Which students face the greatest challenges?

It is well documented that barriers in transfer pathways disproportionately affect Black, Hispanic, and low-income students (Bahr et al., 2017; Fink, Garcia Tulloch, et al., 2023). Research on STEM undergraduate persistence in general shows that women and underrepresented minorities are less likely to persist in STEM than their male or non-minority peers—with these gaps largely explained by differences in prior academic preparation (Griffith, 2010). Thus, obstacles in transfer pathways can be particularly consequential in STEM because community colleges enroll large numbers of students from historically underrepresented backgrounds. In this section, we examine the extent to which disparities in STEM bachelor's completion, time to degree, and graduate enrollment are evident among these groups.

Our findings reveal two distinct patterns. Black, Hispanic, and low-income students are less likely to complete a bachelor's degree in STEM and face longer pathways to completion when they do. Women face somewhat different circumstances: They are especially underrepresented among STEM bachelor's completers, but women who successfully complete a STEM bachelor's through a transfer pathway earn their degree more quickly than transfer STEM bachelor's completers overall and enroll in graduate education at relatively high rates.

Figure 11 shows that among community college transfer bachelor's completers in our sample, Black, Hispanic, and low-income students were less likely than transfer students overall to earn their degree in STEM. These disparities were not unique to community college transfers: Among non-transfer bachelor's completers, Black, Hispanic, and low-income students were also less likely to complete in STEM. However, within each demographic group, community college transfers were less likely than their non-transfer peers to complete a bachelor's in STEM.

Figure 11.
Share of Bachelor's Completers Who Completed in STEM, by Transfer Status and Student Characteristics



Even among transfer students who successfully completed a STEM bachelor's degree, timely completion was particularly uncommon among Black, Hispanic, and low-income students. As shown in Figure 12, only 12% of Black, 11% of Hispanic, and 14% of low-income transfer STEM bachelor's completers finished within four years, compared with 16% of transfer STEM bachelor's completers overall. Figure 13 further shows that their longer pathways reflect additional time both before and after transfer. These patterns are especially consequential given the large numbers of Black, Hispanic, and low-income students who enroll in community colleges: Strengthening their pathways to STEM bachelor's completion is critical if transfer is to realize its potential in diversifying participation in STEM.

Black, Hispanic, and low-income bachelor's completers in our sample who transferred faced greater challenges to STEM attainment, and female transfer completers were the least likely to complete in STEM, though those who did finished their bachelor's more quickly. Similar patterns were also present among non-transfer students, suggesting that strengthening transfer pathways is necessary but not sufficient to address broader disparities in STEM.

Figure 12.
Share of Community College Transfer STEM Bachelor's Completers Who Completed Within Four Years (On-Time), by Student Characteristics

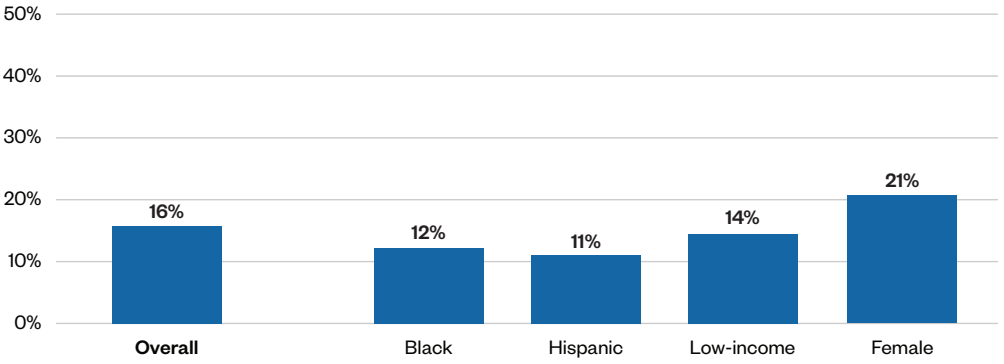
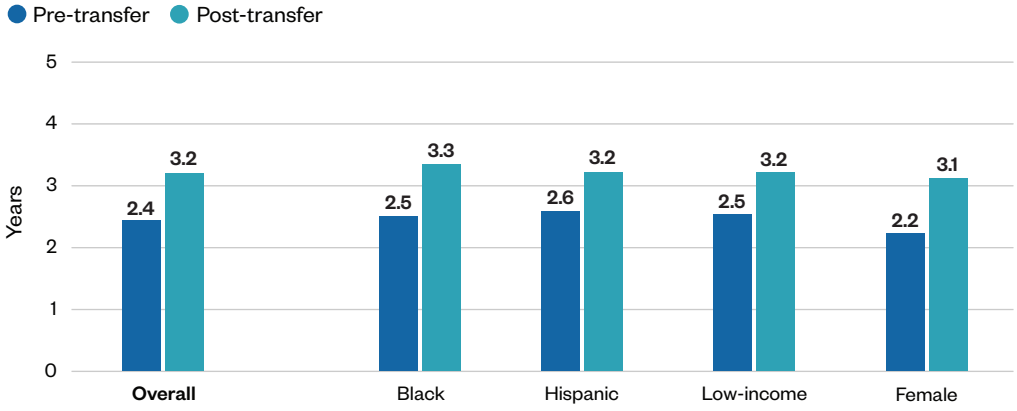


