

New Jersey Department of Education Computer Science State Plan 2019



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Executive Summary

Equitable access to high-quality education will provide every student with the foundational skills needed to succeed in postsecondary fields of study and careers. Computing and technology have become pervasive in our daily lives and must be included on the list of foundational skills each student needs. These skills are also driving job growth and innovation. Equipping students with knowledge of computer science has become an educational and economic imperative.

Governor Phil Murphy and the New Jersey Department of Education (NJDOE) are committed to promoting equitable and expanded access to high-quality, standards-based computer science education for all New Jersey K to 12 students in preparation for postsecondary success. To this end, the following strategic goals have been established:

1. Develop and adopt rigorous Computer Science standards in all grades, that provide a framework for equitable access to a coherent, robust K to 12 Computer Science program for all students.
2. Develop and deliver flexible, accessible and sustainable professional learning for school and district-based educators and educator preparation providers, to grow and sustain coherent, robust, standards-based K to 12 Computer Science programs.
3. Establish initial licensure as well as endorsement pathways to reflect statutory requirements (P.L. 2018, c. 81) in order to increase the number of educators well prepared to deliver computer science education.
4. Engage with families, community stakeholders, K to 12 educators, institutions of higher education, educator preparation providers, and members of district boards of education to extend the NJDOE's capacity, build and leverage key partnerships, and promote the State plan's long-term success.
5. Establish metrics for each of the goals, to allow for discussions regarding progress, success, and remaining gaps. Ensure that the data collected can serve as a basis for establishing the funding in each of the next two fiscal cycles.

These goals target policies deemed critical to supporting and sustaining the implementation of coherent, robust, standards-based K to 12 Computer Science programs. The goals were developed by the NJDOE with input from the Computer Science Advisory Board, based on national research and best practices.

Computer Science Mission and Vision

Mission Statement

The NJDOE is committed to promoting equitable access to high-quality computer science education for all K to 12 students in preparation for postsecondary success.

Vision Statement

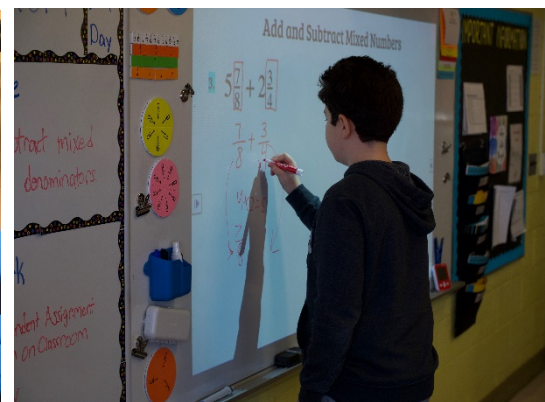
New Jersey will be a leader among states in preparing its students to succeed in today's knowledge-based economy by providing equitable and expanded access to high-quality, standards-based computer science education and building capacity, partnerships and awareness to promote the State plan's long-term success.

Every school district in New Jersey will engage families, district boards of education, and community stakeholders to establish an equitable and coherent approach to computer science instruction that scaffolds high-quality learning experiences and equips K to 12 students with the knowledge and skills to meet or exceed the New Jersey Student Learning Standards.

Educators at all stages of their careers, including pre-service and in-service teachers and school leaders, will have access to differentiated and sustained professional learning, supported through the State budget.

Students will benefit from opportunities to engage in high-quality computer science programs that foster their ability to:

- Develop and apply computational thinking to address real-world problems and design creative solutions;
- Engage as collaborators, innovators, and entrepreneurs on a clear pathway to success through postsecondary education and careers;
- Navigate the dynamic landscape of computer science to become healthy, productive, 21st century global-minded individuals; and
- Participate in an inclusive and diverse computing culture that appreciates and incorporates perspectives from people of different genders, ethnicities, and abilities.



Introduction

The Importance of Computer Science

“In today’s tech-based world, it’s especially crucial that we offer our young minds the skills they need to make them more successful when they enter the global workforce.”

