DEPARTMENT OF EDUCATION

Developing Computer Science Talent in Elementary Students

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Ten Minnesota Commitments to Equity

1. Prioritize equity.

2. Start from within.

3. Measure what matters.

4. Go local.

5. Follow the money.

6. **Start early.**

7. Monitor implementation of standards.

8. Value people.

9. **Improve conditions for learning.**

10. **Give students options.**

While the research indicates that gifted learners exist in all populations, educators routinely miss students whose life experience differs from our own –

specifically, students who live in poverty, are second language learners, have cultural differences, and are gifted but also learning disabled.

Gifted education is usually focused on the "all-around gifted" student. However, not all high-ability students are gifted in every subject. Some have very specific areas of strength in which their ability is significantly above the norm for their age, but other areas where they are closer to the average student.

Talent development focuses on helping develop students' **specific areas** of talent. Talent development allows schools to cast a wider net and provide services to more bright students who have needs beyond the typical curriculum.

GOAL 1: Students will show increased interest in and positive attitude towards their learning in general and computer science in particular.

GOAL 2: Participating sites will identify greater numbers of students as gifted, particularly in computer science.

GOAL 3: Participating sites will identify greater numbers of students who are limited English proficient, 2e, or are from a traditionally underrepresented racial/ethnic group identified as gifted, particularly in computer science.

GOAL 4: Teachers from participating districts will demonstrate a greater awareness of gifted student characteristics and effective instructional best practices.

Why Computer Science Education?

- The K–12 Computer Science Framework envisions a future in which students

  - critically engage in public discussion on computer science topics;

  - develop as learners, users, and creators of computer science knowledge and artifacts;

  - better understand the role of computing in the world around them; and

 - learn, perform, and express themselves in other subjects and interests.

Computer science is defined as "the study of computers and algorithmic processes, including their principles, their hardware and software designs, their [implementation], and their impact on society" *K-12 Computer Science Framework, 2016*

Computer science

Coding

Computational Thinking
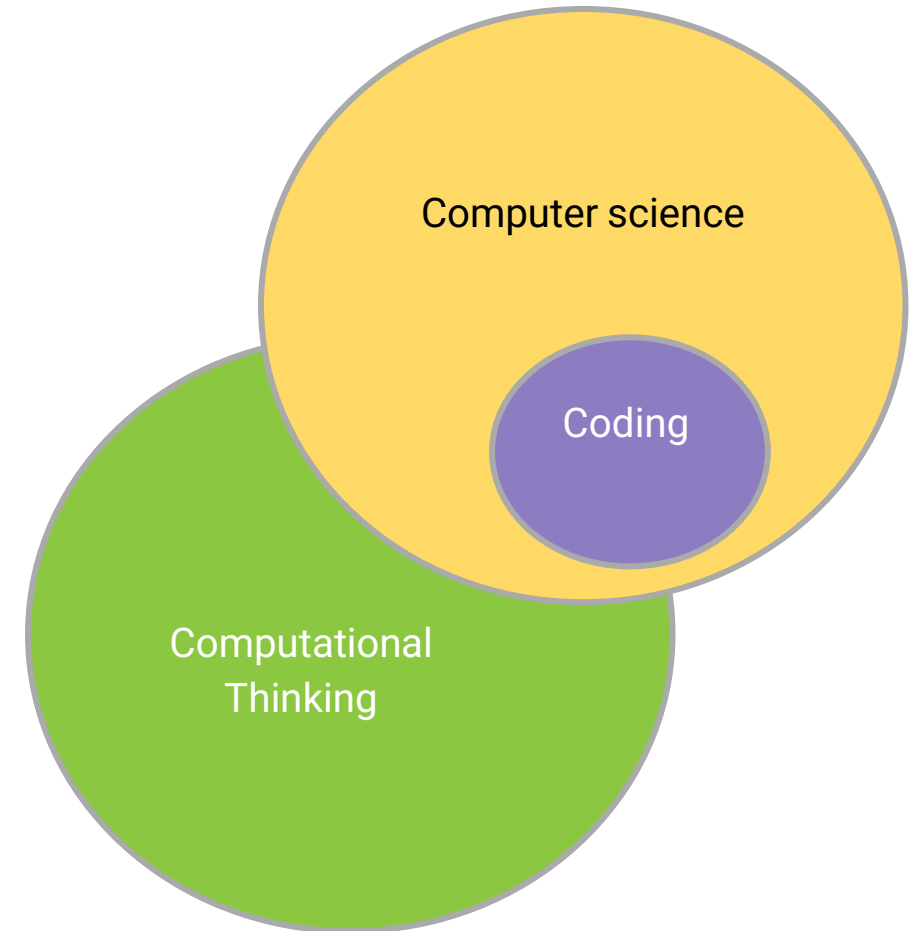
Second grade teachers use lessons from the Scratch Creative Computing Curriculum to guide students.