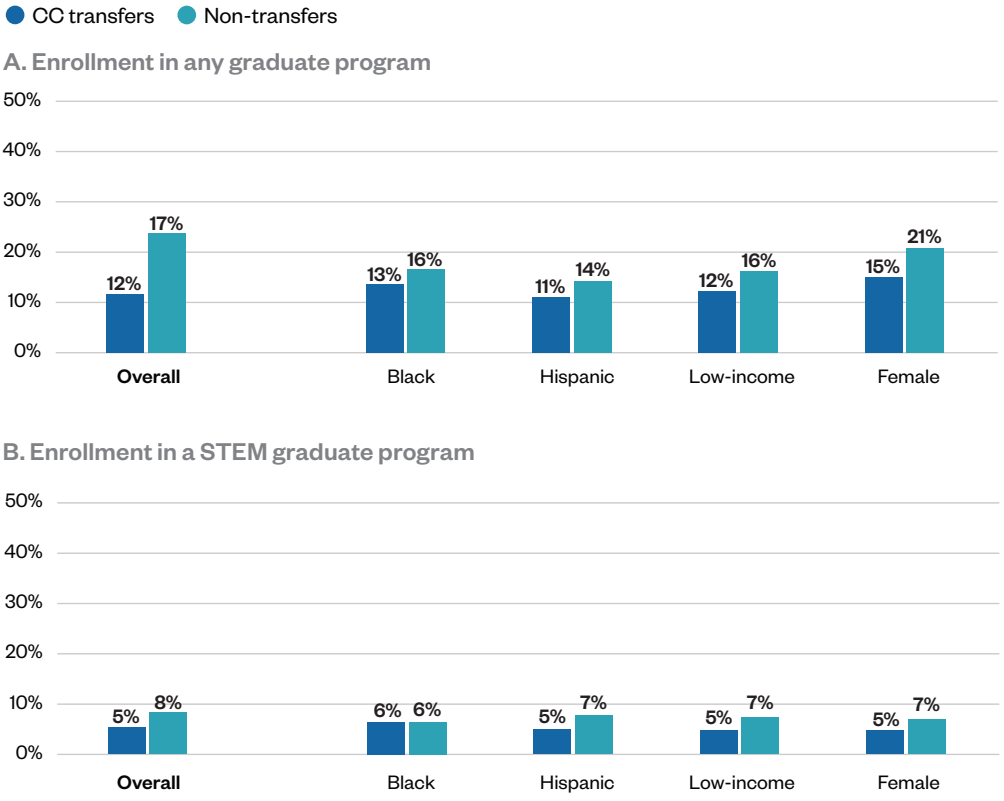
Figure 13.
Average Years of Pre- and Post-Transfer Enrollment Among Community College Transfer STEM Bachelor's Completers, by Student Characteristics



Women experience a different pattern along STEM transfer pathways. They were the least likely of the demographic groups we examine to complete a bachelor's degree in STEM: Only 10% of female community college transfer bachelor's completers earned their degree in STEM, compared with 17% of transfer completers overall. Yet women transfers who did complete a STEM bachelor's earned the degree more quickly than other STEM transfer bachelor's graduates. This difference was mainly driven by women spending fewer years enrolled before transfer.

As shown in Figure 14, women STEM transfer completers are also somewhat more likely than other transfer STEM graduates to enroll in graduate education. Fifteen percent in our sample enrolled in graduate school within one year of bachelor's completion, compared to 12% of STEM transfer completers overall. Furthermore, women were similarly likely to continue into STEM graduate education compared to STEM transfer bachelor's completers overall. As with STEM bachelor's completion, the broader gender pattern is not unique to transfer students: As shown in Figure 11, women who began at four-year institutions were also less likely to complete a bachelor's in STEM than non-transfer completers overall (15% vs. 23%), though they were more likely to enroll in graduate school post-graduation (21% vs. 17%). The transfer pathway therefore intersects with a broader challenge of retaining women in STEM, even as women who successfully complete STEM degrees through transfer demonstrate relatively strong outcomes in terms of time to degree and overall graduate enrollment.

Figure 14.
Rates of Enrollment in a Graduate Program Among STEM Bachelor's Completers, by Transfer Status and Student Characteristics



Taken together, these findings show that improving STEM transfer pathways has considerable potential to broaden STEM diversity, but different groups encounter different constraints. Black, Hispanic, and low-income completers face a dual challenge: lower STEM completion rates and a longer time to degree. For women, the primary gap lies in STEM bachelor's completion itself, as female graduates finish on a timeline faster than men. Because disparities are also evident among non-transfer students in underrepresented groups, stronger transfer pathways alone will not eliminate broader concerns in STEM attainment. But ensuring that the transfer process does not create additional barriers is an important part of realizing community colleges' potential to diversify the STEM talent pipeline.

Where are the outcomes strongest?

By educational pathway

A large body of research has documented the positive impact of taking college-level coursework while in high school, known as dual enrollment, on students' postsecondary enrollment and bachelor's degree attainment (Schaller et al., 2025). Among community college entrants, students with prior dual enrollment are more likely to transfer to a four-year college and complete a bachelor's degree than students without dual enrollment (Velasco et al., 2024a). However, less is known about the extent to which dual enrollment participation can help increase STEM bachelor's completion among transfer students. Given the promise of dual

