



Date: January 2, 2020

Source of Report: LD 1382 Resolve, Directing the Department of Education To Study and Develop a State Plan for Computer Science Instruction and Professional Development

Topic: Computer Science Instruction and Professional Development

Context

Since 2017, the Department of Education and the 128th and 129th Maine State Legislature have been involved in several conversations and work groups related to computer science education. Stakeholders agree that computer science skills and concepts are important and that Maine students should have the opportunity to learn those skills. Much of the debate has been, and continues to be, centered on the best ways to ensure that all Maine students have access to opportunities to learn computer science skills and concepts.

Currently, computer science courses and experiences are offered in schools and/or career and technical education (CTE) programs in all 16 counties in the state. Additionally, opportunities are available before and after school clubs and summer programs. In school, curricular opportunities range from integrating computational thinking skills into existing courses, such as science class, to stand alone computer science courses. These offerings are provided by educational technician IIIs, CTE instructors, and elementary and secondary level teachers. Several Maine-based and national non-profits provide professional support for these educators.

The Department's vision for computer science has been, and continues to be, that all Maine students have access to high quality computer science instruction to prepare them for success in college, career, and civic life. For the purposes of this work, "high-quality" computer science instruction is defined as instructional opportunities that have at least the following four components:

1. Leadership by qualified teachers who have subject-matter expertise;
2. An established progression of learning with increasing rigor;
3. Time for multiple opportunities for students to engage in the learning; and
4. Lessons that are designed to be inclusive of the needs and strengths of all learners.

The Department continues to work toward a more concrete definition of Computer Science, though, this report will later offer a working definition.

The principles that have guided the Department's work related to developing a plan for Computer Science Education in Maine are:

- Mandates need to be kept to a minimum in order to allow educators and school leaders to catch their breaths, evaluate what is and what is not working well, and make recommendations for policy and practice going forward.
- Provision of information, guidance, resources, and support will reawaken the professionalism, innovative spirit, and leadership of those closest to the work, creating a culture of intrinsic motivation, self-reflection, and continuous improvement (all to the benefit of Maine’s students).
- The Department’s role is to provide support, not obstacles, as educators exercise their professional judgment and expertise on behalf of their students.
- Additional considerations can be found in the Maine Department of Education Values-Based Decision-Making Framework.

With these elements in mind, the Department decided that Maine educators should be heavily involved in the drafting of Maine’s Computer Science Education Plan for PreK - 12 students.

Actions

On May 1, 2019, educators gathered in Lewiston to begin the work of defining “computer science” and sharing their questions, concerns, and best practices with members of the Department.

The definition that educators agreed to use is:

Computer Science is defined by the US Department of Education Office of Innovation and Improvement as contexts and spaces “where students are able to engage in hands-on, real-world interaction with key math, science, and engineering principles. In addition to coding, it gives students opportunities to be producers in the digital economy, not just consumers of technology around them. Computer science also can help foster ‘computational thinking’ skills and practices that are relevant to problem-solving across many disciplines and careers, skills such as breaking a large problem into a number of smaller ones, recognizing how problems relate to ones that have already been solved, setting aside details of a problem that are less important, and identifying and refining the steps needed to reach a solution” (US Department of Education).

During this same meeting, educators reviewed plans from other states, and developed the framework that would be used to write the final state plan. Later that spring, the Legislature passed LD 1382 which directed the Department to study and develop a state plan for computer science instruction and professional development and to share a report in January 2020 with an overview of how computer science and curricula are being implemented, a plan for instruction to include how computer science may be applied toward graduation requirements, a professional development plan for educators, and an estimate of the funding levels necessary to implement recommendations. This report is developed based on the framework proposed by educators and by the requirements of LD 1382, or Public Law Chapter 78.

The Department convened a group of educators on August 5th and 6th to begin drafting a State Plan for Computer Science Instruction. The two-day intensive writing summit was divided into four components.

