The K-12 to Post-Secondary STEM and Computer Science Continuum: Ensuring a Highly Skilled Future Workforce

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Federal STEM Goals

- Build Strong Foundations for STEM Literacy

- Increase Diversity, Equity, and Inclusion in STEM

- Prepare the STEM Workforce for the Future

Committee on STEM Education. National Science and Technology Council. (2018). *Charting a Course for Success: America's Strategy for STEM Education.*

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What are considered STEM careers?

The STEM Labor Force of Today: Scientists, Engineers, and Skilled Technical Workers

Traditional Definition: STEM Workforce

> ...individuals with **at least a bachelor's degree** working in S&E occupations.

S&E occupations encompass five major categories:

(1) computer and mathematics scientists; (2) biological, agricultural, and environmental life scientists; (3) physical scientists; (4) social scientists, and (5) engineers.

Analyses of workers who also utilize science and technological expertise may include those employed in S&E-related occupations, including doctors, nurses, engineering managers, computer programmers, and biological technologists.

National Science Board, National Science Foundation. 2021. The STEM Labor Force of Today: Scientists, Engineers and Skilled Technical Workers. *Science and Engineering Indicators 2022*. NSB-2021-2. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb20212.

New Expanded Definition: STEM Workforce

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...the increasing prevalence of advanced technologies in the workplace has raised the importance of understanding workers in occupations that also require significant STEM expertise but **do not require a bachelor's degree**.

National Science Board, National Science Foundation. 2021. The STEM Labor Force of Today: Scientists, Engineers and Skilled Technical Workers. *Science and Engineering Indicators 2022*. NSB-2021-2. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb20212.

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New Expanded Definition: STEM Workforce

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These...*middle-skill occupations...in STEM*, are critical in adapting and maintaining new processes and technologies that are integral to the U.S. S&E enterprise. The expanded definition of the U.S. STEM workforce...recognizes the increasing use of these skills across a broad range of STEM occupational groups—S&E, S&E-related, and middle-skill occupations—by workers at **all education levels**.

National Science Board, National Science Foundation. 2021. The STEM Labor Force of Today: Scientists, Engineers and Skilled Technical Wor
Science and Engineering Indicators 2022. NSB-2021-2. Alexandria, VA. Available at https://ncses.nsf.gov/pubs/nsb20212.
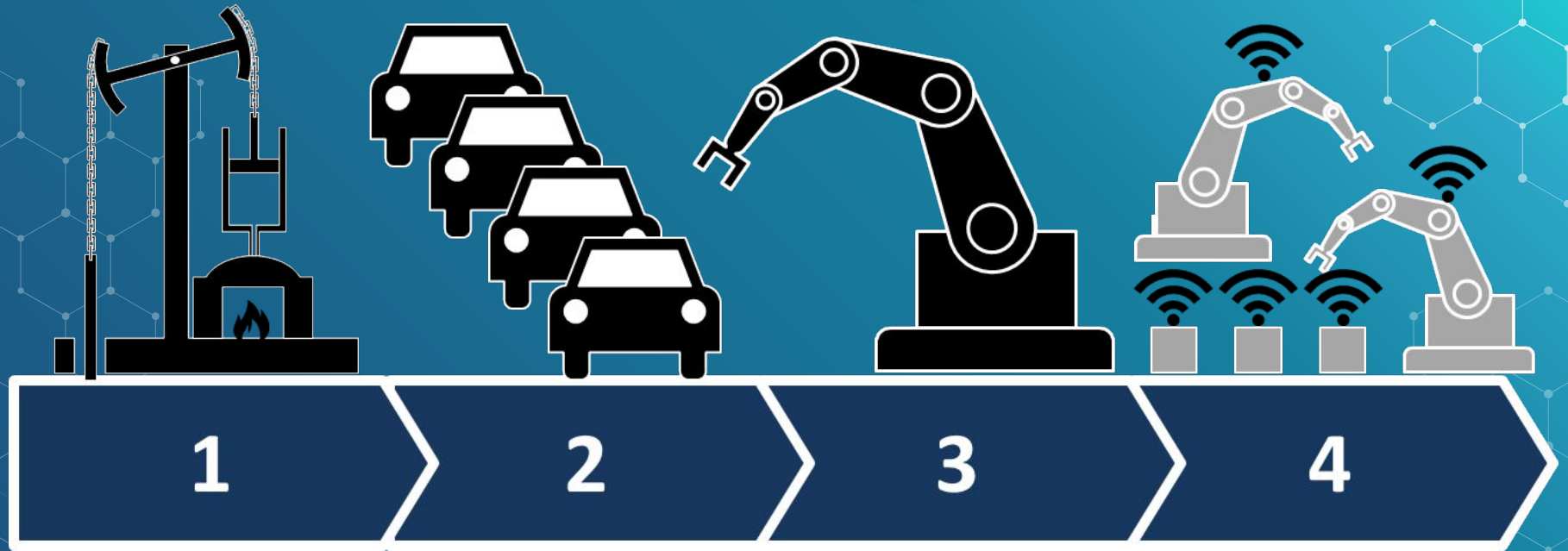
K-12 >>> workforce pathways