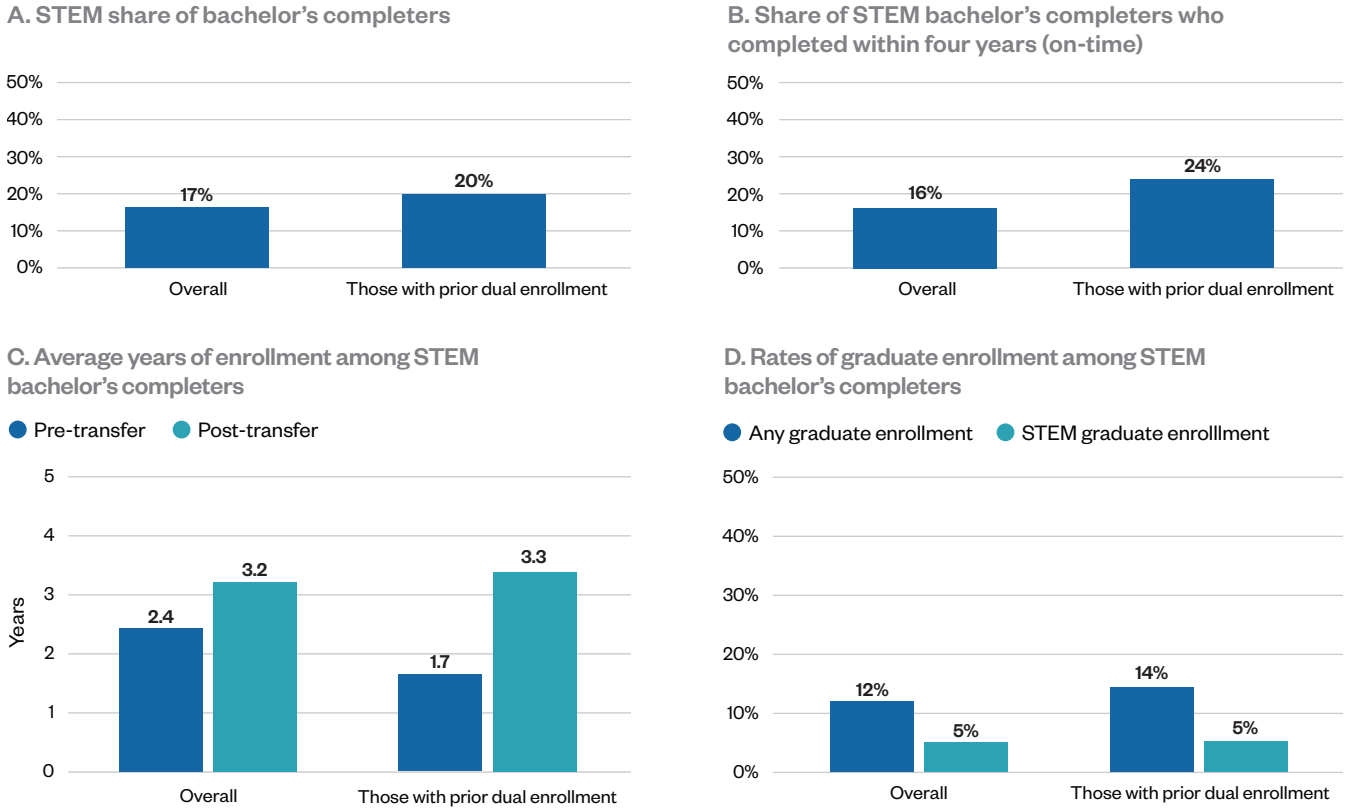
enrollment as a strategy for increasing postsecondary attainment, we now examine whether community college transfer bachelor's completers with prior dual enrollment in our sample experienced stronger outcomes along STEM pathways.

Overall, 22% of community college transfer bachelor's completers in our sample participated in dual enrollment as high school students, compared to 20% of non-transfer bachelor's completers. Figure 15 shows that the share of STEM bachelor's completers was higher among community college transfers with prior dual enrollment compared to community college transfer students overall (20% vs. 17%). Among the STEM bachelor's completers, those who took dual enrollment were substantially more likely to complete their bachelor's degree within four years (24% vs. 16%). This difference in on-time completion reflects fewer pre-transfer years and not fewer post-transfer years. Thus, although prior dual enrollment is associated with a greater likelihood of completing in STEM and a shorter time to the bachelor's degree, we find suggestive evidence that the dual enrollment advantage loses traction after students reach the four-year institution.

Lastly, graduate enrollment rates are similar between transfer STEM bachelor's completers with prior dual enrollment versus STEM completers overall (14% vs. 12% for any graduate enrollment and 5% for STEM graduate enrollment in both groups), which suggests that gains associated with dual enrollment diminish further after bachelor's completion.

Prior dual enrollment is associated with higher STEM completion and more timely bachelor's completion among community college transfers, but these advantages lose traction after transfer: Relative to STEM bachelor's completers overall, students with prior dual enrollment in our sample spent about the same amount of time at the four-year institution and enrolled in graduate education at similar rates.

Figure 15.
STEM Bachelor's Completion and Graduate School Enrollment Metrics Among All Community College Transfer Completers and Those With Prior Dual Enrollment



By state

State variation shows that challenges along STEM transfer pathways are not equally pronounced everywhere. Some states have combined a greater representation of community college transfers among STEM bachelor's completers and a shorter time to bachelor's completion, with Washington standing out for relatively strong outcomes.

Transfer policies, practices, and contexts vary substantially across states, and they continue to evolve. As of 2022, a 50-state comparison by the Education Commission of the States (ECS) found that 20 states had established statewide common course-numbering systems, while 38 states had established a transferable core of lower-division courses (ECS, 2022). Given these state-level differences, identifying where community college transfer students achieve stronger STEM outcomes is critical for local policymakers and practitioners seeking to improve transfer. In this section, we examine variation across states in community college transfers' contribution to STEM bachelor's completion, time to degree, and graduate enrollment. Where possible, we benchmark these outcomes against those of non-transfer bachelor's completers. While these descriptive comparisons cannot identify which specific state policies or practices lead to stronger outcomes, they can highlight broader patterns that may be useful in understanding and strengthening STEM transfer pathways.

As shown in Table 1, community college transfer representation among STEM bachelor's completers varied substantially across states, from 10% or less in 19 states, to roughly about 25% of STEM bachelor's completers in Mississippi, California, Washington, and Florida. States with greater representation of community college transfers among STEM completers also tended to have greater transfer representation among bachelor's completers overall and higher bachelor's completion rates among transfer students. These findings suggest that states where community college transfers make larger contributions to STEM bachelor's degree production may also have conditions that benefit and support community college transfer students more broadly.

Table 1.

