

## NEW BACCALAUREATE SERIES

# Growth in Enrollment and Completion of STEM Community College Baccalaureate Degrees in Washington State



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Washington State is experiencing substantial growth in the number of science, technology, engineering and mathematics (STEM) Community College Baccalaureate (CCB)<sup>1</sup> programs. Student enrollments in STEM CCB programs are also growing, providing an opportune time to study these students and their enrollment in and completion of STEM CCB programs. This research on STEM CCB programs shows women complete degrees at nearly the same rate as men but female enrollments lag behind state and national statistics for STEM education. More closely reflecting national trends, the research shows disparities in enrollment by and completion of students of color compared to white and Asian students, though STEM CCB enrollees are more diverse than STEM enrollees in universities. Understanding these student demographics is important to informing state and institutional policy on STEM education where demand for STEM workers continues to grow in the state.

## BACKGROUND

Washington State has seen major growth in STEM jobs without parallel opportunities for STEM training at the higher education level. A large and still growing gap exists between the number of Washingtonians who are trained to fill STEM jobs and the number of high-wage, high-demand STEM job vacancies. This deficit is especially pronounced at the baccalaureate level where African American, Latinx, and Native American students and women are underrepresented among graduates with STEM degrees (Myers Twitchell, Poppe, Meza, Huizar & Zumeta, 2019).

Baccalaureate degrees in STEM offered at the state's large network of community and technical colleges

(CTCs) have emerged as potentially important to filling the STEM gap. CCB degrees awarded in the form of the Bachelor's of Applied Sciences (BAS) in Washington enroll students of color at higher rates than comparable degree programs, in Business and Nursing, in particular, offered by universities (Blume, 2020). Whether BAS degrees represent an underutilized approach to diversifying Washington's STEM workforce is an important question that this data note attempts to address.

## PURPOSE OF THIS STUDY

This study examines the growth of STEM<sup>2</sup> CCB degrees and describes the demographic characteristics of

<sup>1</sup> The Washington State Board of Community and Technical Colleges (SBCTC) authorizes community and technical colleges to confer community college baccalaureate (CCB) degrees in the form of bachelor of applied science (BAS) degrees.

<sup>2</sup> Programs are classified into six program areas based on the first two-digits of the U.S. Department of Education Classification of Instructional Program (CIP) codes. STEM program areas are those with CIP codes beginning in 30, 10, 11, 15, and 26. Additional information on program CIP code classification into program areas is available by request.

students in these programs. I also present findings on who finishes STEM CCB degrees. When possible, I compare the CCB STEM results for Washington State to STEM students enrolled in the state’s public college and university system and to national studies on postsecondary STEM enrollment and completion. In the last section, I discuss the importance of these results and recommend more research on STEM education that leads to baccalaureates conferred by Washington’s CTCs.

### GROWTH IN STEM PROGRAMS

STEM CCB programs have proliferated in Washington State’s CTCs in recent years. The first BAS programs to enroll students over ten years ago at a handful

of CTCs were in Healthcare, Business, and Interior Design. Beginning in 2013, STEM CCB programs were launched and experienced steady growth. Continuing to grow, 25 BAS programs focused on STEM education have started enrolling students in these programs in 19 CTCs across the state (Joyce Hammer, personal communication, January 18, 2019).

Table 1 shows the names of STEM BAS programs in the Washington CTCs. Fourteen of the programs of study focus on some aspect of information technology or software development. Clearly related are programs emphasizing computer science, cyber security, and data analytics. Other program areas include molecular biosciences, natural resources and sustainable practices.