- ◇ HS Coursework
- ◇ Apprenticeships
- ◇ Training Programs
- ◇ Certificate Programs
- ◇ Associate Degrees
- ◇ Bachelor Degrees
- ◇ Graduate Degrees

Industry 4.0 Technology Transformation

1	2	3	4
⬧ Mechanization ⬧ Water power ⬧ Steam power	⬧ Mass production ⬧ Assembly line ⬧ Electricity	⬧ Computers ⬧ Automation ⬧ Robotics	⬧ Cyber-Physical systems ⬧ Big Data and ML ⬧ Advanced automation

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667,600

NEW COMPUTER & IT JOBS PROJECTED BY 2030

$91,250

Median annual wage for computer and IT jobs in May 2020 compared to $41,950 for all jobs.

https://www.bls.gov/ooh/computer-and-information-technology/home.htm

> The future of Arkansas' economic development is tied to our ability to succeed in data analytics and computing.

Mike Preston, Secretary of Commerce,
Executive Director of the Arkansas Economic Development
Commission, and Co-chair of the Blue-Ribbon Commission

Blue Ribbon Commision. (December 2017). *Recommendations on Advancing the Economic Competitiveness of Data Analytics and Computing in Arkansas*, Executive Summary, p. 4.
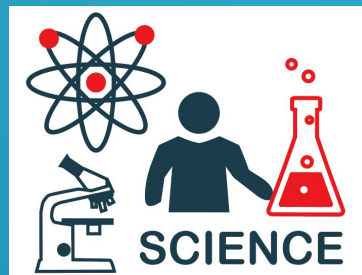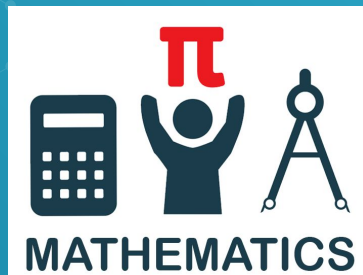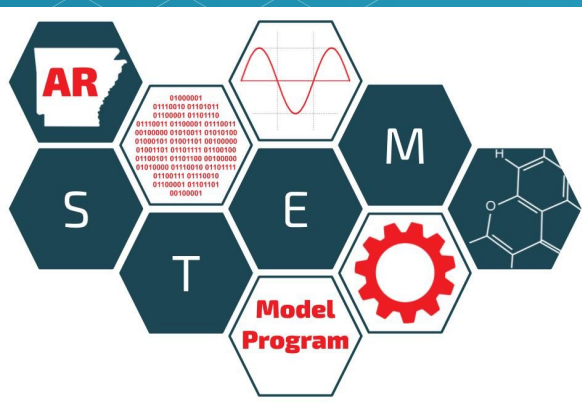
4 C's of the 21st Century

COMMUNICATION
Sharing thoughts, ideas, and questions

COLLABORATION
Working together to reach a common goal

Looking at problems in a new way
CRITICAL THINKING

Trying new approaches to solve problems
CREATIVITY

Computer Science & Computing Practices

- Communication
  - Collaboration
  - Storytelling
- Professionalism
  - Ethics and Impact
  - Inclusion
  - Learning by Failure
  - Perseverance
- Understanding
  - Patterns
  - Problem Solving
  - Research
  - Tools

+

Standards for Mathematical Practice

- Make sense of problems and persevere in solving them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated reasoning

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Science & Engineering Practices

- Asking questions and defining problems
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations and designing solutions
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

STEM Practices

ADE DESE High School Computer Science Standards & Courses

✱Artificial Intelligence & Machine Learning

✱Computer Engineering

✱Cybersecurity ✱Data Science

✱Game Development and Design

✱Mobile Application Development

✱Networking ✱Programming ✱Robotics

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Artificial Intelligence and Machine Learning Industry Recognized Certifications