NJDOE Commissioner of Education, Dr. Lamont Repollet
Computer Science for All announcement, 2018

Computational thinking, the problem-solving process inherent in computer science, provides students with a mechanism for breaking down problems, recognizing patterns and developing creative solutions in logical steps that can be carried out by a computer. Computational thinking is an essential skill across every 21st century job and career and is an enabler of creative thinking and technological innovation. The study of computer science offers students opportunities to develop computational thinking skills that can be applied to problem solving in many disciplines as well as in activities of daily living.

Computing occupations are the number one source of new wages in the United States and make up 58% of all projected Science Technology Engineering and Math (STEM) jobs. But only 10% of STEM graduates earn degrees in Computer Science.¹ College Board statistics indicate that students exposed to computer science in high school are twice as likely to take a computer science class as part of their postsecondary education.² Not every student will choose a career in computing or STEM. But the concepts and practices fundamental to computer science: logical and abstract thinking, creative problem solving, and collaboration are applicable to every occupation and career.³ Beyond the labor market, knowledge of computer science enables students to understand the role of computing and to critically engage in public discussions on important issues of national security and society in our digital world.

Nationally STEM jobs are growing faster than any other job sector in our economy.⁴ There are more than 500,000 open computing jobs in the United States.⁵ Graduates with degrees in Computer Science have the second highest average starting annual salary of \$66,005.⁶

In New Jersey, there are 15,237 open computing jobs spanning every industry. The average salary for a computing occupation in New Jersey is \$107,260, which is significantly higher than the average salary in the State (\$56,970). The existing open jobs alone represent a \$1,634,319,249 opportunity in terms of annual salaries. But in 2017, only 1,642 Computer Science majors graduated from the State’s universities.⁷

National and State leaders across all industry sectors, education, and government have highlighted the importance of K to 12 computer science education. In 2016, President Obama announced Computer Science for All as a national initiative.⁸ The Computer Science for All movement, supported by the National Science Foundation (NSF) and the US Department of Education, in partnership with other federal agencies and private partners, is focused on ensuring that K to 12 computer science education is available to all students across the United

States.⁹ Computer Science for All has fueled research and development of resources to assist states in implementing Computer Science K to 12 education policies and programs. New Jersey has made a commitment to providing equitable and expanded access to high-quality, standards-based computer science education to every public and charter school in the State.

Definition of Computer Science¹⁰

Computer science means the study of computers and algorithmic processes and includes the study of computing principles and theories, computational thinking, computer hardware, software design, coding, analytics, and computer applications.

Computer science often includes computer programming or coding as a tool to create software, including applications, games, websites, and tools to manage or manipulate data; or development and management of computer hardware and the other electronics related to sharing, securing, and using digital information.

In addition to coding, the expanding field of computer science emphasizes computational thinking and interdisciplinary problem-solving to equip students with the skills and abilities necessary to apply computation in our digital world. Using a computer for everyday activities such as browsing the internet; using tools like word processing, spreadsheets, or presentation software; or using computers in the study and exploration of unrelated subjects is not computer science.

Equity

Providing equitable access to high-quality computer science education for all K to 12 students is the central theme of the mission statement for the State plan. Achieving equity will require promoting educational practices focused on curriculum and classroom culture that encourage the recruitment, support and retention of students regardless of race, gender, disability, or socioeconomic status. Establishing a diverse teacher workforce must be a part of the State plan for recruiting and supporting diverse student learners.

The Google Gallup report, *Diversity Gaps in Computer Science*, detailed barriers leading to the underrepresentation of females and other minorities in Computer Science.¹¹ The report found that in K to 12:

- Black and Hispanic students have less access to computer science education than White students;
- Female students are less likely to be encouraged to study computer science than male students;
- Black and Hispanic students are less likely to use a computer at home;
- Females, Black and Hispanic students are less likely to know an adult role model working in the computing or technology fields.