Community College Transfer Share Among Bachelor's Completers, Completion Rate, and Total STEM Graduates, by State

State outcome relative to the U.S. average

Lower — Higher

State	CC transfer representation among bachelor's completers		CC transfer bachelor's completion rate (%)	Total number of STEM bachelor's completers
	Overall (%)	STEM (%)		
U.S. average	**19**	**15**	**66**	**372,584**
Mississippi	32	27	63	2,998
California	31	25	78	37,343
Washington	25	24	78	7,879
Florida	30	24	74	17,165
Hawaii	28	22	70	937
Maryland	24	21	62	8,276
Texas	25	20	70	27,340
Illinois	23	20	71	13,411
Kansas	23	20	60	2,916
Nevada	25	20	63	1,706
Arizona	21	19	50	7,691
Oklahoma	23	19	62	3,770
Virginia	19	19	64	11,767
Idaho	20	18	55	1,886
Oregon	22	18	67	4,584
Alabama	20	17	65	5,756
New Jersey	23	17	75	9,769
North Carolina	18	16	70	8,858
Utah	16	16	59	4,385
Missouri	20	15	59	7,103
Kentucky	18	15	62	3,659
Arkansas	20	15	57	2,514
South Carolina	15	14	70	4,970
Michigan	18	14	62	13,078
New Mexico	20	13	49	1,188
Tennessee	17	13	66	5,181
Iowa	19	13	66	4,743
Colorado	16	13	56	7,819
Wisconsin	16	13	65	7,741
Nebraska	16	12	63	1,983
Minnesota	14	12	63	6,427
New York	15	10	64	30,749
North Dakota	13	10	59	1,664
Delaware	13	10	61	1,191
Louisiana	12	10	51	3,844
Alaska	10	8	27	405
New Hampshire	11	8	40	2,421
Connecticut	10	8	68	4,171
Montana	11	8	51	1,479
South Dakota	10	8	58	1,274
Ohio	10	7	59	13,270
Washington, DC	8	7	33	1,716
West Virginia	11	7	56	1,710
Massachusetts	10	7	62	13,141
Maine	8	7	43	1,501
Rhode Island	9	6	57	1,833
Pennsylvania	9	6	63	19,664
Indiana	8	6	57	10,800
Vermont	5	4	54	1,322
Georgia	4	3	50	15,098

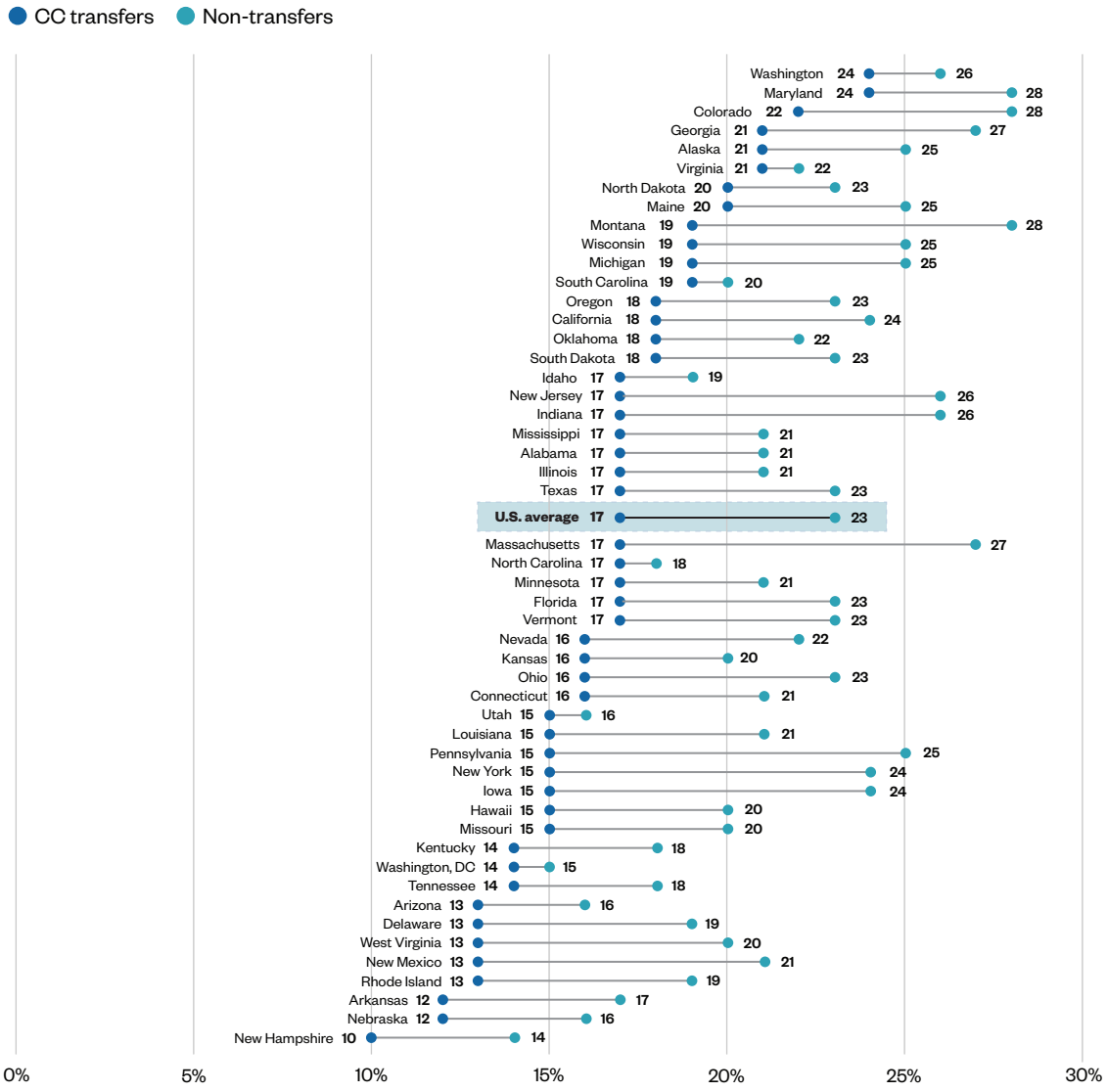
Note. Community college transfer bachelor's completion rate within six years from four-year entry by the state of the four-year institution. Wyoming data is suppressed because it has fewer than three colleges with students in the sample.

Next, we examine the share of community college transfer bachelor's completers who earned their degree in STEM, benchmarked against the share for non-transfer bachelor's completers. Figure 16 presents these estimates for the U.S. average and for each state.