1. PCAP-Certified Associate in Python Programming
2. CLA–C Programming Language Certified Associate
3. CPA–C++ Certified Associate Programmer
4. Java SE 8 Programmer Certification
5. CJSD–Certified JavaScript Developer
6. CompTIA A+
7. CompTIA Network+
8. CompTIA Security+
9. Tensor Flow
10. AWS Certified Machine Learning

Act 757 of 2021

Licensed Practical Nurse Pathway Pilot

- East Ark Secondary Career Center
- UACC-Batesville Secondary Career Center
- SouthArk Secondary Technical Center

Postsecondary STEM/CS Opportunities

- ◇ Provide high school students opportunities for concurrent credit and credentials in STEM/CS

- ◇ Build the STEM/CS educator pipeline

- ◇ Include a Data Science or Computing option in state general education core

- ◇ Engage in postsecondary consortia and collaboration for STEM/CS

Arkansas Data Science and Computing Ecosystem

is a statewide community of practice from education, government, business, industry, and nonprofits committed to data science and computing economic growth and workforce development through data-informed education and training pathways for Arkansans.

Postsecondary "CS" Credentials Offered and Awarded in AR since 2015

CIP code = 11 and CIP detail in 0101, 0102, 0103, 0104, 0105, 0199, 0201, 0202, 0203, 0204, 0205, 0299, 0301, 0401, 0501, 0601, 0602, 0699, 0701, 0801, 0802, 0803, 0804, 0899, 0901, 0902, 0999, 1001, 1002, 1003, 1004, 1005, 1006, 1099, 9999

CIP code = 14 and CIP detail in 0901, 0902, 0903, 0999, 1004, 4201, 4701

CIP code = 15 and CIP detail in 0305, 0404, 0405, 0406, 0407, 1201, 1202, 1203, 1204, 1299

CIP code = 26 and CIP detail in 1103, 1104

CIP code = 29 and CIP detail in 0207, 0307, 0406

CIP code = 30 and CIP detail in 0801, 1601, 3001, 4801, 5202, 7001, 7099, 7101, 7102, 7103, 7104,7199

CIP code = 36 and CIP detail in 0113
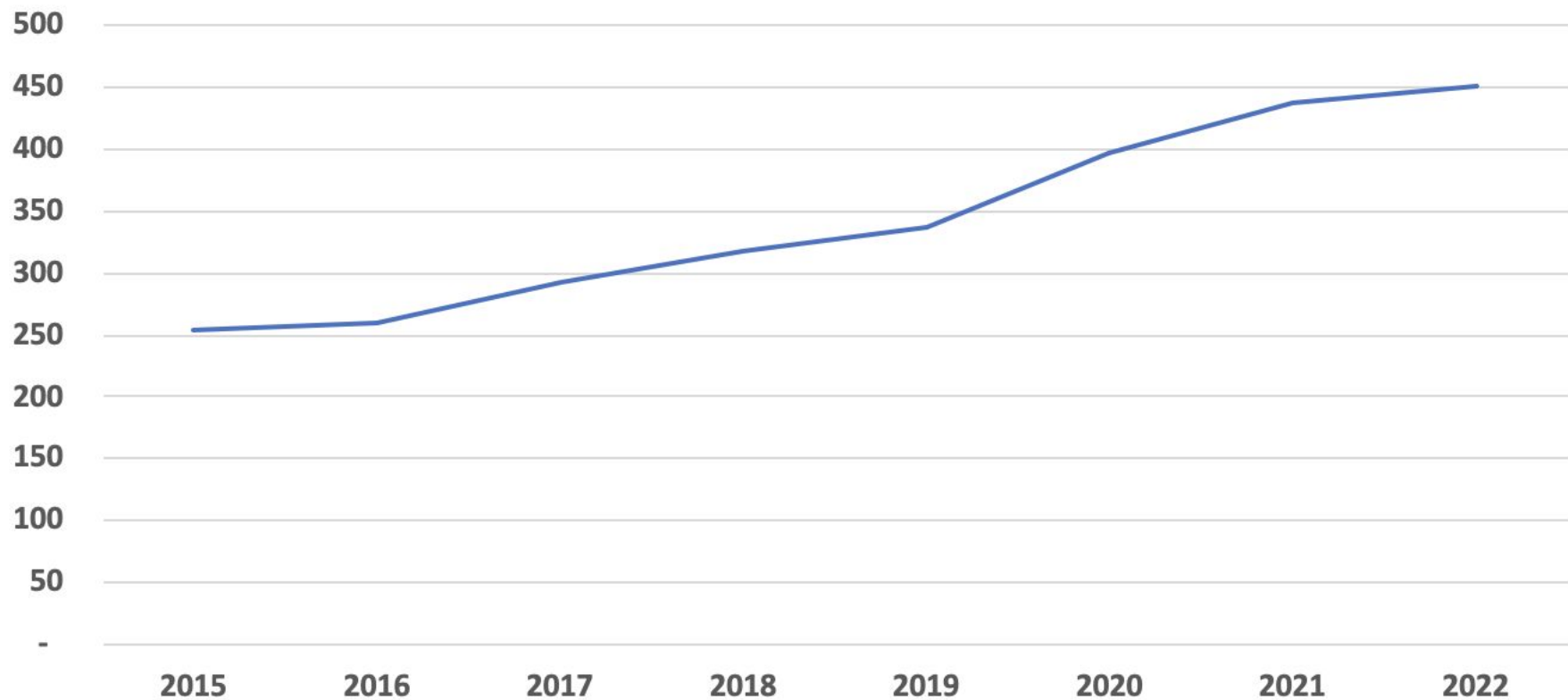
CIP code = 43 and CIP detail in 0116

