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Trends in Sub-baccalaureate Credentials in Computing and Electrical Programs of Study

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Introduction

Technician education programs that prepare students for the skilled technical workforce are an important part of the postsecondary education landscape in the United States. As such, they have garnered much recent interest from policymakers and researchers. Certain credentials unique to technician education, such as certificates, industry certifications, microcredentials, and badges, may represent a path toward retraining or upskilling for some workers, and a route into lucrative STEM occupations for others. But compared with more traditional programs of study, we have relatively little systematic information on the number and types of credentials awarded in career and technical education programs. Such information could be valuable for colleges, state policymakers, and industry leaders seeking to connect employment opportunities to a trained workforce.

The Technician Graduates Data Tool allows users to access public-use data on technician graduates spanning a 25-year period from 1995 to 2019, with new data to be added as it becomes available. The data tool facilitates comparisons of trends for multiple programs at the national and state levels, and it allows users to compare trends for a single program of study across states. It has an intuitive interface that allows users to easily select the programs and states they would like to examine.

This brief explores this new data tool by examining how the number of sub-baccalaureate credentials in computing and electrical fields has changed over time, and whether these trends vary by region.

Data/Methods

The data for this brief come from the U.S. Department of Education's Integrated Postsecondary Education Data System (IPEDS), arrayed in the Technician Graduates Data Tool. Though the tool allows users to examine trends at any credential level up to and including bachelor's degrees, this brief focuses on trends in sub-baccalaureate credentials: associate's degrees and short- and long-term certificates.

To facilitate analysis of the data, we first chose to group states into the four standard U.S. Census regions.[1] These aggregations are shown in Table 1. We then selected three

[1] US Census Bureau. (2010). *2010 Census Regions and Divisions of the United States.* Washington, DC: US Census Bureau. https://www.census.gov/geographies/reference-maps/2010/geo/2010-census-regions-and-divisions-of-the-united-states.html

programs of study that are typically associated with computers and engineering: Computer Engineering, Computer and Information Sciences (CIS), and Electrical Engineering

Table 1: Region and Program Area Specifications

	Included Values
Regions	
Midwest	Indiana, Illinois, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, Wisconsin
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont
South	Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, West Virginia
West	Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, Wyoming
Program Areas	
Computing and Electrical	Computer Engineering, Computer and Information Sciences and Support Services, Electrical Engineering

One trend graph was produced for each combination of region and program area, resulting in a total of 12 graphs. We also created 12 tables with underlying frequencies for each graph. These choices of aggregation have limitations. The standard four census regions may have too much internal heterogeneity, particularly in the South – which includes 16 states and the District of Columbia. The program area groupings may also be internally heterogeneous; we will address that issue later in this brief.

Findings

Figure 1: Sub-Baccalaureate Graduates in Computer Engineering in Northeastern States, 1995–2019