**Table 1. STEM BAS Degree Programs at Washington CTCs**

<b>Biological and Biomedical Sciences</b>	<b>Computer and Information Sciences</b>
Molecular Biosciences	Healthcare Informatics
<b>Communications Technology</b>	Information Systems
Digital Filmmaking	Information Technology
Digital Gaming and Interactive Media	Cyber Security
Digital Media Arts	Data Analytics
<b>Engineering Technology</b>	Cyber Security and Forensics
Engineering Technology	Computer Science
<b>Natural Resources, Environment and Conservation</b>	Information Systems and Technology
Natural Resources Management	Technology: Network Administration
Sustainable Building Science Technology	Information Technology: Networking
Sustainable Practices	Information Technology: Software Development
Sustainable Agriculture Systems	Information Technology: Application Development – Software Development
Forest Resource Management	Information Technology: Network Administration and Security
Environmental Conservation	Information Technology: Computer Network Architecture

Note: The titles of BAS degree programs in this table reflect program names reported to the Washington SBCTC as of January 2019 rather than CIP code titles.

## METHODS AND DATA

This study is an extension of earlier studies on Washington State BAS degrees that report growth in enrollment and completion numbers and rates (Meza, 2019; Blume, 2020; Meza & Bragg, 2020). These studies rely on data obtained through a data-sharing agreement between the Washington SBCTC and our Community College Research Initiatives group at the University of Washington. The student-level data file represents students who enrolled in a Washington CCB program from 2007 through the spring quarter of 2018. A total of 7,953 students are included in the file, and 1,858 of those students who enrolled in a STEM program are the focus of the analysis presented here [see Meza (2019) for more information on the data source].

Variables in the data file include: student self-reported race, ethnicity, age, CTC of enrollment, whether students received veteran's benefits and/or need-based financial aid, as well as college enrollment dates, classification of instructional program (CIP) codes, and degree conferral date.

## GROWTH IN STEM ENROLLMENTS

Since CCB degrees were first piloted in Washington in 2007, enrollments have grown in a range of programs, reaching a total of 4,796 matriculated BAS students in academic year 2018-2019 (Washington SBCTC, n.d.). STEM CCB programs have seen substantial enrollment growth up through the present time, bringing STEM CCB enrollment to the largest single CCB program area in Washington State. Compared to Business and Healthcare (which includes safety and human services), STEM CCB enrollments have grown steadily while Business and Healthcare programs leveled off or declined between 2014 and 2018. By 2018 the number of students enrolled in STEM CCB programs had overtaken the number of students enrolled in either the Business or Healthcare programs, with STEM enrollments making up more than one-third of the total BAS degree enrollments in the state. By comparison, enrollments in Business and Healthcare made up about

25% each of the total enrollment, with their combined enrollment approximating about half of all BAS students in Washington (Meza, 2019).

## GROWTH IN STEM COMPLETIONS

Similar to growth in STEM enrollments, STEM CCB completions are growing faster than other program areas, with over 300 degrees awarded in 2018 ( $n=314$ ) and surpassing the number of CCB degrees awarded in Business ( $n=294$ ) and Healthcare ( $n=284$ ). Thus, whereas the Business and Healthcare program areas have more longevity than STEM, newer STEM BAS degree programs represent a growing pathway for Washington CTC students to secure a baccalaureate degree and enter the STEM workforce. Figure 1 shows completion in the STEM, Business and Healthcare program areas over the three most recent years that data are available for this analysis.

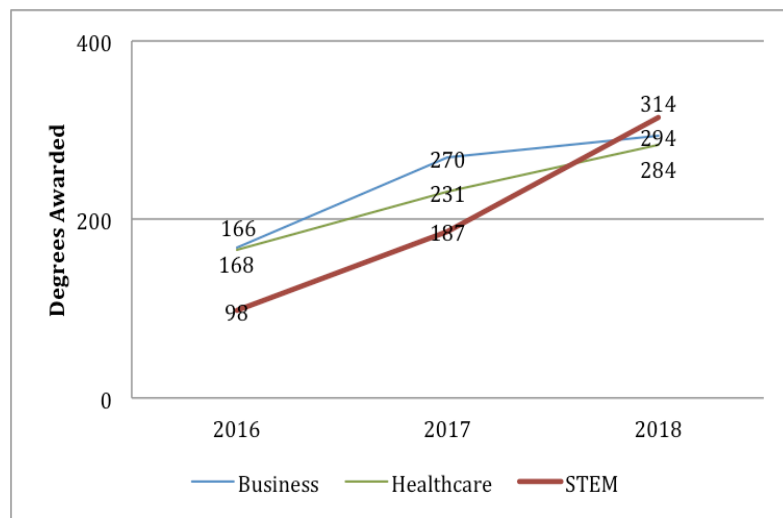


Figure 1. Growth in degrees awarded in Business, Healthcare (including Safety and Human Services) and STEM from 2016 to 2018.