CIP code = 47 and CIP detail in 0104
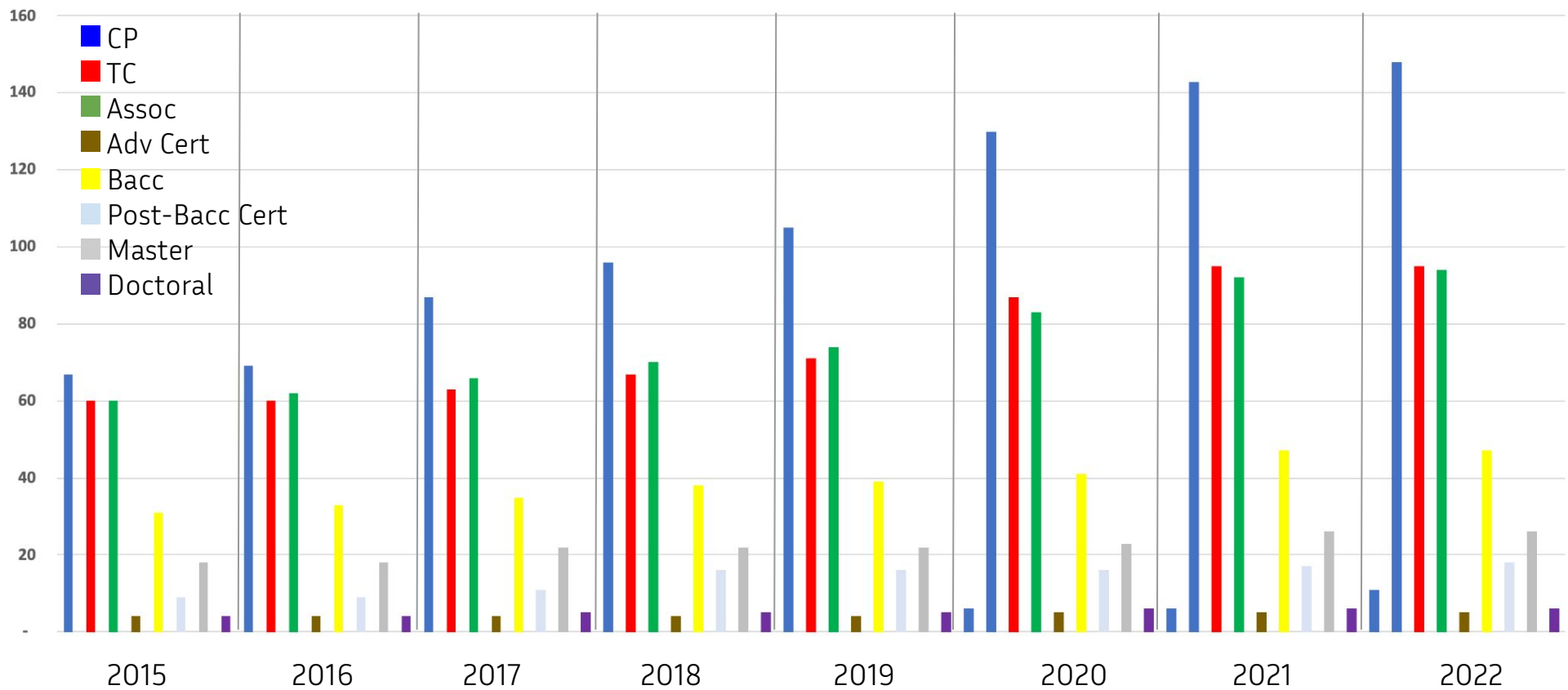
CIP code = 50 and CIP detail in 0411