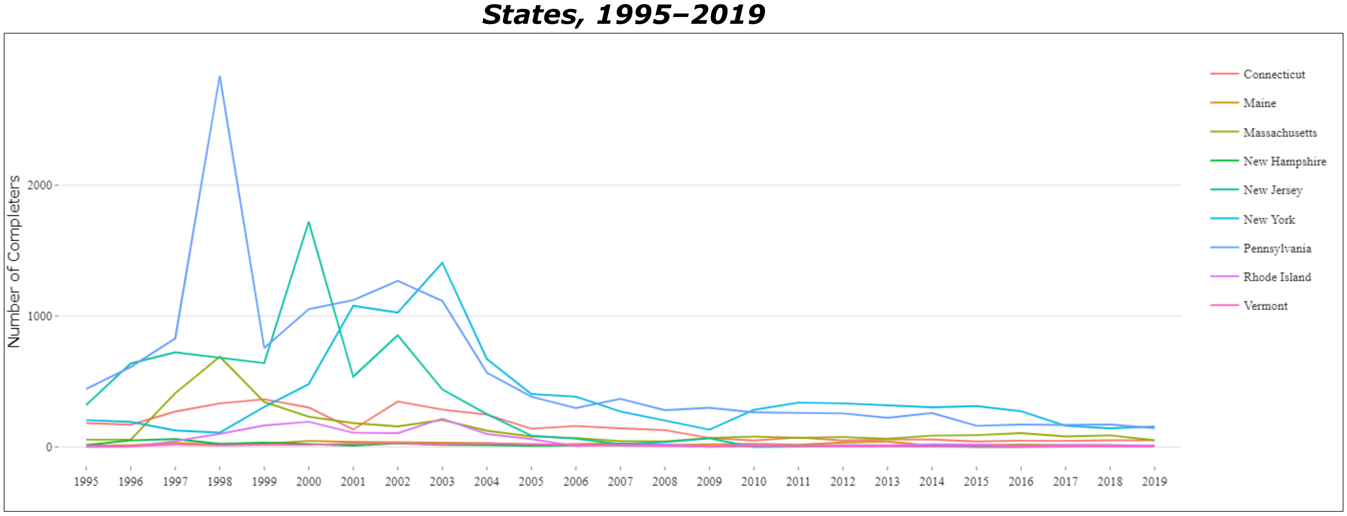

Figure 1 plots the number of sub-baccalaureate credentials awarded in Computer Engineering in Northeastern states from 1995 to 2019. Examining the trends, we observe that most states saw their peak in credential awards for this field in or before 2003. The highest values were in Pennsylvania in 1998 (n=2,835) and New York in 2000 (n=1,407).

The number of awards falls off after this period, with New York seeing a modest rebound around 2010.

Figure 2: Sub-Baccalaureate Graduates in Computer and Information Sciences in Southern States, 1995–2019