The lack of exposure results in lower confidence, further contributing to the underrepresentation of minorities in computing careers and computing-related programs of studies in higher education. According to the Bureau of Labor statistics in 2018, only 27.2% of those employed in computer systems design and related services were females, 7% were Black or African American and 6.6% were Hispanic.¹² In 2016, of the students graduating with Computer Science and Information Systems degrees, only 10% were Black, 10% were Hispanic and 18% were female.¹³ The NJDOE is committed to improving equity in the landscape of computer science by adopting high-quality standards in computer science, providing professional learning that supports instruction of a diverse population of learners, and recruiting and retaining a diverse educator workforce.



State of the State

“In the 21st-century economy, we must prepare our students with the critical thinking and problem-solving skills they need to think about the world in new and creative ways. Computer Science for All is a game-changer, giving our children the tools, they need to learn coding and tackle complex problems in an increasingly technologically connected world.”

New Jersey Governor Phil Murphy
Computer Science for All announcement, 2018

Currently in New Jersey only a small number of students participate in rigorous computer science course work at the high school level. According to the College Board, during the 2017-2018 school year, only 3,853 New Jersey students took the Advanced Placement Computer Science A (AP CSA) exam and 2,764 students took the AP Computer Science Principles (AP CSP) exam. Participation among female and minority students is even lower. Twenty-five percent of the AP CSA test takers were females, 3% were black and 9% were Hispanics. Thirty-three percent of the AP CSP test takers were females, 4% were black and 14% were Hispanics.¹⁴

On October 3, 2018, Governor Phil Murphy announced New Jersey’s Computer Science for All initiative to advance K to 12 STEM education; a plan to bring technology and programming-focused classes to schools across New Jersey. In support of Computer Science for All, the FY 2019 budget included \$2 million to increase the number of public high schools that offer advanced computer science courses. The NJDOE was charged with convening a Computer Science Advisory Board to create a State plan for Computer Science Education. Governor Murphy became the 18th governor to join the Governors’ Partnership for K to 12 Computer Science, a bipartisan coalition of governors committed to expanding access and funding for Computer Science education.

The State allocated \$2 million in additional funding for Computer Science education in the FY2020 budget (this follows \$2 million allocated in the FY2019 budget). In alignment with this State plan, the FY2020 funding will lay the foundation for a sustainable infrastructure for professional learning across New Jersey. Other goals and milestones outlined in this State plan provide a roadmap to advance Governor Murphy’s vision and provide access to high-quality computer science education for every student in New Jersey.

The Code.org Advocacy Coalition is a bipartisan coalition of corporations and nonprofits that work together to help establish federal and State policies to expand and sustain access to K to 12 computer science and to broaden participation and diversity in the field. This Coalition defined nine State-level policies to make computer science fundamental in K to 12 education.¹⁵ The nine policies are used to guide states in planning a coherent approach to K to 12 computer science education and to assess a State’s progress in providing equitable access to high-quality,

K to 12 computer science education. Below is an overview of New Jersey's progress in each of the nine policy areas.

1. State Plan for K to 12 Computer Science Education

New Jersey's State plan outlines the major policy initiatives and related milestones necessary to advance the State's mission and vision for computer science education. This three-year plan reflects the best thinking of a diverse team of stakeholders as well as national research and best practices. This State plan presupposes that a Computer Science Advisory Board should be maintained and refreshed as needed and that it should assess progress and update the State plan at the end of each of the next three years.

2. Define computer science and establish rigorous computer science education standards

As part of the development of this State plan, New Jersey has for the first time offered a State definition for Computer Science. This definition, and its exclusions, will serve as foundation for developing the next generation of New Jersey Student Learning Standards (NJSLS) for Computer Science. A strand of Computational Thinking and Programming was added to the New Jersey Core Curriculum Content Standards for Technology in October 2014 (8.2.E). Although New Jersey has been credited with early adoption of Computer Science standards, the existing strand alone will not support Computer Science for All. The New Jersey standards are currently under revision as per the five-year review cycle in administrative code and when they are completed in spring 2020, will include an expanded computer science standard. The new K to 12 standards will set the expectations on which schools build standards-aligned curriculum, instruction, and assessment. Computer Science standards will also inform high-quality professional development, teacher certification, and preservice programs.

