A young girl with long brown hair and glasses, wearing a light green shirt, is smiling and looking towards the camera. She is sitting at a desk in a computer classroom. In the background, other students are working at computers, and a teacher in a pink shirt is standing and looking at a computer monitor. The scene is brightly lit, suggesting a modern educational environment.

NYS K-12 Computer Science and Digital Fluency Learning Standards

January 2020

Vision

Every student will know how to live productively and safely in a technology-dominated world. This includes understanding the essential features of digital technologies, why and how they work, and how to communicate and create using those technologies.

Parallel Efforts: Computer Science and Digital Fluency

Digital Fluency

- USNY Statewide Learning Technology Plan (2010)
 - *Technology is a path for teaching and learning, but it is also a body of practices, skill, and knowledge to be learned. All New York State learners will develop technological literacy to enter college, become productive members of the workforce, and succeed as citizens.*
- Spring 2017 Survey on Technology Literacy
 - 3,375 responses, 70% New York State teachers
 - 93% of respondents agreed that a need existed for a common statewide understanding of student technology literacy
- NYS ESSA Plan, Part IV.A.3
 - *The Department will continue its work with stakeholder groups to create guidance on digital literacy for students. (p. 190)*

Computer Science

- Computer Science Certification
 - In March 2018, NYS Board of Regents adopted regulations that created a classroom teaching certificate in computer science and a corresponding tenure area
- Part R, Chapter 56, Laws of 2018
 - Required the Education Department to work with stakeholders to review existing recognized computer science frameworks and develop draft model New York State Computer Science Standards for Kindergarten through Grade 12.



Initial Stakeholder Meeting

September 2018: Meeting of experts in computer science and educational technology from across New York State

- Recommended the separate but related areas of Computer Science and Digital Fluency should be combined under one “umbrella,” as has been done in several other states.
- Developed the Guiding Principles
- Began identifying existing recognized computer science frameworks to utilize in standards authoring efforts

Guiding Principles

- **Equity and Access**

Equity and diversity should be attended to, allowing for engagement by all students and flexibility in how students may demonstrate proficiency. The standards support a cultural view of learning and human development in which multiple expressions of diversity are recognized and regarded as assets for teaching and learning—otherwise referred to as Culturally Responsive-Sustaining Education (CR-S).

- **Interdisciplinary Connections**

The standards will complement and promote learning across disciplines.

- **Coherence**

The standards will be focused on the most important knowledge and skills that all students need to know. The standards will be clearly written, demonstrate vertical and horizontal alignment, and articulate a clear learning progression.

- **Relevance and Engagement**

The standards will motivate and empower students, allow for a focus on appropriate real-world challenges, and will prepare students to adapt and prosper in a world that is increasingly influenced and shaped by technological advancements.



Representation in Authoring, Review, and Revision

Individuals representing the following groups participated in authoring, review, and revision work:



- K-12 Teachers
 - Computer science, math, science, STEM
 - Educational technology, library and media specialists
 - Special Education
 - ELL/MLL Education
 - Early Learning, Elementary (Common Branch)
- K-12 Administrators, District Coordinators, and BOCES staff
- National Experts
 - Dr. Leigh Ann DeLyser, CSforAll
 - Dr. Kathi Fidler, Brown University
- Higher Education
- Business and Industry
- Professional Organizations
- Community and Parent Organizations
- National Experts in Computer Science Standards
- Urban, Suburban, Rural; Regional Representation

STANDARDS AUTHORIZING, REVIEW, AND REVISION

AUTHORIZING WORKGROUPS

Workgroup members, divided into small groups by concept area, met virtually to create a first draft of the standards.



Oct 2018 – May 2019

June 2019



REVIEW PANEL

Review Panel members completed both a high-level review of all standards, and an in-depth review through a specific “lens” (perspective)

FIRST REVISION

NYSED staff and a consultant revised the standards to address the Review Panel feedback and Department policy and expectations.



July – Aug 2019

Oct – Nov 2019



STAKEHOLDER FEEDBACK SURVEY

NYSED received 410 survey responses representing 839 individuals and members of organizations across New York, with 564 leaving specific comments.

SECOND REVISION

NYSED convened a workgroup on December 4 and 5, 2019, to address the stakeholder feedback priorities and revise the standards.



Dec 2019



Stakeholder Feedback and Actions Taken

Approximately 60% of respondents to the Stakeholder Feedback Survey indicated that they either moderately or strongly supported the standards overall; however, several themes clearly emerged as priorities for immediate revision.