CIP code = 51 and CIP detail in 2706

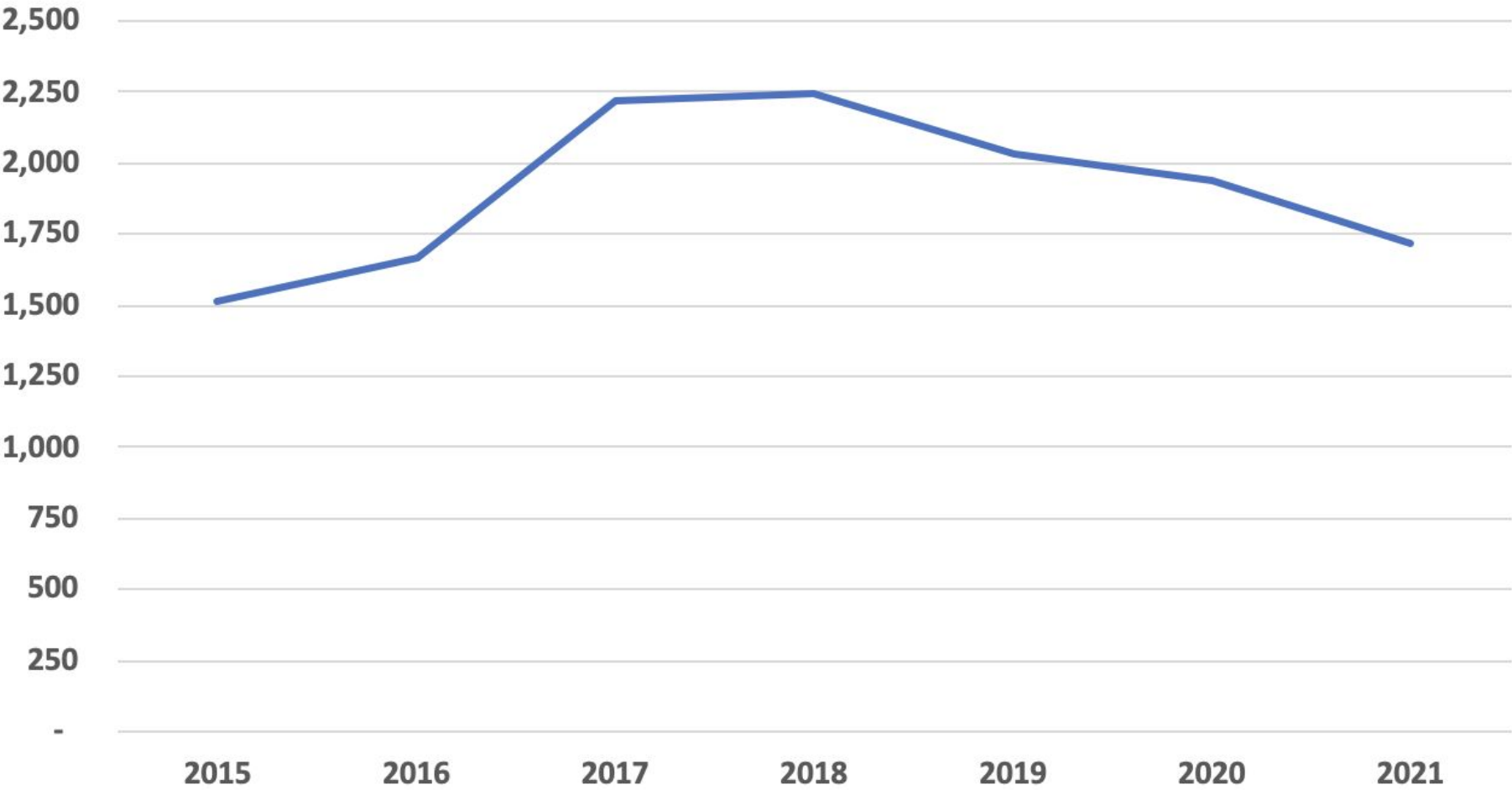CIP code = 52 and CIP