## CCB STEM STUDENT DEMOGRAPHICS

The analysis of BAS program enrollments for this data note as well as others (Meza, 2019) shows student demographics are related to BAS program areas, with some BAS program areas enrolling more demographically diverse learners than others. STEM programs enroll students who are significantly more

likely to be male, veterans, not African American or Latinx, not parents, and younger than students in the BAS program areas of Business and Healthcare (see Meza, 2019). These results suggest a more traditional student profile for STEM BAS programs than other BAS programs of study, and it is important to recognize that continued enrollment growth in STEM may shift the overall demographics of BAS programs in Washington. In effect, Washington’s CTCs may see a decline in the diversity of the overall BAS student population if STEM enrollments continue to grow while other program areas grow more slowly, level off, or decline.

**CCB STEM GRADUATE DEMOGRAPHICS COMPARED TO STATE AND NATIONAL STEM GRADUATES**

This analysis offers a comparison of STEM CCB completions to STEM baccalaureate completions in

Washington’s four-year colleges and universities and to overall national statistics for STEM education, when available. Comparing graduate demographics for STEM CCB programs to four-year college and university STEM baccalaureate graduates, we find interesting results. First, results show STEM CCB programs graduate a higher percentage of white, African American, Latinx, and multi-race students than four-year colleges and universities, though the percentage difference in the racial and ethnic groups in the two settings is relatively small (Figure 2).

Further, a lower percentage of Asian, Hawaiian and Pacific Islander students complete STEM CCB programs than four-year colleges and universities, though again the percentage difference is relatively small (Washington Education Data Resource Center, n.d.; McFarland et al., 2019; NCES, 2017).