Priority for Revision	Actions Taken
Number of Standards	<ul style="list-style-type: none">Reduced number of standards from 45 to 35 by combining redundant standards and focusing on the most important knowledge and skills
K-2 Grade Band	<ul style="list-style-type: none">Revised K-2 grade band to focus on thinking, creativity and problem solving, and ensure almost all standards can be met without the use of a device.
References to Specific Technologies	<ul style="list-style-type: none">Standards, clarifying language, and examples were revised to eliminate references to specific technologies.
Interdisciplinary Connections	<ul style="list-style-type: none">Examples were revised to include more interdisciplinary connections, and an additional Appendix was created to highlight additional examples.
Computational Thinking	<ul style="list-style-type: none">The standards were reorganized and revised; Computational Thinking was elevated to its own concept area.Standards in abstraction and modeling were added.

Overview of the Standards

CONCEPT	SUB-CONCEPTS	STANDARDS
IMPACTS OF COMPUTING	SOCIETY	1, 2
	ETHICS	3, 4, 5
	ACCESSIBILITY	6
	CAREER PATHS	7
COMPUTATIONAL THINKING	MODELING AND SIMULATION	1
	DATA ANALYSIS AND VISUALIZATION	2, 3
	ABSTRACTION AND DECOMPOSITION	4, 5
	ALGORITHMS	6, 7, 8
	PROGRAMMING	9, 10, 11, 12
NETWORKS AND SYSTEMS DESIGN	HARDWARE AND SOFTWARE	1, 2, 3
	NETWORKS AND THE INTERNET	4, 5
CYBERSECURITY	RISKS	1
	SAFEGUARDS	2, 3, 4
	RESPONSE	5
DIGITAL LITERACY	DIGITAL USE	1, 2, 3, 4
	DIGITAL CITIZENSHIP	5, 6