detail in 1201, 1206, 1207, 1299, 1301
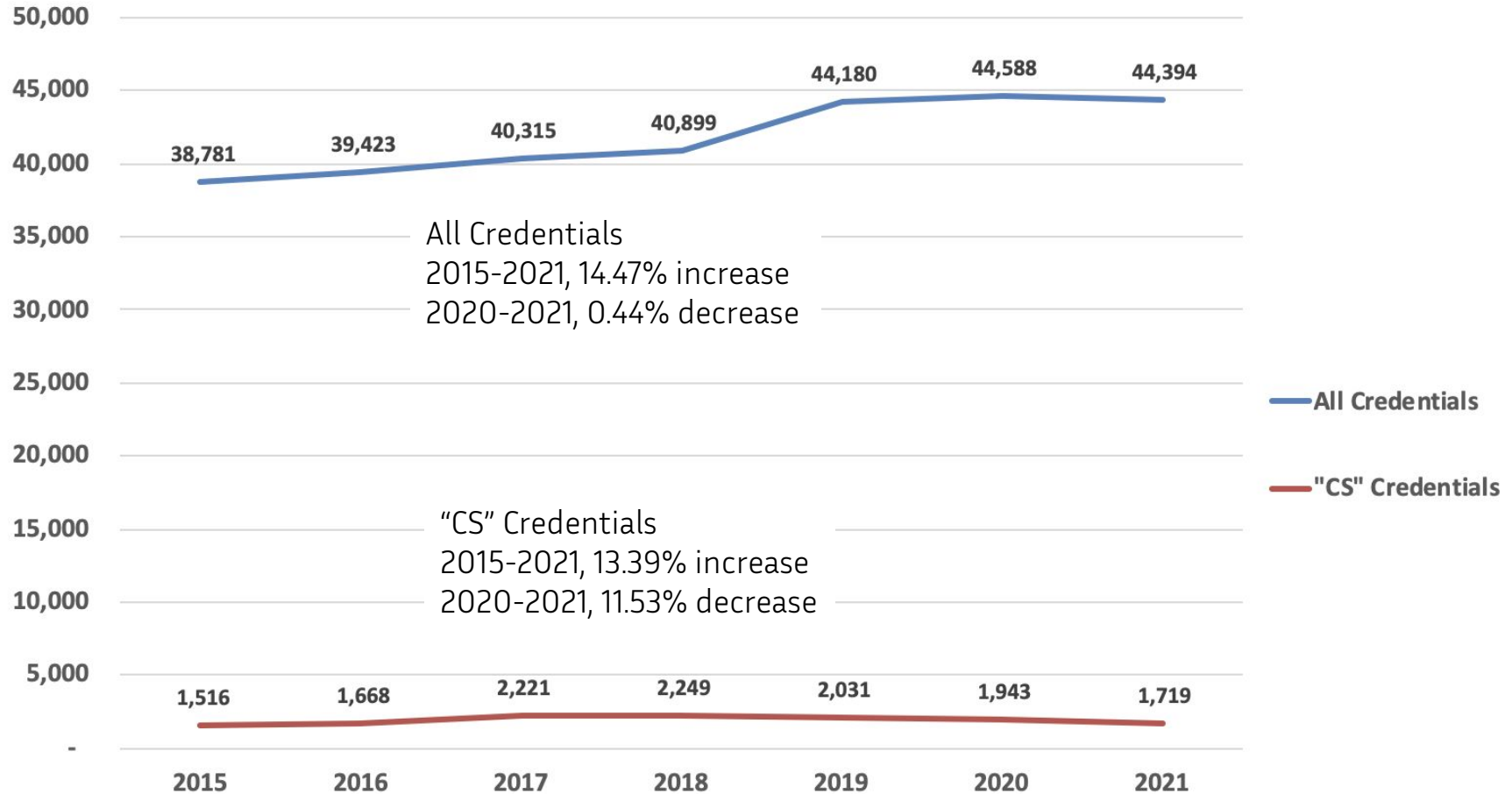
Annual "CS" Credentials Offered