The low STEM completion observed nationally among community college transfers varies considerably in magnitude across states. Washington, Maryland, and Colorado stand

out as having the highest shares of STEM bachelor's completers among both community college transfers and non-transfer students, with a STEM share of nearly one-quarter. In Washington, the gap in STEM shares between community college transfer and non-transfer students is well below the national average of 6 percentage points, at only 2 percentage points (24% vs. 26%). Other states exhibit substantially larger differences between transfer and non-transfer student shares, suggesting that the transfer disadvantage in STEM completion observed nationally is not equally pronounced across state contexts.

Figure 16.
STEM Share of Transfer and Non-Transfer Bachelor's Completers, by State



Note. Outcomes reported by the state of the four-year institution. Wyoming data is suppressed because it has fewer than three colleges with students in the sample.

As shown in Table 2, time to bachelor's completion also varies substantially across states. Transfer students reached bachelor's completion in STEM post-transfer more quickly in some states than in others. Community college STEM bachelor's completers in California, Delaware, Illinois, New Jersey, and Washington spent the fewest years enrolled post-transfer, at 2.8 to

2.9 years. However, fewer post-transfer years do not always translate into higher rates of on-time bachelor's completion, as timely completion also depends on the years students spend enrolled before transfer. For example, while Washington and Illinois combine fewer post-transfer years with high rates of on-time STEM bachelor's completion among completers, other states with similarly short post-transfer years do not. These results underscore that while reducing the time students spend at the four-year institution can help reduce overall time to STEM bachelor's completion, for many states, improving timely completion also requires focusing on student progress at the community college prior to transfer.

Table 2.

Time to Bachelor's Degree Among Community College Transfer Completers, by State

State	CC transfer bachelor's completers: STEM		CC transfer bachelor's completers: Non-STEM	
	On-time bachelor's completion rate	Average years to bachelor's completion post-transfer	On-time bachelor's completion rate	Average years to bachelor's completion post-transfer
U.S. average	**16%**	**3.2**	**20%**	**2.8**
Washington	25%	2.8	29%	2.6
Kansas	24%	3.4	29%	3.0
West Virginia	24%	3.2	25%	3.0
Iowa	24%	3.4	32%	2.8
Washington, DC	24%	2.9	18%	3.1
Indiana	22%	3.4	24%	2.9
Illinois	22%	2.9	23%	2.6
South Carolina	22%	3.3	29%	3.0
North Dakota	22%	3.1	27%	3.0
Ohio	20%	3.5	23%	2.9
Mississippi	20%	3.2	28%	2.8
Delaware	20%	2.8	16%	2.7
New Mexico	20%	3.4	19%	2.9
Pennsylvania	19%	3.1	21%	2.8
Nebraska	19%	3.2	20%	2.9
New York	19%	3.0	21%	2.8
Massachusetts	18%	3.2	18%	2.8
Minnesota	17%	3.1	23%	2.8
Nevada	17%	3.6	16%	3.1
Texas	17%	3.4	21%	2.9
New Jersey	16%	2.9	18%	2.6
Arkansas	16%	3.5	23%	3.1
Maine	16%	3.3	16%	3.1
Wisconsin	16%	3.4	16%	3.2
California	16%	2.9	15%	2.5
New Hampshire	16%	3.1	12%	2.9
North Carolina	15%	3.1	21%	2.8
Maryland	15%	3.1	19%	2.8

Table 2. (continued)
Time to Bachelor's Degree Among Community College Transfer Completers, by State

State	CC transfer bachelor's completers: STEM		CC transfer bachelor's completers: Non-STEM	
	On-time bachelor's completion rate	Average years to bachelor's completion post-transfer	On-time bachelor's completion rate	Average years to bachelor's completion post-transfer
Montana	15%	3.4	21%	3.1
Virginia	15%	3.2	20%	2.9
Oklahoma	15%	3.5	18%	3.3
Connecticut	15%	3.0	16%	2.8
Alabama	14%	3.5	23%	3.0
Michigan	14%	3.3	18%	3.0
Tennessee	14%	3.1	23%	2.7
Louisiana	13%	3.5	14%	3.2
Florida	13%	3.3	21%	2.8
Vermont	13%	3.4	21%	3.1
Rhode Island	13%	3.2	16%	3.0
Missouri	12%	3.4	19%	3.0
South Dakota	12%	3.4	24%	3.0
Arizona	12%	3.1	15%	2.7
Alaska	12%	3.7	10%	3.8
Idaho	12%	3.5	15%	3.2
Oregon	12%	3.3	19%	2.8
Georgia	11%	3.5	12%	3.4
Colorado	11%	3.5	17%	3.0
Kentucky	11%	3.5	19%	3.1
Hawaii	10%	2.9	13%	2.7
Utah	7%	3.5	14%	2.9

Note. Outcomes reported by the state of the four-year institution. Wyoming data is suppressed because it has fewer than three colleges with students in the sample.

Lastly, we present graduate enrollment rates among community college transfer STEM bachelor's completers across states. As shown in Table 3, states with relatively strong STEM transfer bachelor's outcomes do not necessarily have the highest rates of graduate enrollment among STEM bachelor's completers. For example, Washington performed well across several outcomes, yet the graduate enrollment rate of community college transfer STEM bachelor's completers in the state (10%) was below the U.S. average of 12%. Florida is a notable exception. It had a strong representation of community college transfers among its STEM completers, and it exhibited graduate enrollment rates for these completers that were above the national average (14% for any graduate enrollment and 7% for STEM graduate enrollment). Overall, these patterns suggest that state conditions associated with stronger pathways to STEM bachelor's completion do not necessarily translate into stronger pathways to graduate education for community college transfer students.

Table 3.