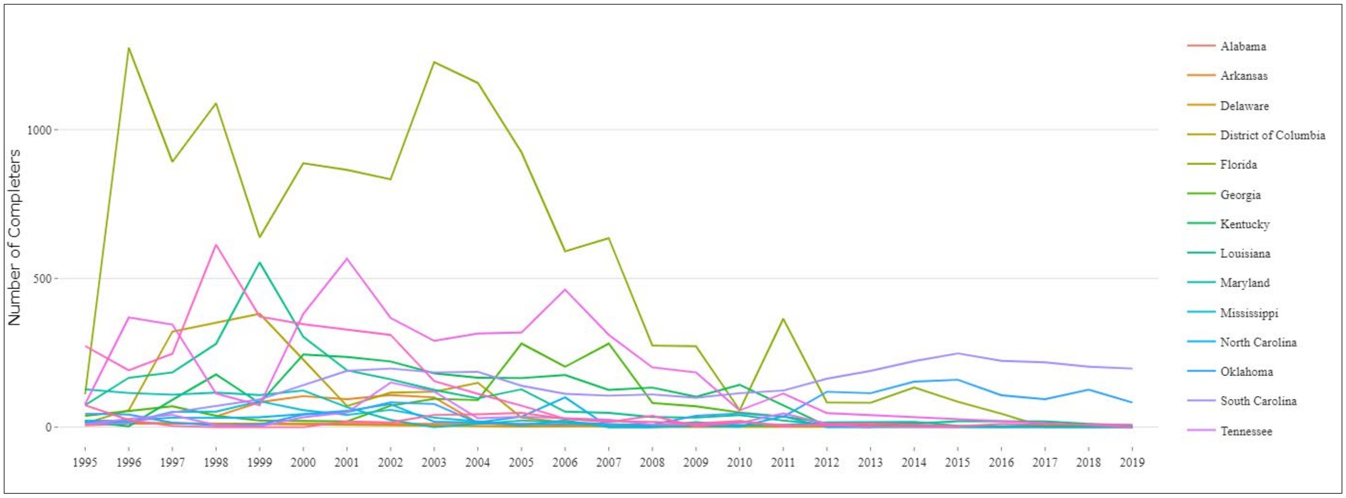

Figure 2 examines sub-baccalaureate credentials awarded in CIS over the same 25-year period, this time focusing on southern states. Here, we observe trends similar to those in Figure 1. Prior to 2004, three southern states –Tennessee, Louisiana, and Virginia (which is represented by the pink line in the graph; the preset length of the key display is a limitation of the data tool) – generally awarded between 300 and 600 CIS credentials. Florida is the substantial outlier in this region, awarding more than 500 CIS credentials every year until 2007. But as with Computer Engineering credentials in the Northeast, many southern states saw the number of these credential awards drop after 2004, with only a few slight recoveries after 2010.

Figure 3: Sub-Baccalaureate Graduates in Electrical Engineering in Western States, 1995-2019

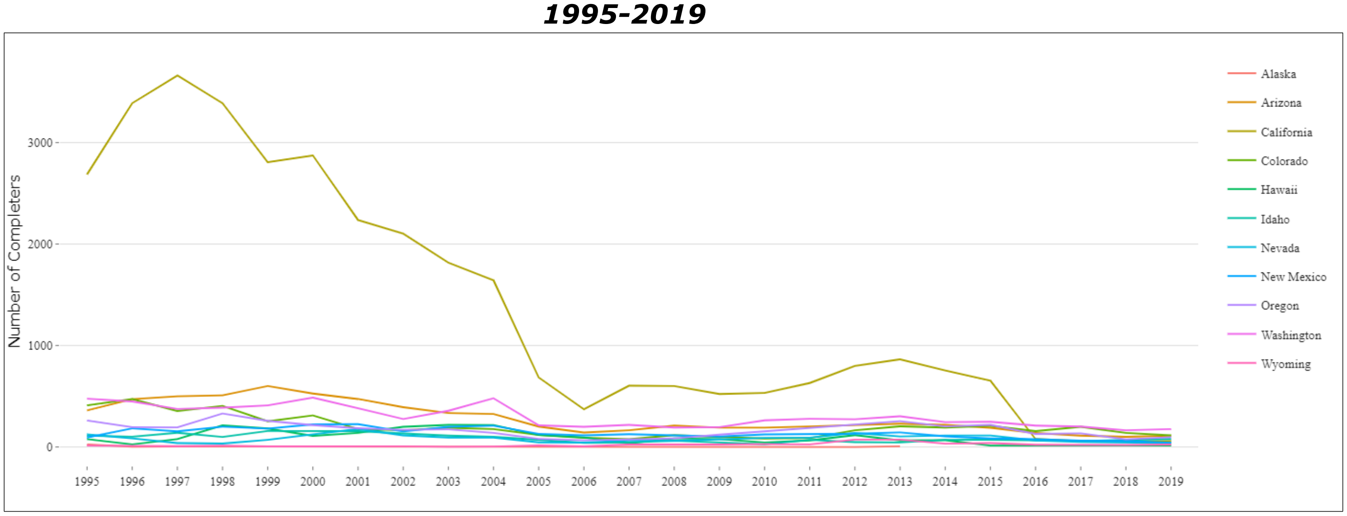

Figure 3 examines credentials awarded in Electrical Engineering in the same study period, and focuses on Western states. As one would expect, California – by far the most populous state in the country – overwhelms the observable trends in other, more rural western states. Prior to 2003, California saw more than 2,000 graduates per year in Electrical

Engineering. But this number begins to decline around 1997, reaching a low point in 2006; rebounds slightly; then declines to its lowest levels after 2015. In the other western states, production of these credentials peaked either prior to 2001 (e.g., Arizona, Colorado, Oregon), or around 2004 (e.g., Idaho, Washington). As with Figures 1 and 2, we see some western states make modest rebounds after 2010, but none reach the levels observed prior to 2004.