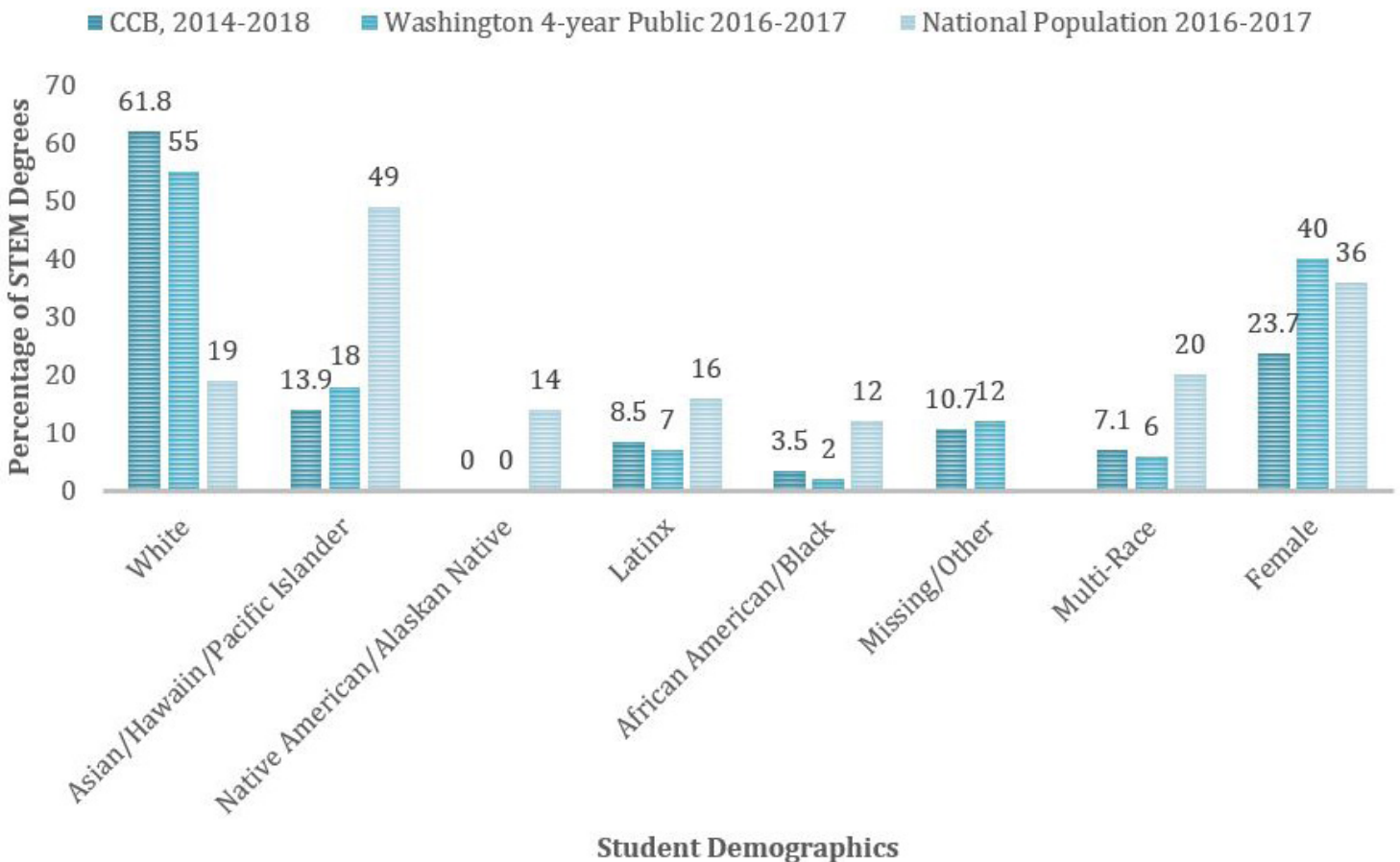


Figure 2. Percentage of STEM degrees by race and ethnicity and gender.

Note: Washington four-year public data from Washington Education Research Data Center public dashboard, national data from McFarland (2019).

A comparison of graduates by gender is especially important to note, as the percentage of graduates who are female is lower in the STEM CCB programs than the four-year college and university STEM baccalaureate programs. Data for this study do not reveal why a larger percentage of male students complete STEM CCB degrees than STEM baccalaureate degrees offered by four-year colleges and universities but the reason may lie in the composition of CCB programs of study offered by the CTCs. Though speculative, it is possible Information Technology-related programs that predominate the STEM CCB degrees may have an influence on enrollment and completion by gender, tending toward male students. For example, using National Student Clearinghouse data Jaggars, Fink, Fletcher & Dundar (2016), found that of those students who started at a community college only 12% of computer science bachelor's recipients were female, compared with 50% of other STEM graduates. A National Center for Education Statistics (NCES) report reveals 80% of engineering graduates nationwide are male (McFarland et al., 2019). A similar statistic was not available for programs focused on Information Technology.

Also compared to the national statistics reported by NCES (McFarland et al., 2019), the STEM CCB as well as STEM baccalaureate programs of four-year colleges and universities in Washington lag behind national statistics on STEM education. Both STEM CCB programs and STEM baccalaureate programs offered by four-year colleges and universities graduate a less diverse student group than shown in the national statistics. These results suggest if Washington State is to diversify the STEM workforce more needs to be done to prepare diverse students of color and females for high-wage, high-demand STEM degrees.

### **CCB STEM COMPLETION BY STUDENT DEMOGRAPHIC GROUP**

Looking at STEM CCB completion and student demographics more closely, results show sizeable differences in overall completion rates by sub-

group, with Asian students having the highest rate of completion at 73.4%, followed by multi-race students at 66.0%, and then white students at 63.0% and African American students at 54.8% (Meza & Bragg, 2020). This pattern of completion rates by racial and ethnic group is reflective of other empirical research on STEM education. Recent analysis of a nationally representative sample of college students found 58% of white students who declared a STEM major earned a STEM degree (Riegle-Crumb, King & Irizarry, 2019), the same study showed 34% of African American students who declared a STEM major graduated with a STEM degree.