Part 1: Establishing the Vision and Understanding the Problem

- **Vision for Computer Science in Maine:** *That all Maine students have access to high quality computer science instruction to prepare them for success in college, career, and civic life.*
- **The Problem:** *While there are excellent computer science programs provided throughout Maine, equitable access to these programs is not yet a reality. All students need access to high quality computer science instruction to prepare them for success in college, career, and civic life.*
- Recognizing the complexity of the problem, the group spent time identifying the root cause(s) so that it could create more targeted solutions to lack of access. The goal is to make lasting systematic change (address the root cause) instead of finding a 'band aid' type of solution (reacting to a symptom of the problem).
- View educator notes here: [Getting to the Root Cause Graphic Organizer](#).

Part 2: Brainstorming and Refining Solutions

- Educators generated many solutions, grouped them, and then settled into 10 writing teams to develop them further.
- Educators were asked to refine solutions using their expertise, experience, and the [Maine Department of Education Values-Based Decision Making Framework](#)
- View the 10 solutions here: [Solutions - Writing Documents](#)

Part 3: Drafting Sections of the State Plan

- Educators were assigned to five teams (based on application responses) and were asked to look at all 10 solutions through the lens of the section they were tasked to write. They chose various solutions to build out into recommendations for their part of the state plan.
- Educators drafted [questions to ask guests](#) in order to help their writing process and then engaged in a review and revision process.
- View the drafted five sections here: [State Plan Components - Writing Documents](#)

Part 4: Beginning the Professional Learning Conversation

- Educators were asked to quickly brainstorm ideas for professional learning needs, based on the skills they hope students would develop as a result of Computer Science Instruction. Those [ideas can be found in this summary document](#).
- Educators then split up into groups to brainstorm in small groups focused on elementary educators, secondary educators, administrators and other stakeholder audiences, as well as who would lead the professional learning (DOE, other educators, or outside organizations).
- Educators ended the two-day summit by interviewing each other and [creating educator profiles with words of advice and resources to share with others](#).

The Department members who participated in the August meetings returned to the office with significant feedback from these educators and began the work of creating a set of proposals and action plan to support their recommendations. The educators gathered again on September 20th, 2019 to both review a draft of this plan and to give feedback on the ways in which the Department could collect more data from each district to support the recommendations. Educators continued to provide feedback, generate ideas, and ask critical questions of the draft plan and survey, while wrestling with the tough question of how Maine could truly achieve

equitable access to high-quality computer science education. This report ultimately reflects some of their thinking, with the understanding that the Department will continue to work with the educators to further develop and implement this plan.

Over the course of these three meetings, the Department leveraged the expertise of 48 Maine educators, who were classroom teachers, librarians, technology directors, technology integrators, technology coaches, curriculum coordinators, or other administrators. Each of the nine superintendent regions were represented and educators were able to bring the full PreK-12 perspective. A [full list of the educators](#) is available online. More detailed descriptions of the work they did and all the resources they had access to can be found on the [Computer Science Plan Digital Work Space](#).

Findings/ Recommendations

Recommendation #1: <i>Establish statewide public awareness for what computer science is and why it is important for students to develop related knowledge and skills. Work with cross-sector partners to create a shared vision, definitions, goals, and desired outcomes.</i>			
Number	Activities	Involved Parties	Timeline
1.1	Develop and share a vision for Computer Science instruction in Maine PreK-12 schools	DOE, teacher leader cohort, partners	Jan-Feb 2020
1.2	Identify and share a list of essential learning outcomes and transferable skills that should be developed by students because of Computer Science instruction	DOE (conversations between educators and industry partners)	Feb-June 2020
1.3	Establish “Look Fors” to help educators/students identify evidence of learning as a result of computer science instruction and “Look Fors” to help administrators support	DOE, teacher leader cohort	Summer 2020

	educators who are teaching computer science		
1.4	Design and implement a research study to track progress toward achieving the goals	DOE, research partner	Fall 2021
1.5	Establish an advisory board composed of educators and administrators from Maine schools and higher education as well as other stakeholders	DOE, advisory board, districts	Mar-June 2020
1.6	Orchestrate awareness campaigns (social media, community events, etc.)	DOE, districts, teacher leader cohort, partners	Jan-June 2020 (ongoing)