Potential Explanations

Examining these trends in the other nine plots we created, we note the same general patterns.[2] One potential explanation of the downward trends after 2000 is the passage of laws related to the H-1B Visa program in the United States. The passage of two acts in 1998 and 2000 increased the availability of foreign guest workers, a disproportionate share of whom take work in computer-related occupations.[3] This increased use of foreign workers may have depressed the need for certified domestic workers in these fields. The modest recoveries noted around 2010 may have been due to investments made in workforce preparation with the support of the American Rescue and Recovery Act of 2009.

Limitations

In addition to the limitations of our methodological choices described above, there are further limits presented by both the data tool and the IPEDS data that underlie it.

The Technician Graduates Data Tool provides visualizations (graphs) of the trends in credential and degree awards. But complex analysis of these trends could perhaps be better accomplished with data tables where actual frequencies can be easily viewed and manipulated. For example, populations vary substantially within states, and these variations may make an examination of unadjusted frequencies misleading. Thus, it might be of value to see the rate of production of a given type of degree or credential per 100,000 residents. Tabular data would allow for this more complex analysis. The visualizations also automatically fit the y-axis (number of credentials) to the selected data. Thus, though the graphs look similar, the meanings of the trend lines may be inconsistent. Recent updates to the Technician Graduates Data Tool provide some of this functionality.

IPEDS data rely on the Classification of Instructional Programs (CIP) coding scheme. The CIP was intended to "assist in collecting, reporting, and interpreting data about instructional programs."[4] Importantly, CIP data are compiled by individual institutions rather than by a centralized government entity, and different postsecondary institutions may use the codes in different ways. Similarly, uses of CIP codes within an institution may change over time as program content evolves. Another reason CIP coding may change within technician programs, for example, is in response to changes in the federal government's designation of certain programs of study as eligible for Optional Practical Training for F-1 Visa students.

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[2] These other figures are presented in the Appendix to this brief.

[3] Batalova, Jeanne. (2010). *H-1B Temporary Skilled Worker Program*. Migration Information Source. New York: Migration Policy Institute. https://www.migrationpolicy.org/article/h-1b-temporary-skilled-worker-program

[4] Malitz, Gerald. (1987). *A Classification of Instructional Programs (CIP)*. Washington, DC: Center for Education Statistics, Office of Educational Research and Improvement.

Conclusion

This brief used IPEDS data arrayed in the Technician Graduates Data Tool to examine trends in awards of sub-baccalaureate credentials in three computer-related programs of study, with a focus on regional variation. Overall, we observed similar trends in these awards for all four broad regions of the country. Beyond these substantive observations, this brief demonstrated the utility and functionality of the Technician Graduates Data Tool for comparing program trends across states.

About the Author

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Appendix. Supplemental Figures

Figure A1. Sub-Baccalaureate Graduates in Computer and Information Sciences in Midwestern States, 1995–2019