The curriculum includes many Scratch projects that get progressively more complicated, the use of design journals, opportunities for peer review, and lots of practice debugging.

When you click on the objects you can learn about me!
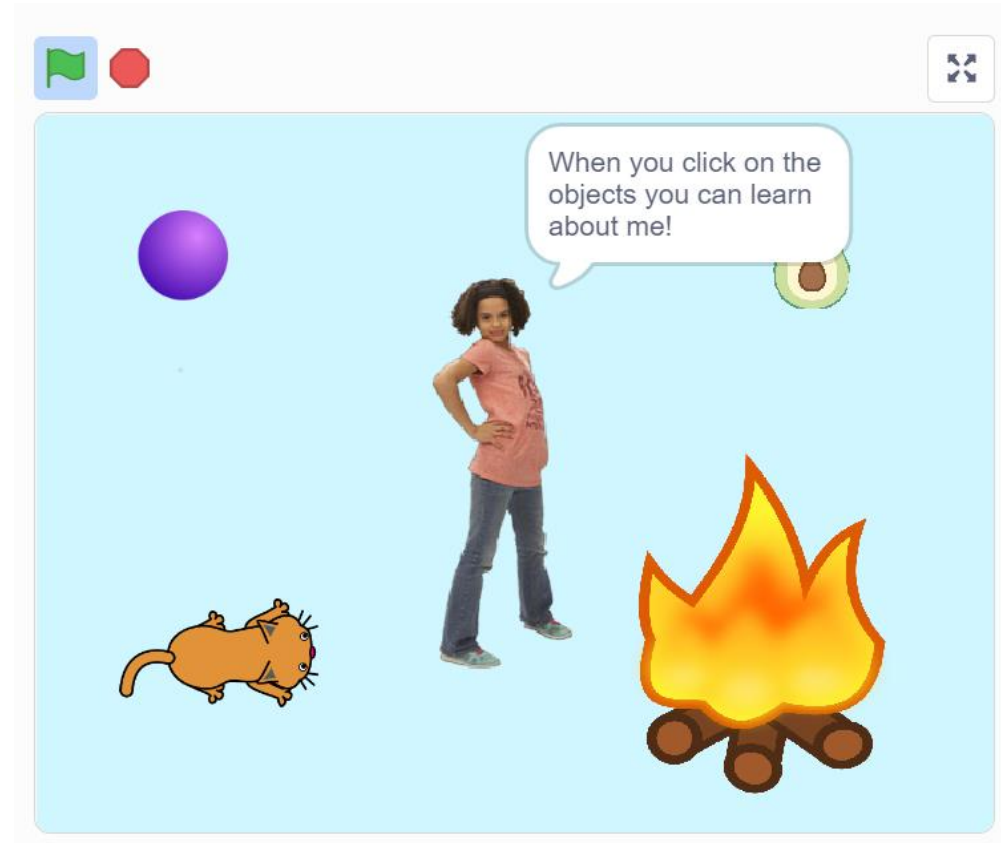
Third grade teachers have been trained in Scratch and Makey Makey.

Makey Makey is a physical computing device that can be programmed with multiple languages (including Scratch) to create interactive projects.

Our Approach to CS Talent Identification

Give the students the opportunity to interact with computer science

Train teachers and tell them what skills or behaviors to look for

In terms of computer science and gifted education

Identify students who show early or accelerated development of those skills

Provide teachers with additional ideas for how to challenge these students (video)

- Professional learning modules in gifted education

- 6+ hours of computer science training
- Expert consultation on gifted identification and services
- Coordinator meetings
- Opportunities for professional learning at the local level
- Other MDE sponsored events
- Hormel Gifted and Talented Education Symposium