Looking at overall completion rates by gender for STEM CCB students, 61.1% of females and 63.4% of males in STEM complete baccalaureate degrees (Meza & Bragg, 2020).<sup>3</sup> This is notable as national data show that female STEM aspirants who have earned an associates degree are less likely to graduate with a STEM baccalaureate degree and more likely to switch out of a STEM major than their male peers (Chen, 2013). Whereas the student data file used for this analysis does not reveal reasons for completion, it is possible the small number of female BAS students who enroll in STEM programs experience a more supportive environment for completion as compared to four-year colleges and universities. Important to understand about this finding, however, is that the number of females in the STEM completion group is much lower than the number of males. Only 151 of 659 students are female, making up 23.0% of the overall STEM group. This percentage is substantially lower than the 31.8% of the total STEM baccalaureate degrees awarded to females in 2015-2016 (NCES, 2017) and the 40% of STEM degrees awarded to females in Washington's four-year colleges and universities in 2016-2017, suggesting the importance of increasing enrollment and completion of females in STEM CCB programs.

Building on these descriptive statistics with respect to the question of how the demographic characteristics of students who complete a STEM CCB degree compare to those who enroll, multivariate logistic regression

<sup>3</sup> The number of Latinx completers was too small to include in this analysis.

reveals that Asian students are significantly more likely to graduate with a BAS degree in a STEM area. No other race or ethnicity showed a statistically significant relationship with obtaining a degree despite the gaps shown in the descriptive analysis. Likewise, gender was not significantly predictive of obtaining a degree. Whereas these results are promising, it is important to note that small numbers of underserved students of color enroll in STEM programs, making statistically significant gaps difficult to discern with the small population sizes represented. Increasing enrollment of underserved students of color and women and continuous monitoring of progress to completion should be of paramount importance.

## DISCUSSION

The overall completion rates for STEM CCB programs are relatively high, at 62.9%, although equity gaps are evident in the data. Far fewer women enroll in CCB STEM programs than males, possibly partly because of the particular programs of study that predominate CCB STEM education. However, female STEM students graduate at rates fairly comparable to their male counterparts, suggesting success for the female students who do enroll. Specifically, the female STEM completion rate is only 2 percentage points lower than the rate for male STEM completion. Despite the finding that the completion rate for African American students in STEM CCB programs was far higher than national STEM education, exceeding the national completion rate of African-American students by approximately 20 percentage points, the completion rates for African American students was much lower than Asian and white students in STEM CCB programs.

Closing these gaps should be a priority for STEM CCB programs. If women and students of color could continue to increase completion rates from their already comparatively positive levels, there appears to be opportunities to grow a more diverse STEM workforce in Washington. The potential contribution of STEM CCB degrees to offer opportunity for more students to enter the STEM workforce, particularly underserved students, is positive for Washington State.