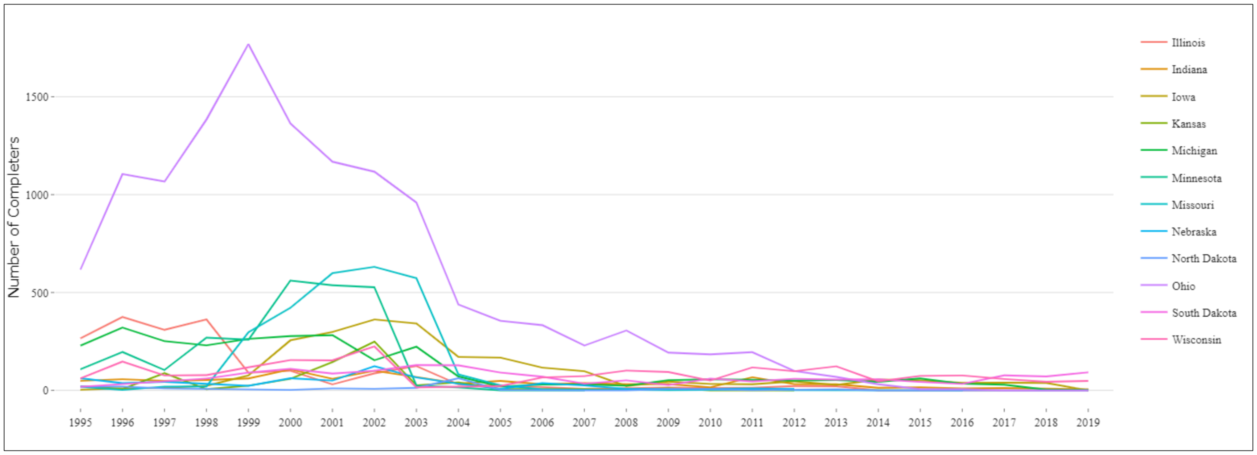


Figure A2. Sub-Baccalaureate Graduates in Computer Engineering in Midwestern States, 1995–2019

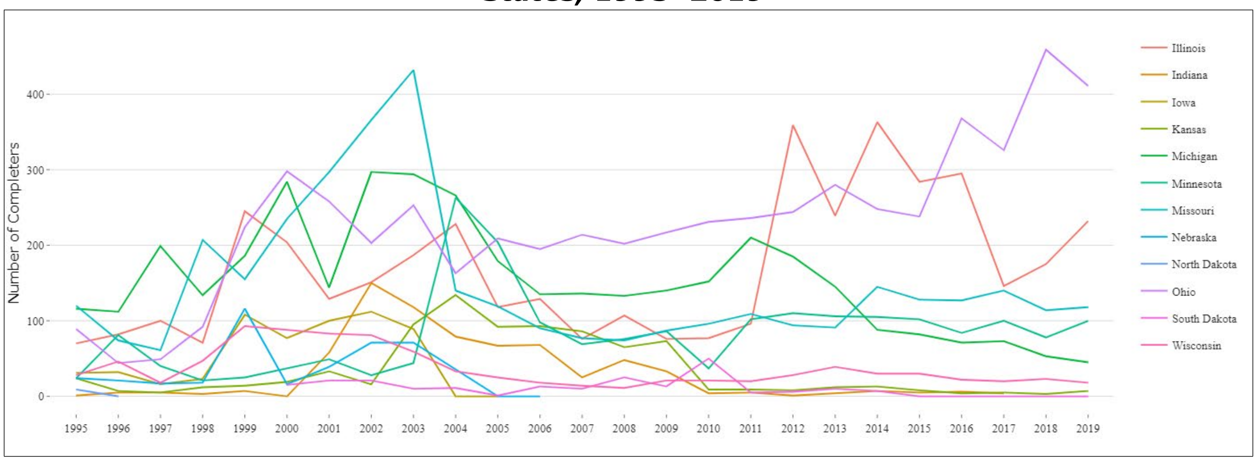


Figure A3. Sub-Baccalaureate Graduates in Electrical Engineering in Midwestern States, 1995–2019