The "**Introduction to Computer Science Teaching and Integration**" Canvas course was created to provide K-5 teachers with background knowledge about computer science teaching and integration. As part of the course participants will:
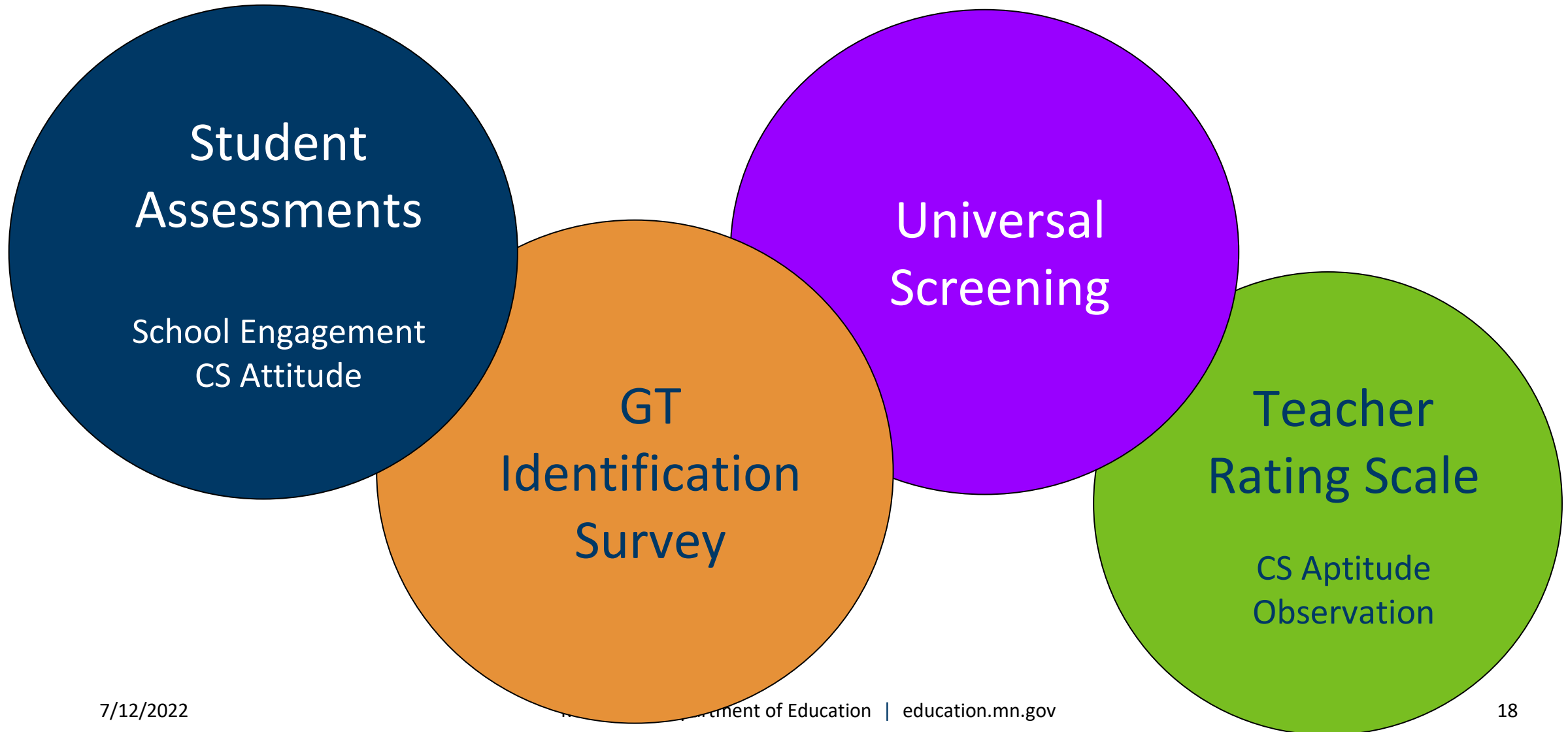
Explore computer science practices and concepts	Learn about best practices for equitable teaching of K-5 computer science
Consider how to integrate computer science into other content areas	Review examples of how to identify and provide support for students who need additional challenge in computer science.

Successes

1. Creation of three new instruments
   - Attitude toward computer science (grades 2/3)
   - Perception of appeal, challenge, and choice in school (grades 2/3)
   - Computer science aptitude teacher rating scale
2. All districts now identify students as GT and provide services. Substantial improvement in equity.
3. All districts now identify computer science talent, provide specific tier I CS resources, and have been trained in how to provide additional challenge in CS.
4. GT and CS professional learning
5. One principal won NAGC GT Coordinator of the Year!

| Site	N ID	% School GT	% Black	%Asian	%White	%Latinx	%Native	%Two+	%ELL	%SPED	%FRL
A	GT: 10/108	9%	0/.03	.10/.11	.70/47	.10/.36	0	.10/.02	.0/.34	.30/.31	.50/.81
	CS: 9/108	8%	0/0.3	.22/.11	.67/.47	.11/.36	0	0/.02	.11/.34	.11/.31	.33/.81
B	GT: 13/119	11%	0/.04	.31/.23	.62/.52	0/.17	0	.08/.05	.15/.21	.08/.24	.54/.70
	CS: 16/119	13%	.06/.04	.25/.23	.44/.52	.13/.17	0	.06/.05	.06/.21	.06/.24	.50/.74
C	GT: 14/138	10%	0/0	0/0	.57/.41	.43/.57	0	0/.01	.29/.45	.06/.13	.43/.58
	CS: 20/138	14%	0/0	0/0	.75/.41	.20/.57	0	.01/.01	.10/.45	.10/.13	.2/.58
D	GT: 241/1145	21%	.24/.30	.04/.05	.48/.33	.10/.22	.01/.01	.12/.09	.15/.33	.07/.16	.51/.70
	CS: 217/1145	19%	.17/.30	.05/.05	.58/.33	.09/.22	.01/.01	.10/.09	.14/.33	.07/.16	.41/.70
E	GT: 19/82	23%	0	0	.74/.66	.26/.33	0	0	0/.04	.05/.27	.53/.52
	CS: 20/82	24%	0	0	.7/.66	.3/.33	0	0	0/.04	.10/.27	.55/.52
F	GT: 17/182	9%	.06/.05	.18/.10	.65/.57	0/.26	0/.02	.12/.07	.06/.24	0/.22	.35/.59
	CS: 11/128	6%	0/.05	.09/.10	.82/.57	0	0	0	0	.09/.22	.09/.59
ALL SITES	314/1774 293/1774	18% 17%									