## REFERENCES

- Blume, G. (2020, February).** *How do students earning CCB degrees compare to their peers at public universities in Washington?* (New Baccalaureate Series, Data Note 5). Seattle, WA: Community College Research Initiatives, University of Washington. Retrieved from [https://www.uw.edu/ccri/newba\\_dn5/](https://www.uw.edu/ccri/newba_dn5/)
- Chen, X. (2013).** STEM Attrition: College Students' Paths into and out of STEM Fields. Statistical Analysis Report. NCES 2014-001. *National Center for Education Statistics.*
- Jaggars, S. S., Fink, J., Fletcher, J., & Dundar, A. (2016).** *A Longitudinal Analysis of Community College Pathways to Computer Science Bachelor's Degrees.* Mountain View, CA: Google Inc. Retrieved from <http://goo.gl/Eiz33G>
- Meza, E. A. (2019, August).** *The community college baccalaureate in Washington: Who enrolls?* (New Baccalaureate Series, Data Note 2). Seattle, WA: Community College Research Initiatives, University of Washington. Retrieved from [https://www.uw.edu/ccri/newba\\_dn2/](https://www.uw.edu/ccri/newba_dn2/)
- Meza, E. A. & Bragg, D. D. (2020, February).** *Community college baccalaureate degree completion in Washington* (New Baccalaureate Series, Data Note 4). Seattle, WA: Community College Research Initiatives, University of Washington. Retrieved from [https://www.uw.edu/ccri/newba\\_dn4/](https://www.uw.edu/ccri/newba_dn4/)
- Myers Twitchell, J., Poppe, M., Meza, E., Huizar, D., Zumeta, W. (2019, September).** *STEM By the Numbers: Equity and Opportunity in Washington's Regions.* Seattle, WA: Washington STEM. Retrieved from [https://washingtonstem.org/wpcontent/uploads/2019/10/WaSTEM\\_SBTN\\_TechnicalDocument.pdf](https://washingtonstem.org/wpcontent/uploads/2019/10/WaSTEM_SBTN_TechnicalDocument.pdf)
- McFarland, J., Hussar, B., Zhang, J., Wang, X., Wang, K., Hein, S., ... & Barmer, A. (2019).** *The Condition of Education 2019.* NCES 2019-144. *National Center for Education Statistics.*
- National Center for Education Statistics. (2017).** *Digest of Education Statistics: 2016 Tables and Figures (2017).* Table 318.45: Number and Percentage Distribution of Science, Technology, Engineering, and Mathematics (STEM) Degrees/Certificates Conferred by Postsecondary Institutions, by Race/Ethnicity, Level of Degree/Certificate, and Sex of Student: 2008-09 through 2015-16.
- Riegle-Crumb, C., King, B., & Irizarry, Y. (2019).** Does STEM stand out? Examining racial/ethnic gaps in persistence across postsecondary fields. *Educational Researcher*, 48(3), 133-144.
- Washington Education Research Data Center. (n.d.).** Statewide public four-year dashboard. Olympia, WA: Author. Retrieved from <https://erdc.wa.gov/data-dashboards/public-four-year-dashboard#graduation-continuation>
- Washington State Board for Community and Technical Colleges. (n.d.).** *Applied baccalaureate degrees.* Olympia, WA: Author. Retrieved from <https://www.sbctc.edu/colleges-staff/programs-services/applied-baccalaureates/>

Washington State Board for Community and Technical Colleges (n.d.). *Enrollment*. Olympia, WA: Author. <https://www.sbctc.edu/colleges-staff/research/data-public/>

## NEW BACCALAUREATE DATA NOTES

**Bragg, D. D. (2019, January).** *The evolving landscape for new baccalaureate degrees in the United States* (New Baccalaureate Series, [Data Note 1](#)). Seattle, WA: Community College Research Initiatives, University of Washington.

**Meza, A. E. (2019, August).** *The community college baccalaureate in Washington: Who enrolls?* (New Baccalaureate Series, [Data Note 2](#)). Seattle, WA: Community College Research Initiatives, University of Washington.

**Soler, M. C. (2019, November).** *Updating the national landscape: State adoption of community college baccalaureate degrees* (New Baccalaureate Series, [Data Note 3](#)). Seattle, WA: Community College Research Initiatives, University of Washington.

**Meza, E. A. & Bragg, D. D. (2020, January).** *Community college baccalaureate degree completion in Washington* (New Baccalaureate Series, [Data Note 4](#)). Seattle, WA: Community College Research Initiatives, University of Washington.

**Blume, G. (2020, February).** *How do students earning CCB degrees compare to their peers at public universities in Washington State?* (New Baccalaureate Series, [Data Note 5](#)). Seattle, WA: Community College Research Initiatives, University of Washington.

**Meza, E. A. (2020, March).** *Growth in enrollment and completion of STEM community college baccalaureate degrees in Washington State* (New Baccalaureate Series, [Data Note 6](#)). Seattle, WA: Community College Research Initiatives, University of Washington.

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