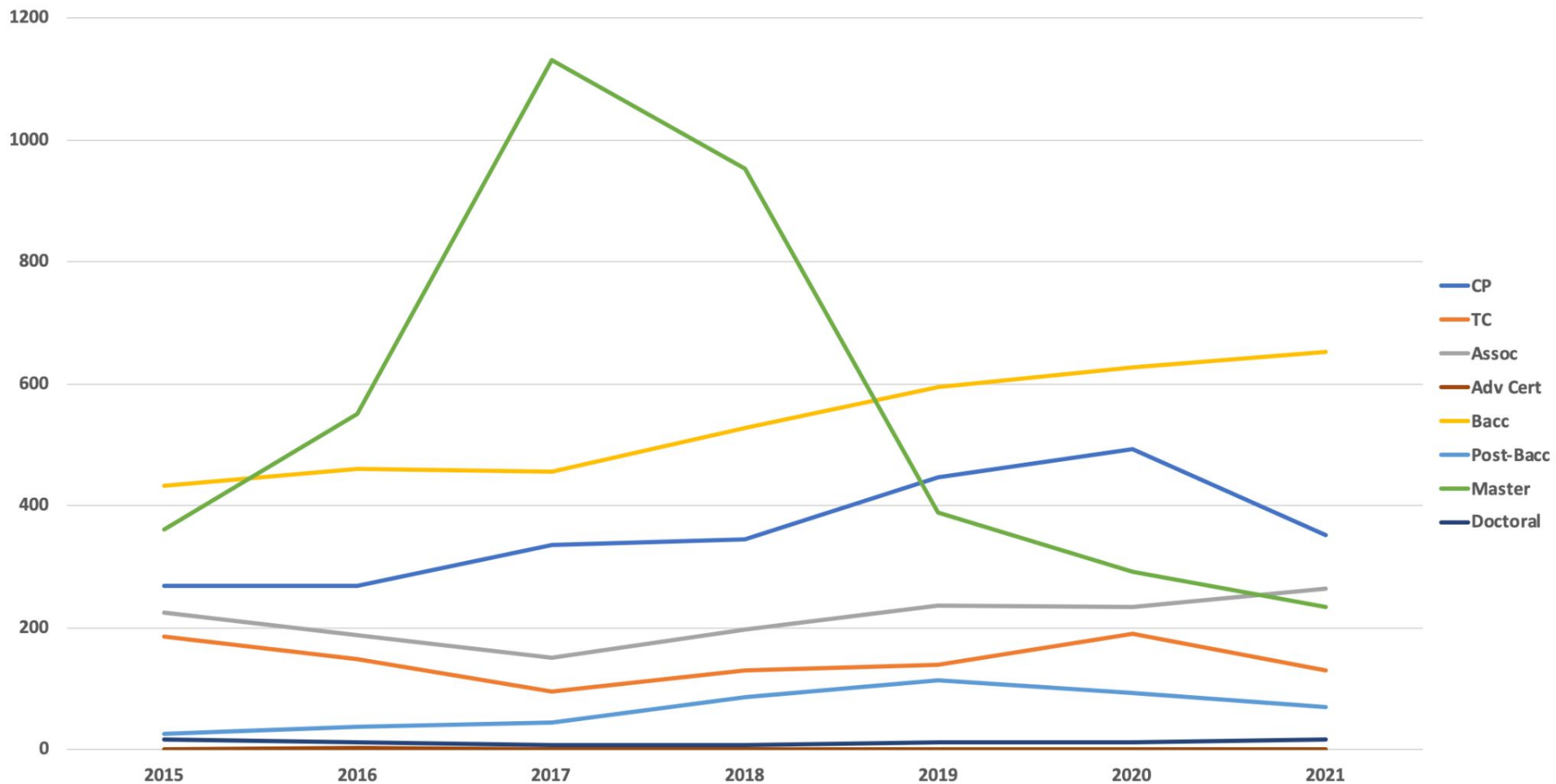
Disaggregated Annual "CS" Credentials Offered