Computer Science Attitude

We want to ask you some questions about computers. Below are a bunch of things you might do with computers. This includes tablets, iPads, or Chromebooks. You can rate each statement as always true for you, mostly true for you, sometimes true for you, rarely true for you, or never true for you, all by moving the smiley face slider.

If the statement is <u>never</u> true for you, move the slider two clicks to the left.

Computer Science Attitude

▶ 0:00 / 0:04 ━━━━━━━━━━ 🔊 ⋮
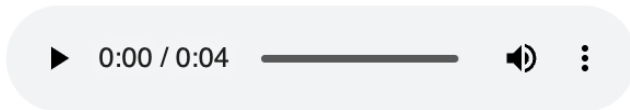
1. I like creating new things using computers.
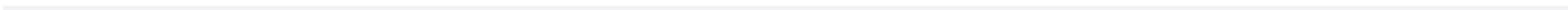
Computer Science Aptitude

1 = Does not at all describe this student   2 = Describes this student a little   3 = Somewhat describes this student   4 = Describes this student a lot   5 = Perfectly describes the student

	1	2	3	4	5
1. Approaches problems in creative or nontraditional ways					
2. Can develop multiple ways to approach a programming task					
3. Is curious about how things work					
4. Is persistent when encountering challenges in programming					
5. Enjoys challenging puzzles or logic problems					
6. Can describe or demonstrate the steps taken to approach a programming task					
7. Is systematic in their thinking or explanations					
8. Can complete programming tasks with little or no support					
9. Can break down a task into smaller parts					
10. Can effectively troubleshoot when presented with a programming error					
11. Can recognize and replicate patterns					
12. Can predict the outcome of a set of programming commands					

Challenges

1. Ceiling effects on the CS Attitude instrument made it impossible to document any growth.

2. The CS intervention was probably too low-dose to change students' attitudes toward school.

3. Teachers taking on new / additional tasks during and after COVID-19

Computer Science Attitude: Fall 2022 – Spring 2023

Site	Expressing		Questioning		Collaborating	
	Fall	Spring	Fall	Spring	Fall	Spring
A	4.1	4.0	4.2	4.1	3.9	3.9
B	4.2	3.8	4.4	4.1	4.0	3.7
C	4.0	4.1	4.2	4.2	3.9	3.9
D	4.0	4.1	4.3	4.1	4.0	4.0
E	4.3	4.0	4.1	4.1	4.1	3.9
F	4.1	4.0	4.1	4.1	4.1	3.9
Total	4.1	4.0	4.2	4.1	4.0	3.9

Sustainability in Uplus Schools

- Creation of handbook and presentation materials

- Educator library materials

- Hardware, software purchases

- Staff development day presentations

- Professional learning at NAGC and the Hormel Symposium

- Makey Makey, CogAT training

- Commitment to Universal Screening beyond the life of the grant

- Committed resources and staff time beyond the life of the grant

Sustainability for ALL Schools

- All materials made universally, publicly available along with instructions for use (and challenges faced)
- Expanded Project North Star modules
- Computer Science module for educators
- How to integrate computer science into math, language arts, and science videos
- Tips for differentiating instruction video
- Leveraging state and federal funds power point

How Are Schools Identifying CS Talent?

Teacher CS Aptitude Observation Scale	Universal Screening
• Programming-specific questions • CS thinking related to any content area	• CogAT nonverbal • Local norms
Student Interest	STEM teacher recommendation

"Computer Science has engaged learners who were otherwise disengaged, and given them a platform to showcase their thinking and creativity in a non-traditional way that ultimately leads to them feeling like they do belong at school."

3rd grade teacher and Resource Specialist

"I hadn't thought of this before: Computer Science Education is Inclusive. We work so hard to include all our students in all curricular areas. Computer Science Education is about as level a playing field as you can get."

2nd grade teacher

Thank You!

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