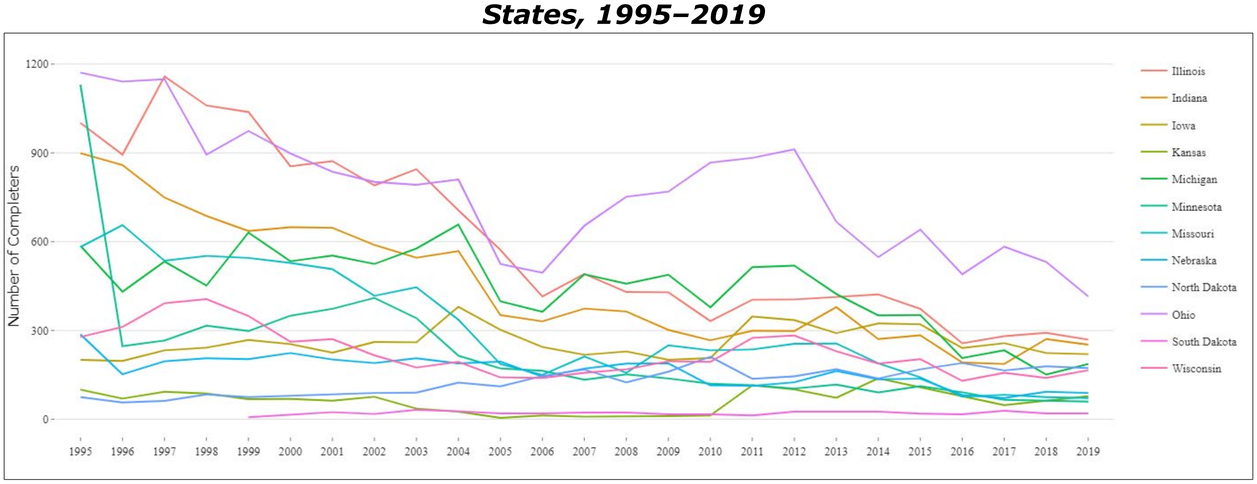


Figure A4: Sub-Baccalaureate Graduates in Computer and Information Sciences in Northeastern States, 1995–2019

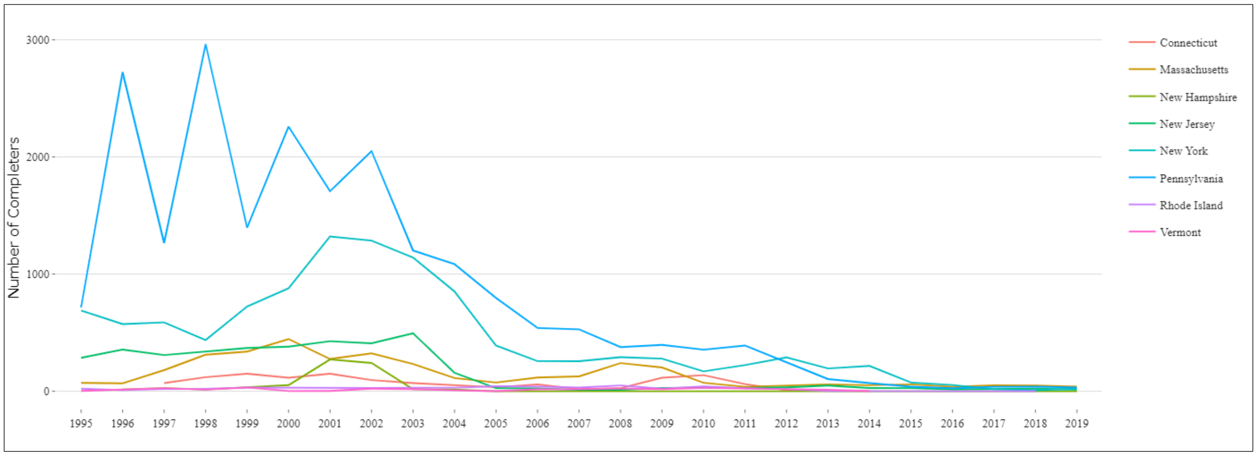


Figure A5. Sub-Baccalaureate Graduates in Electrical Engineering in Northeastern States, 1995–2019