3. Allocate funding for rigorous computer science teacher professional development and course support

New Jersey's FY2019 and FY2020 budgets each included \$2 million to support Computer Science education. The funds from the FY2019 budget were used to award Advanced Computer Science grants to New Jersey school districts. The FY2020 funds will be dedicated to developing the capacity of New Jersey educators to provide high-quality learning experiences related to Computer Science through the development of professional learning hubs in northern, central and southern New Jersey. In addition, funds will be awarded to create state and career and technical education program curriculum. Finally, at least fifteen school districts will receive funding to provide expanded access for students who are economically

disadvantaged to computer science courses. Not enough data is available at this time to evaluate the funding required to build and sustain a highly-qualified Computer Science teacher workforce. It will be incumbent on the NJDOE to establish metrics and forecast the funding needed in each of the next two fiscal cycles.

4. Implement clear certification pathways for computer science teachers

Goals and milestones related to this policy have been identified as part of this State plan. To comply with legislation, a 9 to 12 grade Computer Science endorsement will be developed and adopted. A full K to 12 Computer Science certification will also be established.¹⁶ Additional data will be collected to determine the need for a 5 to 8 grade Computer Science endorsement.

5. Create programs at institutions of higher education to offer computer science to preservice teachers

Currently there are no preservice education programs. Establishing an endorsement and an initial certification are the first steps in building toward this policy goal. Additional milestones related to this policy are identified in this State plan.

6. Establish dedicated computer science positions

The NJDOE is currently seeking to fill a full-time position for a dedicated computer science specialist.

7. Require that all secondary schools offer computer science

As a result of legislation, starting with the 2018-2019 school year, all high schools in New Jersey must offer a course in Computer Science.¹⁷ Data has not been collected to determine to what extent schools have adopted this policy nor the effectiveness of the implementation.

8. Allow computer science to satisfy a core graduation requirement

In compliance with legislation, Advanced Placement Computer Science A may satisfy a high school graduation requirement in Mathematics.¹⁸ In addition, computer science may also satisfy the five credit, 21st Century Life and Careers graduation requirement (although the single course may not be counted as fulfilling both requirements).

9. Allow computer science to satisfy an admission requirement at institutions of higher education

To satisfy this indicator, a State policy or administrative guidelines must be adopted that would allow Computer Science to satisfy a required credit for admission at all public four-year postsecondary institutions in a State. NJDOE will collaborate with

the Office of the Secretary of Higher Education to make this a reality over the upcoming year.

In the next section, strategic goals aimed at supporting and sustaining the implementation of coherent, robust, standards-based K to 12 Computer Science programs as outlined in the nine policies will be identified.

Strategic Goals

Each of the following goals have been designed to fulfill on the State's commitment to Computer Science for All. The Computer Science Advisory Board acknowledges that specific action steps will be needed to increase access for traditionally underrepresented groups of students, including but not limited to students of color, females, low-income students and students with disabilities.

Adopt Standards (Policy 2)

Goal 1. Develop and adopt rigorous Computer Science standards in all grades, that provide a framework for equitable access to a coherent, robust K to 12 Computer Science program for all students.

Implement Professional Learning (Policy 3)

Goal 2. Develop and deliver flexible, accessible and sustainable professional learning for school and district-based educators and educator preparation providers, to grow and sustain coherent, robust, standards-based K to 12 Computer Science programs.

Strengthen Teacher Pipeline (Policies 4 and 5)

Goal 3. Establish initial licensure as well as endorsement pathways to reflect statutory requirements (P.L. 2018, c. 81) in order to increase the number of educators well prepared to deliver computer science education.