Recommendation #2: <i>Coordinate computer science related efforts in order to connect people and organizations to each other and to students, educators, and schools, and to align resources toward a common goal.</i>			
Number	Activities	Involved Parties	Timeline
2.1	Establish a clearinghouse of freely available resources for computer science instruction	DOE, teacher leader cohort, partners	Summer 2020
2.2	Facilitate connections between districts and educators with invested groups (higher education, nonprofits and	DOE, teacher leader cohort, advisory board, schools and districts, higher education, partners	Ongoing

	businesses)		
2.3	Establish a list of organizations that can provide additional (non-financial) support	DOE, teacher leader cohort, advisory board, partners	Summer 2020
2.4	Establish a grant program that provides funds/materials to get high need schools to the minimum required to offer computer science	DOE	Summer 2020
2.5	Explore, and if necessary, establish long term plan for teacher preparation and credentialing (microcredentials, courses, certificates, endorsements, or certifications)	DOE and higher education partners	Summer 2020
2.6	Establish model policies for computer science as a local graduation requirement, teacher qualifications, etc.	DOE and association partners	Summer 2020
2.7	Explore creating a pathway similar to a CTE pathway for students interested in computer science	DOE, teacher leader cohort	SY 2021-2022
Resources Needed:			
<ul style="list-style-type: none"> Competitive grant funding 			

	Recommendation #3: <i>Count high school level computer science courses toward a local graduation requirement that is above and beyond the state mandated</i>
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<i>graduation requirements; districts will determine both local graduation requirement substitution as well as the criteria for these computer science courses.</i>			
Number	Activities	Involved Parties	Timeline
3.1	Ensure all students are notified of computer science instruction opportunities	Districts and schools	Ongoing
3.2	Notify school administration, computer science teachers and students of course opportunities for students	DOE, districts, higher education	Ongoing
3.3	Determine and share with students the ways in which a computer science course can count toward a local graduation requirement	DOE, districts, advisory board, higher education	Ongoing
3.4	Develop and share resources that educators can use to guide the development of a high school course	DOE, advisory board	Summer 2020
3.5	Lead online methods course with yearlong PLC for teachers	DOE, districts, higher education	SY 2020-2021
3.6	Teach an online computer science class for high school students	DOE, districts, higher education, partners	Fall 2020
Resources Needed:			
<ul style="list-style-type: none"> • Materials costs for online course for students 			

- Materials costs for online methods course for teachers

Recommendation #4: <i>Provide professional learning to PreK-8 teachers in computer science instruction that is integrated into the pre-existing requirements of each grade level and shows a progression of learning with a clear increase in rigor.</i>			
Number	Activities	Involved Parties	Timeline
4.1	Establish a cohort of regional teacher leaders	DOE, teacher leader cohort	Spring - Summer 2020
4.2	Share models with respect to district size and location.	DOE, teacher leader cohort	Summer 2020 and ongoing
4.3	Model integrating computer science with other content areas	DOE, teacher leader cohort, and districts	Summer 2020 and ongoing
4.4	Provide models which incorporate differentiated instruction that address all learners	DOE, teacher leader cohort, and districts	Summer 2020 and ongoing
Resources Needed:			
<ul style="list-style-type: none"> • Professional Learning Costs • Stipends for Teacher Leaders 			