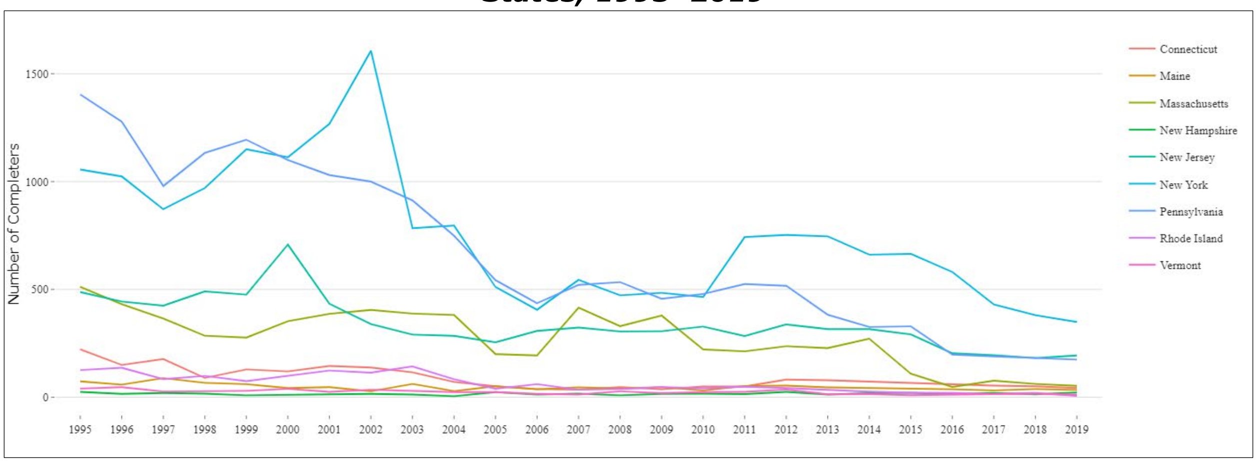
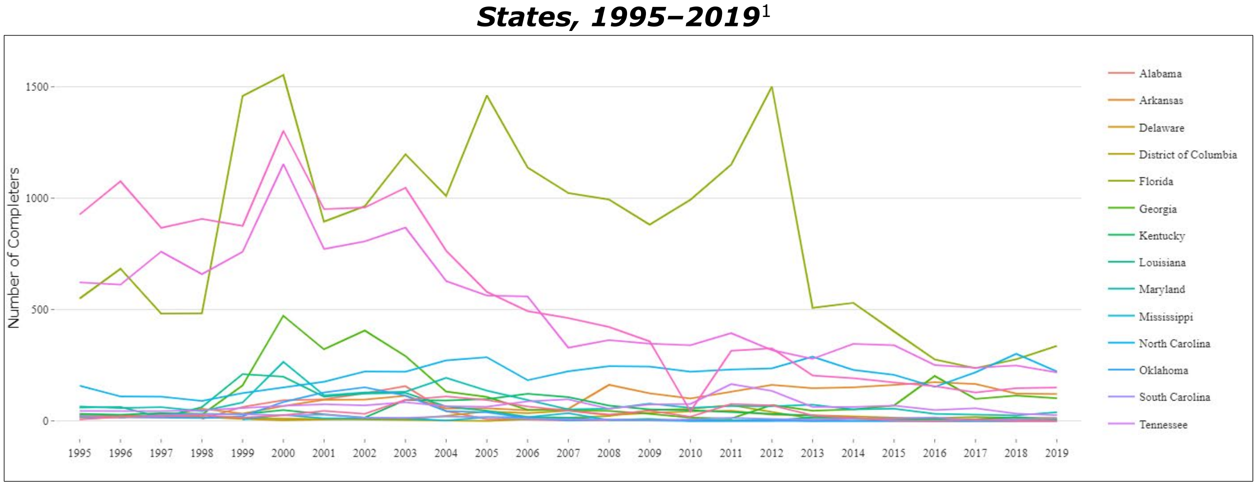
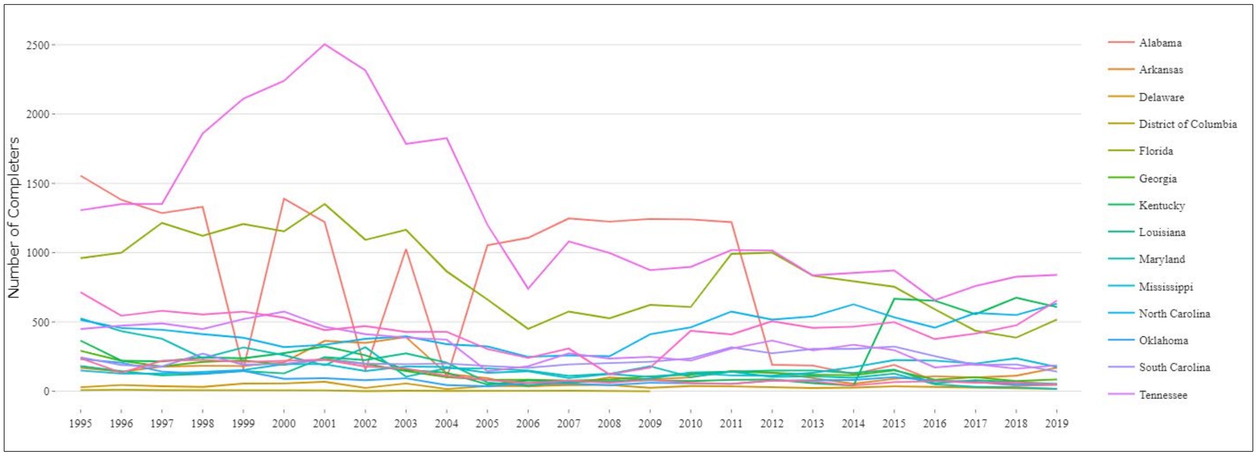