Annual "CS" Credentials Awarded

Annual Credentials Awarded
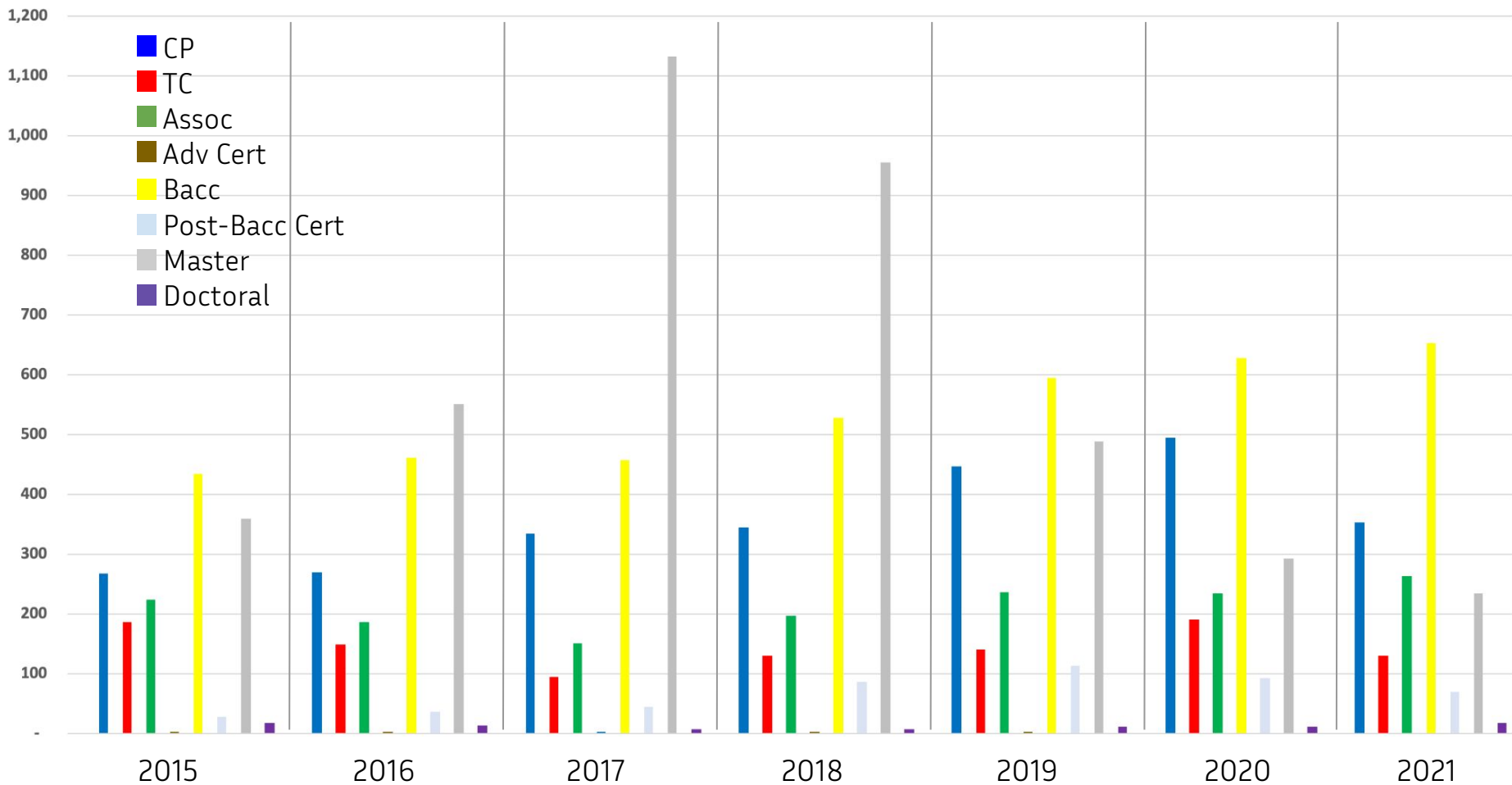

All Credentials
2015-2021, 14.47% increase
2020-2021, 0.44% decrease

"CS" Credentials
2015-2021, 13.39% increase
2020-2021, 11.53% decrease

All Credentials — 38,781 · 39,423 · 40,315 · 40,899 · 44,180 · 44,588 · 44,394

"CS" Credentials — 1,516 · 1,668 · 2,221 · 2,249 · 2,031 · 1,943 · 1,719

Years: 2015 · 2016 · 2017 · 2018 · 2019 · 2020 · 2021

Disaggregated Annual "CS" Credentials Awarded

Disaggregated Annual "CS" Credentials Awarded

Legend:
- CP
- TC
- Assoc
- Adv Cert
- Bacc
- Post-Bacc Cert
- Master
- Doctoral

Questions?

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