Build Capacity, Partnerships and Awareness (Policies 2, 4, 5, 7 and 8)

Goal 4. Engage with families, community stakeholders, K to 12 educators, institutions of higher education, educator preparation providers, and members of district boards of education to extend the NJDOE's capacity, build and leverage key partnerships, and promote the State plan's long-term success.

Establish a Data-Driven Decision-Making Approach (Policy 3)

Goal 5. Establish metrics for each of the goals, to allow for discussions regarding progress, success, and remaining gaps. Ensure that the data collected can serve as a basis for establishing the funding in each of the next two fiscal cycles.

Milestones

The NJDOE milestones below have been developed from the strategic goals in this State plan. The State plan will be updated at the end of each of the next three years. Progress should be detailed, and goals and milestones should be revisited and revised as needed. The yearly review and revision of the goals and milestones in this State plan will be undertaken by the NJDOE and the Computer Science Advisory Board.

Adopt Standards

Develop and adopt rigorous Computer Science standards in all grades, that provide a framework for equitable access to a coherent, robust K to 12 Computer Science program for all students.

Milestone	End Date
Review, revise, and adopt NJ Computer Science Student Learning Standards.	June 2020
Support school districts by disseminating standards related information and curating resources to implement the standards.	June 2021 (ongoing)

Implement Professional Learning

Develop and deliver flexible, accessible and sustainable professional learning for school and district-based educators and educator preparation providers, to grow and sustain coherent, robust, standards-based K to 12 Computer Science programs.

Milestone	End Date
Allocate the \$2 million budget line item to establish a sustainable, regionally centered, professional learning network.	June 2020 (ongoing)
Establish a mechanism to disseminate information on externally funded (e.g. NSF funded) K to 12 professional development opportunities.	June 2021 (ongoing)

Strengthen Teacher Pipeline

Establish initial licensure as well as endorsement pathways to reflect the requirement of legislation P.L. 2018, c. 81 (C.18A:26-2.26), in order to increase the number of educators well prepared to deliver computer science education.

Milestone	End Date
Develop, approve, and adopt regulations for CS teacher endorsements and initial licensure.	2020
Engage with institutions of higher learning and other providers to facilitate the development of CS teacher preparation programs.	2021
Investigate and implement mechanisms for incentivizing preservice and in-service teachers to enroll in CS teacher preparation programs.	2022

Build Capacity, Partnerships and Awareness

Engage with families, community stakeholders, K to 12 educators, institutions of higher education, educator preparation providers, and members of district boards of education to extend the NJDOE's capacity, build and leverage key partnerships, and promote the State plan's long-term success.

Milestone	End Date
Establish a computer science webpage on the NJDOE website and/or partner site to communicate with all stakeholders.	2020
Develop and execute a communications strategy that engages superintendents, directors of curriculum and instruction, content supervisors, boards of education and other critical decision makers in K to 12 CS education informational sessions.	2021
Participate in a CS summit to engage districts, State boards, industry, institutions of higher education and other stakeholders.	2022

Establish a Data-Driven Decision-Making Approach

Establish metrics for each of the goals, to allow for discussions regarding progress, success, and remaining gaps. Ensure that the data collected can serve as a basis for establishing the funding in each of the next two fiscal cycles.

Milestone	End Date
Define data needed, develop survey, collect data and write landscape report. Establish baseline from data and create metrics to evaluate goals and strategy.	2020
Using data collected and metrics adopted, evaluate progress on goals and modify the CS State plan as indicated.	2021 (ongoing)

Appendix A: Acknowledgements

The NJDOE, under the leadership of Commissioner Dr. Lamont Repollet, expresses their appreciation for the time and expertise supplied by the Computer Science Advisory Board (Appendix B) in the development of the State plan. We also acknowledge Code.org, the Computer Science Teachers Association of New Jersey (CSTANJ) and the New York City Foundation for Computer Science Education who provided their expertise to earlier versions of the plan.

New Jersey Computer Science Advisory Board Members

Name	Affiliation
Robert Asaro-Angelo, Commissioner	New Jersey Department of Labor and Workforce Development
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