Figure A6: Sub-Baccalaureate Graduates in Computer Engineering in Southern States, 1995–2019[1]



[1] The Data Tool limits the size of the key, thus not all states are clearly indicated in the key.

Figure A7: Sub-Baccalaureate Graduates in Electrical Engineering in Southern States, 1995–2019 [1]



[1] The Data Tool limits the size of the key, thus not all states are clearly indicated in the key.

Figure 4 Figure 8A: Sub-Baccalaureate Graduates in Computer Engineering in Western States, 1995 - 2019

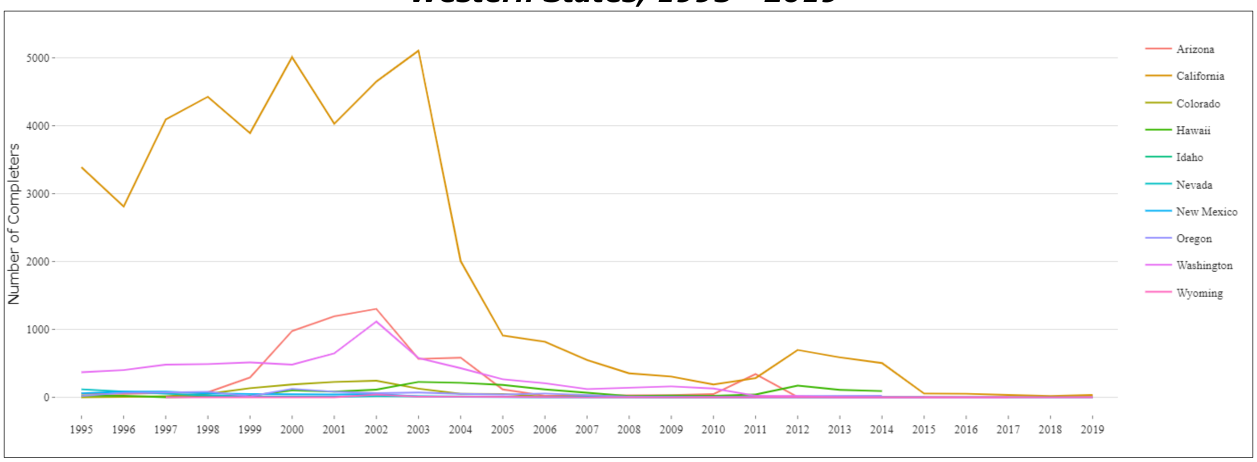


Figure A9. Sub-Baccalaureate Graduates in Computer and Information Sciences in Western States, 1995–2019