Graduate Enrollment Rate of Transfer and Non-Transfer STEM Bachelor's Completers, by State

State	CC transfers		Non-transfers	
	Enrollment rate in any graduate program among STEM bachelor's completers (%)	Enrollment rate in STEM graduate program among STEM bachelor's completers (%)	Enrollment rate in any graduate program among STEM bachelor's completers (%)	Enrollment rate in STEM graduate program among STEM bachelor's completers (%)
U.S. average	**12**	**5**	**17**	**8**
Washington, DC	23	10	20	9
Arkansas	22	5	20	8
Nebraska	20	9	26	9
Kentucky	18	6	27	10
Oklahoma	17	9	22	12
Alaska	15	3	7	2
Ohio	15	6	20	8
Missouri	15	6	19	8
Utah	14	7	17	7
Arizona	14	8	19	10
Florida	14	7	21	10
New Mexico	14	8	13	8
Kansas	13	3	17	5
Texas	13	7	20	9
Mississippi	13	4	18	6
Maryland	13	8	19	9
Nevada	13	6	16	7
Massachusetts	13	3	17	9
California	13	4	18	9
Tennessee	12	9	17	9
New Jersey	11	7	18	10
Alabama	11	4	19	7
Virginia	11	5	15	7
Minnesota	10	5	16	7
Colorado	10	6	13	6
Hawaii	10	3	17	7
New York	10	5	19	10
Washington	10	5	13	6
Idaho	10	4	10	3
Michigan	10	5	19	9
Georgia	10	6	15	8
North Dakota	10	5	13	6
Connecticut	10	4	18	8

Table 3. (continued)
Graduate Enrollment Rate of Transfer and Non-Transfer STEM Bachelor's Completers, by State

State	Community college transfers		Non-transfers	
	Enrollment rate in any graduate program among STEM bachelor's completers (%)	Enrollment rate in STEM graduate program among STEM bachelor's completers (%)	Enrollment rate in any graduate program among STEM bachelor's completers (%)	Enrollment rate in STEM graduate program among STEM bachelor's completers (%)
Wisconsin	10	3	15	5
Iowa	10	4	17	8
Delaware	10	5	22	12
Oregon	9	4	11	6
Louisiana	9	2	20	7
Pennsylvania	9	4	18	8
Maine	9	4	13	6
Illinois	8	4	16	7
Vermont	8	2	13	7
New Hampshire	7	2	9	4
West Virginia	7	2	10	2
South Dakota	6	4	11	4
South Carolina	6	3	11	3
Montana	6	3	9	6
Indiana	6	2	14	6
Rhode Island	5	2	17	7
North Carolina	4	1	14	5

Note. Outcomes reported by the state of the four-year institution. Wyoming data is suppressed because it has fewer than three colleges with students in the sample.

Discussion

Community colleges are already a major part of STEM bachelor's production nationwide. The capacity of community college transfer pathways to contribute to the STEM talent pipeline should not be surprising. Research has shown that transfer students exhibit high persistence rates post-transfer and that they achieve academic outcomes that are comparable to their non-transfer peers, even in STEM fields (Bahr et al., 2023; Melguizo et al., 2011; Velasco et al., 2024b). Despite this potential, too many community college transfers do not complete bachelor's degrees in STEM. Because community college students represent a large share of higher education enrollment, with a disproportionate representation of students from historically underrepresented groups (Brock et al., 2025), broadening career exploration opportunities in STEM and bolstering STEM-specific transfer supports for community college students could help to increase and diversity the STEM talent pool nationwide.

Prolonged time to bachelor's completion relative to non-transfer students is a central challenge transfer students face (Sotherland & Stange, forthcoming), and our findings show that it is an

even greater challenge among community college students seeking STEM degrees. The vast majority (84%) of transfer students in our sample who completed a STEM bachelor's degree spent more than four years to do so—a pattern that was especially salient among engineering degree earners. Time to completion was longer among transfer bachelor's completers in STEM than in non-STEM fields. Longer time to degree, especially in highly sequential programs such as engineering, suggests that program planning, credit transferability, and timely credit applicability toward a degree should be an area of major focus for higher education leaders. Our results are consistent with prior research finding that, for STEM-aspiring transfer students, taking the right courses at the right time is major factor influencing on-time degree completion (Bahr et al., 2017; Burdman et al., 2025; Fink et al., 2023).

The finding that time to completion among STEM transfer bachelor's earners is notably longer post-transfer than pre-transfer highlights the important role four-year institutions may play in improving timely STEM degree completion. Four-year institutions exert considerable influence over post-transfer conditions, largely controlling which community college credits transfer and apply toward bachelor's and major requirements, and determining the level of support transfer students receive to navigate their coursework. Four-year institutions could contribute to more timely STEM completion among transfer students by improving program alignment and providing better guidance and support.

Barriers that transfer students face may continue to influence their education beyond bachelor's completion, as transfer students are less likely to pursue graduate school than non-transfer completers, regardless of field of completion. By addressing obstacles, four-year institutions could also potentially increase their pool of graduate students overall and in STEM. In order to develop more strategies to support the transition to graduate school, future research should explore the degree to which the availability of transfer-oriented research opportunities, mentoring, and financial aid can help improve access to graduate education for transfer bachelor's completers. In the meantime, four-year institutions can explore strategies to support the transition to graduate school among community college transfers and ensure that research-related opportunities and exposure are equitable among transfer and non-transfer students.

It is worth highlighting that Black, Hispanic, low-income, and female transfer students seeking STEM careers face greater obstacles compared to transfer students generally. Black, Hispanic, and low-income transfer students have a lower chance of completing a bachelor's in STEM and take longer to complete it when they do. Women transfers are the least likely to earn a STEM bachelor's, but those who do are more likely to complete on time and more likely to pursue graduate education (though not necessarily in a STEM field). However, our findings show similar gaps among non-transfer students in these demographic groups, suggesting that strengthening transfer pathways is necessary but not sufficient to broaden and diversify the STEM talent pipeline.