Recommendation #5: <i>Ensure educators have clear and consistent district-wide guidance on desired learning outcomes through district selected computer science standards.</i>			
Number	Activities	Involved Parties	Timeline
5.1	Offer SAUs a menu of suggested standards to	DOE, teacher leader cohort, partners, schools	Spring 2020

	choose from or criteria from which they can develop their own criteria from which they can develop their own	and districts, regional superintendent associations, Maine Principals Association, regional curriculum coordinators associations	
5.2	Create a capacity matrix for meeting HS and PreK-8 goals by self-assessing	DOE, teacher leader cohort, schools and districts, regional superintendent associations, Maine Principals Association, regional curriculum coordinators associations	Summer 2020
5.3	Maine DOE content specialists will work with teachers to identify where computer science standards intersect with the content areas of the Maine Learning Results	DOE, districts, intersections team	Ongoing
5.4	Provide professional learning opportunities for administrators and curriculum coordinators	DOE, regional superintendent associations, Maine Principals Association, regional curriculum coordinators associations	Ongoing

Resources Needed:

- Intersections team subs, travel and lodging costs

Recommendation #6: <i>Encourage each district to develop an implementation plan to ensure all students have access to high quality computer science instruction to prepare them for success in college, career, and civic life.</i>			
Number	Activities	Involved Parties	Timeline

6.1	Provide guidance and support for districts as they develop implementation plans	DOE, regional superintendent associations, Maine Principals Association, regional curriculum coordinators associations, districts, teacher leaders cohort	Ongoing
6.2	Develop “Like me” models with respect to delivery approach, school size and geography, etc.	DOE, teacher leader cohort, districts, regional superintendent associations, Maine Principals Association, regional curriculum coordinators associations	Summer 2020 and ongoing
6.3	Develop a SAU implementation plan capacity matrix for self-assessment	DOE, teacher leader cohort, districts, regional superintendent associations, Maine Principals Association, regional curriculum coordinators associations	Summer 2020
6.4	Develop suggested pathways for teachers of other content who want to teach computer science	DOE, districts, higher education, interested teachers	Summer 2020

Resources Needed:

- Travel and lodging for transitioning teachers’ CS training

Recommendation #7: <i>Invite districts to share the progress toward achieving the vision by sharing their successes on their computer science implementation plan and requesting professional learning.</i>			
Number	Activities	Involved Parties	Timeline

7.1	Develop HS goal capacity matrix for self-assessment	DOE, teacher leader cohort, districts, advisory board	Summer 2020
7.2	Develop PreK-8 goal capacity matrix for self-assessment	DOE, teacher leader cohort, districts, advisory board	Summer 2020
7.3	Establish an advisory board (who will monitor progress toward state plan, serve as ambassadors, help draft legislative reports, approve grant funding)	DOE, advisory board	Spring - Summer 2020
7.4	Assist with statewide, regional and districtwide capacity studies to guide decision-making and adjustments	DOE, advisory board	Spring 2020 and ongoing until 2028
7.5	Continuously identify needs and target them with appropriate supports		Ongoing
<p>Resources Needed:</p> <ul style="list-style-type: none"> • Advisory board travel and lodging costs 			

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APPROVED

JUNE 18, 2019

BY GOVERNOR

CHAPTER

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RESOLVES

STATE OF MAINE

IN THE YEAR OF OUR LORD

TWO THOUSAND NINETEEN

H.P. 1003 - L.D. 1382

Resolve, Directing the Department of Education To Study and Develop a State Plan for Computer Science Instruction and Professional Development

Sec. 1. Study and development of state plan for computer science instruction and professional development. Resolved: That the Department of Education shall study and develop a plan for implementing computer science instruction in schools and shall submit a report to the Joint Standing Committee on Education and Cultural Affairs, no later than January 1, 2020, that includes the following:

1. An overview of how computer science courses and curricula are being implemented in schools;

2. A state plan for instruction in computer science in public preschool to grade 12 that includes the development of standards, clarifies how instruction in computer science may be applied toward graduation requirements, provides equitable access to computer science instruction across the State and provides for instruction in computer science in all high schools by 2022 and in all grades by 2025;

3. A professional development plan for educators that includes training in computer science and a component that includes peer-to-peer training in computer science; and

4. An estimate of the funding levels necessary to implement the plans in subsections 2 and 3.

The Joint Standing Committee on Education and Cultural Affairs may submit a bill relating to the subject matter of the report to the Second Regular Session of the 129th Legislature.