COMPUTATIONAL THINKING AND COMPUTER SCIENCE

UCLA CRESST
NATIONAL CENTER FOR RESEARCH ON EVALUATION, STANDARDS, AND STUDENT TESTING

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STEM+C3 TEACHER RESIDENT AND MENTOR LEARNING

STEM+C3 FOCUS ON CT FOR EQUITY

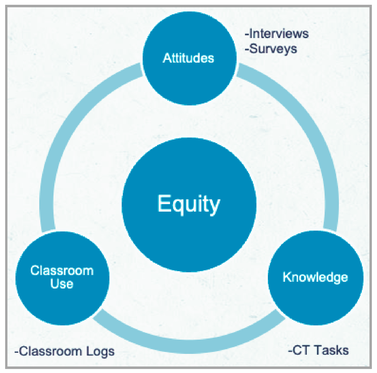
Computational thinking for equity seeks to empower students to use problem-solving and design skills that are informed by computing to explore, express, critique, and create artifacts about the world around them (Perez, Clark, Hadad, Nava, & Giannoti, 2023).

Practices focused on include:

- Algorithmic thinking
- Collaborate around computing & data
- Communicating with & about computing & data
- Debugging & evaluating
- Develop & use abstraction
- Decomposition
- Exploring equity issues through computational thinking & data

EVALUATION

The CRESST evaluation examined CT and/or CS from three perspectives and used multiple measures.



Data was collected from three cohorts: 2020-21, 2021-22, and 2022-23.

Samples	Teacher residents	Mentors
Cohort 1	10	10
Cohort 2	16	17
Cohort 3	12	15
Total	38	32*

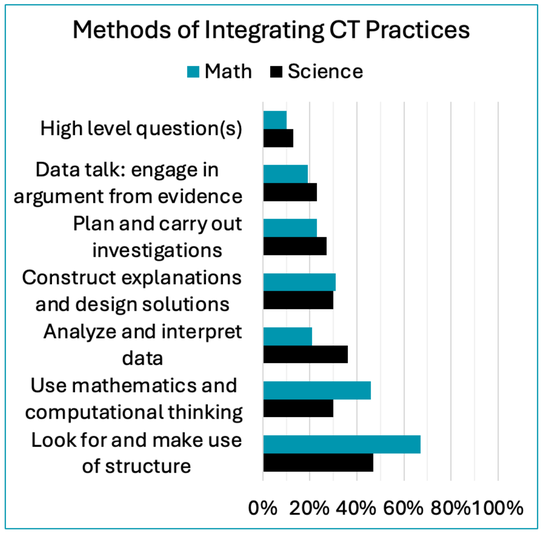
* Mentors participated in one or more cohorts.

USE OF CT IN THE CLASSROOM

During the spring of each school year, teacher residents were asked to complete instructional logs during the two weeks that they served as the primary instructor.

On average both the math and science teacher residents used two methods to connect their instruction to CT. **2**

Residents were purposeful in their use of CT, using some methods more than others.



"**Algorithmic thinking** was included as students had to summarize the steps they took to finding distances."

"CT was included to help students argue with evidence and **decompose** large mathematical problems (punnett squares)."

"To highlight the **step-by-step** mitosis process."

"Students had to **debug** during coding to identify their errors when a code did not produce what they intended."

KNOWLEDGE OF CT

Teacher residents and mentors completed eight CT Tasks at two timepoints.

Overall scores were significantly higher for teacher residents than for mentors at pre-test and post-test.

88%
Teacher residents post

78%
Mentors post

Participants excelled on items that...

- were multiple choice or short answer
- focused mostly on algorithmic thinking and debugging/evaluation

Participants struggled on items that...

- required written explanations
- focused mostly on abstraction and communicating with and about data

Participants varied in how explicit they were in their task reflections. In this example, the teacher resident used and defined CT concepts.

"At first, I was confused on the second rule, so I used **debugging** to identify any errors in my thinking in order to understand what the second rule meant. Once I corrected my thinking, I used **algorithmic thinking** by establishing a step-by-step plan to check if my **debugging** was correct. I started by identifying which point to start with. Next, I counted how many dots were there afterwards. Finally, I followed one line and counted how many dots were close to that line (rule 2). Once I checked, I did that for each of the examples. Finally, I applied those steps to the last star."

ATTITUDES

On the post-surveys, teacher residents and mentors...

Defined CT as...

- thinking logically to solve problems
- abstracting general principles and applying them to solutions

Agreed that CT can be:

- incorporated in the classroom by allowing students to problem solve

Were less likely to view CT as just using computers.

Expressed comfort in...

- using computing skills
- learning to understand computing concepts
- achieving good grades in computing courses.

Felt that CS...

- would improve their career performance
- is valuable in and of itself

Teacher residents and mentors provided feedback about the CT & CS instruction.

"I think the most rewarding part of the program was learning how to implement social justice and CT into the curriculum."

Feedback was used to improve instruction.

"I would have altered the structure of the computing course to involve much more direct instruction and synchronous time."

"It would be helpful to have examples of different ways to integrate CT into the math and science classroom since I did not feel prepared to integrate CT into my own."

THANK YOU TO THE STEM+C3 LEADERSHIP TEAM AND OUR UNDERGRADUATE ASSISTANTS, QUINTIN DEBLEY AND PAYTON FITZPATRICK