The good news is that stronger STEM transfer outcomes are achievable. First, the findings in this study align with research documenting the benefits of dual enrollment (see Schaller et al., 2025). The fact that transfer students with prior dual enrollment were more likely to complete in STEM and do so on time suggests that these students were better equipped to plan their pathway to a STEM bachelor's degree. The national-level averages suggest that prior dual enrollment transfers were particularly successful at reducing the time of enrollment at the community college—though not at the four-year college—which could indicate

better credit transferability from dual enrollment to the community college than from the community college to four-year institutions. Thus, while our findings suggest that dual enrollment is a promising means to increase STEM talent via transfer, it also points to the same bottlenecks that other transfer students face at four-year institutions.

Second, large variation in STEM transfer outcomes across states suggest that better outcomes are achievable. Washington, in particular, stands out for relatively strong outcomes across multiple measures, which coincide with a statewide transfer system that promotes coordination between community colleges and four-year institutions along with major-specific alignment. Other states, like California and Florida, show strong results on other STEM transfer metrics. Colleges and states systems could use the findings in this report to assess where they need to prioritize their efforts to broaden STEM bachelor's and graduate programs and to improve timely progress through STEM pathways among their students.

Examples of State Transfer Systems With Strong STEM Outcomes

Washington: Major Related Programs and Associate in Science–Transfer Degrees

Washington state has a long-standing statewide transfer framework focused on minimizing credit loss and ensuring coursework alignment. It works by having community colleges and four-year institutions collaborate in creating transfer-oriented degrees, making coursework consistent across colleges, and facilitating the transferability of credits (Washington Student Achievement Council, 2025). Since the early 2000s, the state has implemented transfer-oriented associate degrees organized around Major Related Programs (MRPs). MRPs facilitate an easier transition from community colleges to state public and private four-year institutions by encouraging students to earn credits that will apply toward their degree of intent. These include associate degrees for specific MRPs that are mentioned in the state's Direct Transfer Agreement as well as the STEM-specific Associate in Science–Transfer (AS-T) degree (along two tracks: biology/chemistry/earth science and engineering/physics/computer science). Research has found that, compared to other transfer students, those who complete MRP or AS-T degrees are more likely to transfer, transfer with fewer excess credits, and earn bachelor's degrees, particularly in business and STEM fields (Kaikkonen, 2014; Kukreja & Byrne, 2025).

California: Associate Degree for Transfer

California's Associate Degree for Transfer (ADT) was established through the Student Transfer Achievement Reform Act of 2010 to simplify transfer between California community colleges and California State University campuses. Developed jointly by the community college and university systems, ADTs combine general education and major-specific coursework with guaranteed admission for eligible students into participating universities. Students who transfer through an ADT are also protected from repeating equivalent coursework after transfer, reducing unnecessary credit accumulation (California Community Colleges Chancellor's Office, 2026). Although the ADT model is not specifically designed for STEM pathways in the way that Washington's AS-T degrees are, rigorous quasi-experimental evidence shows that ADTs increase bachelor's degree attainment primarily by increasing successful transfer to four-year institutions, though findings suggest only a modest reduction in excess credits accumulated among bachelor's completers (Baker et al., 2023).

Conclusion: What Universities, Community Colleges, and States Should Do

Community college transfer students are an important source of STEM talent. They account for 15% of STEM bachelor's degree earners in our sample. And after completing a bachelor's degree, many continue into graduate education. Our study indicates that community college transfers could play an even larger role in expanding and diversifying STEM bachelor's and graduate education. Currently, too few community college students make it to transfer, STEM transfer students take longer to complete bachelor's degrees after transfer, and transfer students remain underrepresented in graduate education. Strengthening community college transfer should therefore be viewed not simply as a means to improve transfer efficiency but as a strategy for expanding and diversifying the nation's STEM talent pipeline.

Our findings suggest distinct but complementary actions for four-year institutions, community colleges, and state higher education systems.

Four-year institutions: Remove post-transfer barriers to STEM bachelor's completion and graduate enrollment.

Accelerate bachelor's degree completion by aligning coursework and mapping sequential STEM program pathways with transfer partners. We find that STEM transfer students take longer to complete bachelor's degrees after transferring. Because this additional time to degree arises primarily post-transfer rather than from time spent at the community college, four-year institutions should identify and address the causes of these delays. Other research suggests that effective university transfer practices include clearly mapping STEM program prerequisites and course sequences for community college students, providing sufficient access to required upper-division courses for students, and helping transfer students enter appropriate STEM course sequences immediately after transfer (see LaViolet et al., 2025). Four-year college leaders should also track transfer students' progress by major, ensuring that both academic departments and central transfer offices share responsibility transfer students' timely bachelor's completion.

Expand access to graduate education by extending STEM transfer pathways. Four-year institutions should treat graduate enrollment as an important longer-term outcome of successful transfer. Transfer students who complete STEM bachelor's degrees should have the same opportunities as other students to participate in undergraduate research, develop relationships with faculty mentors, learn about graduate and professional programs, and receive guidance about applications and financing. These supports are especially important because transfer students have less time at the university to develop the relationships and experiences that often open doors to graduate study.

Community colleges: Help more students enter and navigate STEM transfer pathways

Help more students—particularly those historically underrepresented in STEM—explore STEM bachelor's programs and careers. Community colleges should actively help students explore STEM fields and careers, identify an intended bachelor's major and transfer destination early, and develop a full-program plan that extends through bachelor's completion (LaViolet et al., 2025). The colleges should pay particular attention to expanding access to these pathways among women, Black, Hispanic, and low-income students, who remain underrepresented among STEM bachelor's completers.

Ensure that STEM transfer-intending students become "major-ready," not merely transfer-ready. Working with their primary university partners, community colleges should work backward from the requirements of university STEM bachelor's programs to help students complete the math, science, and other lower-division courses required for their intended major before transfer. Advising should be organized around major-specific plans rather than individual course selection and should connect students with faculty and advisors who understand the requirements, transfer options, and career opportunities in particular STEM fields (Jenkins et al., 2025). The goal should be for students to arrive at the four-year institution prepared to enter the next course in their major sequence rather than discover after transfer that additional lower-division coursework is required.