Reading the Standards

DRAFT NYS K-12 Computer Science and Digital Fluency Standards

Computational Thinking

ALGORITHMS

Concept
Sub-Concept

Standard Identifier
Standard

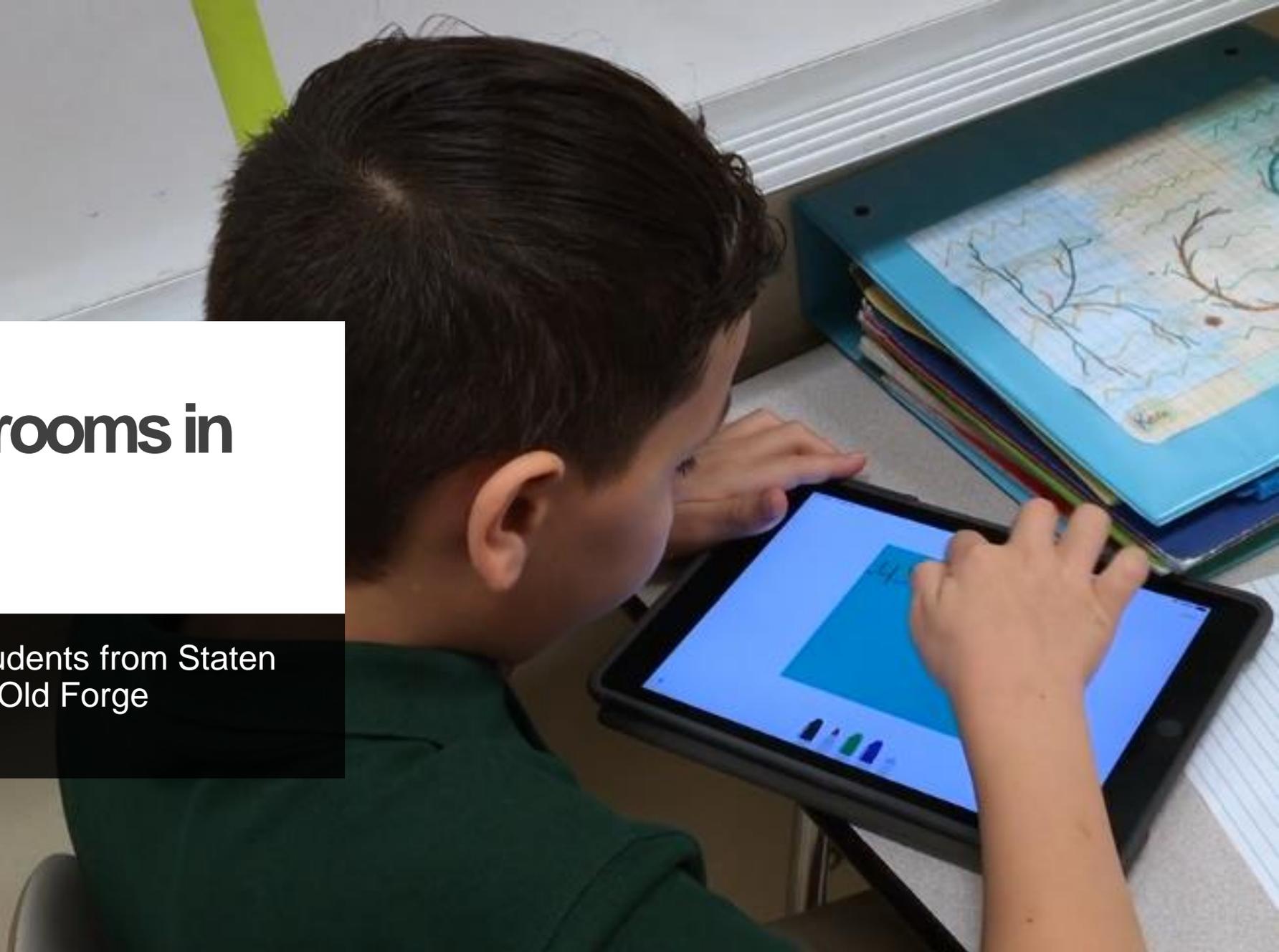
Clarifying
Statement

Example
(Illustrative Only;
Not Required)

	K-2	3-5	6-8	9-12
Standard Identifier Standard	K-2.CT.7 Create and compare two or more algorithms for the same task.	3-5.CT.7 Compare two or more algorithms and select the most appropriate one for a task.	6-8.CT.7 Compare and refine algorithms for a specific task.	9-12.CT.7 Analyze trade-offs related to two or more algorithms for completing the same task.
Clarifying Statement	Clarifying Statement: The task can be a familiar, daily activity or more abstract. The focus is on finding more than one way to reach the same goal.	Clarifying Statement: Tasks can be unplugged or related to a computer program.	Clarifying Statement: The steps of an algorithm can be implicit. Tasks should be culturally relevant and familiar to students.	Clarifying Statement: The focus of this standard is a high-level understanding that algorithms involve trade-offs, especially related to memory use and speed. Students are not expected to get into specifics about the trade-offs.
Example (Illustrative Only; Not Required)	For Example: Students could plan two routes for a robot or other character to reach the same location. Alternatively, students could write "How To" guides for the same task. Students might showcase their work, explaining the steps.	For Example: Students could compare algorithms for making a culturally relevant food item (i.e. pb&j, doner, bahn mi, etc.). Students could then choose an algorithm and explain the reason for their choice. Possible reasons students may provide for their choices might include the detail, the fewest steps, or an algorithm that describes a process most similar to how they make the food item at home.	For Example: Students could compare routes suggested by a mapping app and refine the route based on knowledge of the area near their school or home. Alternatively, students could write an algorithm to draw a geometric shape and refine the algorithm by creating new versions of it until it has no unnecessarily repeating code.	For Example: Students could be asked to look for a specific value in a sorted data set using a sequential search and then a binary search. They can count the number of comparisons it takes to find the value. Alternatively, students could model sorting algorithms with books on a bookshelf and contrast different methods in terms of shelf space and the time spent.

21st Century Classrooms in New York State

Video Featuring Teachers and Students from Staten
Island, Dobbs Ferry, Buffalo, and Old Forge





Immediate Next Steps

To ensure the new standards meet the needs of all students, NYSED staff have identified the following next steps:

- Engage further with early learning experts to ensure the K-2 grade band standards are developmentally appropriate, and that both the clarifying statements and provided examples are helpful and relevant to K-2 teachers.
- Return to the Board of Regents for final adoption of the standards in spring 2020.
- Begin to develop resources and guidance to aid the field in implementing the standards in accordance with the proposed implementation timeline.

Timetable for Roll-Out and Implementation

Upon approval by the Board of Regents, the projected timeline for implementation of the new Computer Science and Digital Fluency Standards is as follows:

Dates	Phase	Activities
Adoption – Aug 2021	Awareness-Building	Roll-out and building awareness of the new standards and timeline for implementation
Sept 2021 – Aug 2023	Capacity-Building	Focus on curriculum development, resource acquisition, professional development
Sept 2023 – Aug 2024	Year 1 Implementation	All credit-bearing Computer Science courses will be aligned with NYS CS&DF Standards
September 2024	Full Implementation	CS&DF Standards implemented in all grade bands K-12



Questions and Discussion