States and higher education systems: Build the infrastructure for strong STEM transfer pathways

Map statewide major-specific STEM pathways that connect community college programs to bachelor's completion. States and systems need to bring community colleges and four-year colleges and universities together to map lower- and upper-division requirements for major STEM fields and ensure that community college coursework counts toward those requirements across receiving institutions. A study by CCRC colleagues found that community college students who take math and non-math STEM courses stipulated in statewide STEM transfer agreements are much more likely to transfer and complete STEM degrees than students who do not (Fink, Myers, et al., 2023). Statewide transfer guarantees should address not merely whether credits transfer but whether they apply toward students' intended majors and enable students to enter upper-division coursework without unnecessary repetition or delay.

Use data to identify and close gaps in STEM transfer, bachelor's completion, and graduate enrollment. The substantial variation in STEM transfer outcomes across states suggests that policy and system design can make a difference. States should track the STEM transfer pipeline from community college entry through transfer, bachelor's completion, and, where possible, graduate enrollment. These data should be disaggregated by field and student characteristics and used to identify where students are being lost, which institutions and pathways produce stronger outcomes, and where policy changes or additional resources are needed. States and systems can use these measures not only to identify gaps but also to set expectations for community colleges and four-year institutions to improve transfer, timely bachelor's completion, and equitable STEM outcomes.

Taken together, these strategies would shift the goal of STEM transfer policy from simply helping students move between institutions to building coordinated pathways from community college entry through STEM bachelor's and graduate education. Doing so could enable community colleges to play a much larger role in meeting the nation's need for STEM talent while broadening who has access to STEM careers and advanced education.

Endnotes

1. Note that, by definition, our sample does not include students who completed a bachelor's degree at a community college.
2. We also considered postbaccalaureate certificate as one of the graduate levels. However, we exclude that category from this report as too few graduates in our data pursued this degree level.
3. We estimated this number by holding the total count of community college transfer completers constant while shifting some of these students from the non-STEM to the STEM completer groups until their representation was 19% in both groups. Under this hypothetical scenario, 252,067 community college transfers would complete in non-STEM (down from the actual 270,471 we found in the data), and 74,288 would complete in STEM (up from the 55,884 found in the data). Consequently, the total number of STEM completers would increase to 390,988, of which 74,288 (or 19%) would be community college transfers.

4. Following the data sample and definitions in Velasco et al. (2024a), we computed the transfer-out bachelor's completion rate among the students who declared a STEM major post-transfer. We found that while their transfer-out bachelor's completion rate was 49%—which is very similar to the 48% found for all community college transfers—only 42% were completing a bachelor's in a STEM field, meaning that 14% switched out of STEM.

5. To facilitate comparison, this analysis excludes non-transfer students and focuses on STEM versus non-STEM time to bachelor's completion among community college transfer students. (While the NSC data allow us to track community college transfers for six years at the four-year institution, plus the additional years spent at the community college, we can track non-transfer students for six years only, giving them by definition fewer years to complete than transfer students, which could overstate differences in time to completion between transfers and non-transfers.)

6. To check the robustness of these findings, we also computed the graduate enrollment rates allowing for enrollments at any point in time after bachelor's completion, rather than only in the year following completion. When doing so, we found that the gaps in graduate enrollment between transfer and non-transfer STEM and non-STEM bachelor's completers persist at similar magnitudes.

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Appendix. Variable Definitions

This report examines student outcomes by several institutional and student characteristics defined below.

Institutional Sector

We classify institutions into community colleges and four-year institutions using IPEDS and Carnegie Classification information from the 2021–22 academic year.

Four-year institutions include:

- Public colleges and universities
- Private nonprofit colleges and universities
- Private for-profit colleges and universities

We include as community colleges all state-defined community colleges, excluding:

- Branch campuses
- Military colleges
- Less-than-two-year colleges
- Adult and career-technical centers and colleges

Student Race/Ethnicity and Gender

We use NSC data on student race/ethnicity and gender at the start of the 2015-16 academic year.

Among community college transfer students:

- 3% of STEM bachelor's completers are missing race/ethnicity information
- 2% of non-STEM bachelor's completers are missing race/ethnicity information
- 3% of STEM bachelor's completers are missing gender information
- 2% of non-STEM bachelor's completers are missing gender information

Among non-transfer students:

- 5% of STEM bachelor's completers are missing race/ethnicity information
- 3% of non-STEM bachelor's completers are missing race/ethnicity information
- 5% of STEM bachelor's completers are missing gender information
- 4% of non-STEM bachelor's completers are missing gender information

Student Neighborhood Income

We use a proxy measure linking students' home addresses to U.S. Census tract median household income estimates.

Income categories:

- Low income
- Medium income
- High income

Among community college transfer students:

- 12% of STEM bachelor's completers are missing income information
- 13% of non-STEM bachelor's completers are missing income information

Among non-transfer students:

- 16% of STEM bachelor's completers are missing income information
- 14% of non-STEM bachelor's completers are missing income information

Prior Dual Enrollment

We follow NSC's definition and flag a student as a dual enrollee when their high school diploma date is after their start date at the postsecondary institution. If high school diploma information is not available, dual enrollment status is based on the student's age at the start date of the term; that is, if the student is younger than 17.7 while enrolled in college for any number of terms, the student is considered a dual enrollee.

Note that dual enrollment status is not defined by the type or number of courses students take and that Advanced Placement (AP) and International Baccalaureate (IB) courses are not considered dual enrollment courses. Rather, dual enrollment status is based solely on enrollment at a postsecondary institution occurring while the student is expected to be in high school.

Our sample includes both students with prior dual enrollment and students without any prior dual enrollment. Prior dual enrollment students are new undergraduates entering postsecondary education with prior records of postsecondary activity indicating they fell under the dual enrollment student definition before their post–high school college entry. Non–dual enrollment students were new undergraduates—not in high school—who enrolled at a postsecondary institution with no records indicating dual enrollment participation. We do not include any current dual enrollment students (i.e., students who were still in high school in 2015-16) in our analyses.

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