Infusing Computational Thinking Instruction into Elementary Mathematics & Science: Patterns of Teacher Implementation

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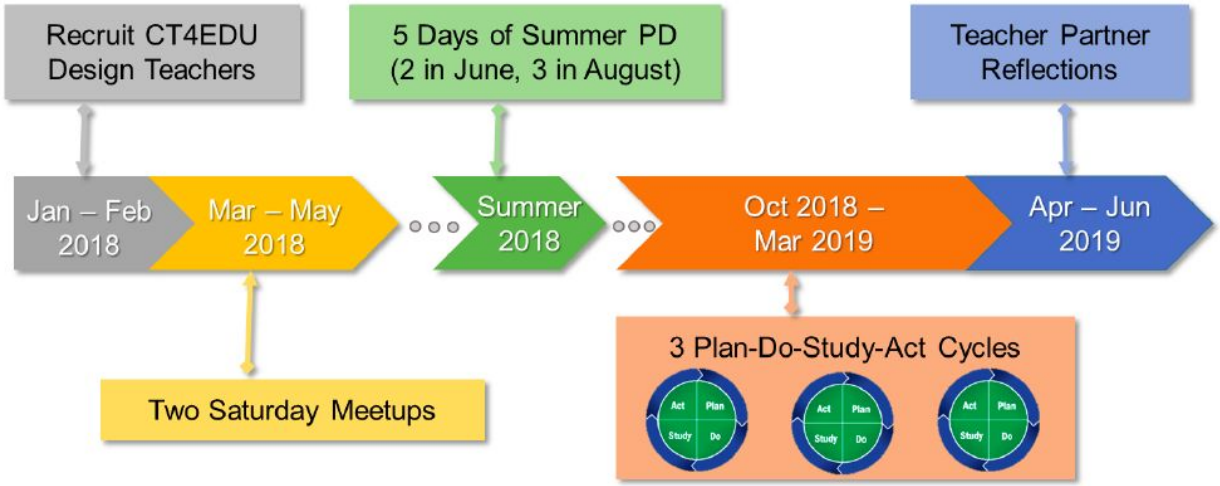
Context & Questions

CT4EDU (Computational Thinking for Educators) is a Research-Practice Partnership focused on bringing CT to elementary students through co-development of lessons and activities.



How are teachers thinking about CT ideas?

How are they applying the ideas in their math and science teaching?

Participants & Background

Seven teachers are included in this study.

- 1 third grade, 2 fourth grade, 4 fifth grade

All participated in 7 days of professional development around CT.

Abstraction **Decomposition** **Patterns** **Debugging**

- Completed CT activities (stand-alone and embedded in math and science)
- Screened existing lessons for CT ideas
- Intentionally added and enhanced the CT

Data & Methods

Data Sources:

- Lesson planning documents → *How are Ts thinking about CT?*
- Classroom video → *How are they taking CT up?*

Preliminary Analysis:

- Reviewed video to reflect on differences among implementations.
- Based on initial wonderings, returned to planning documents and video to ask:
  - Are the big CT ideas explicit in teachers' lesson plans?
  - Are the big CT ideas made explicit to kids during implementation?
  - Is there are focus on particular CT ideas during implementation?

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Pattern A: Using CT to guide teacher planning

CT explicit In plans?	CT explicit in implementation?	Focus on particular CT ideas in implementation?
✓	✗	✗

From lesson plan:

Students will engage in abstraction when they “Look at visual representations of mixed numbers, identifying the whole and the extra.”

$$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

Pattern B: Using CT to structure lessons

CT explicit In plans?	CT explicit in implementation?	Focus on particular CT ideas in implementation?
✓	✓	✓

From lesson plan:

Students will make and test their hopper poppers. “The students will then be given an opportunity to debug their hopper popper to get a better result (higher jump).”

Pattern C: CT as problem-solving Strategies

CT explicit In plans?	CT explicit in implementation?	Focus on particular CT ideas in implementation?
✓	✓	✗

From lesson plan:

“Decompose your group’s number.”
“What patterns do you see [in place value]?”
“Don’t forget to debug.”
“Use abstraction to have each person share their expanded form value.”

Summary of Results

	CT explicit in plans?	CT explicit in implementation?	Focus on particular CT ideas in implementation?
Pattern A: (N = 2) CT to plan	✓	✗	✗
Pattern B: (N = 3) CT to structure	✓	✓	✓
Pattern C: (N = 2) CT as strategies	✓	✓	✗

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Implications for Future Research

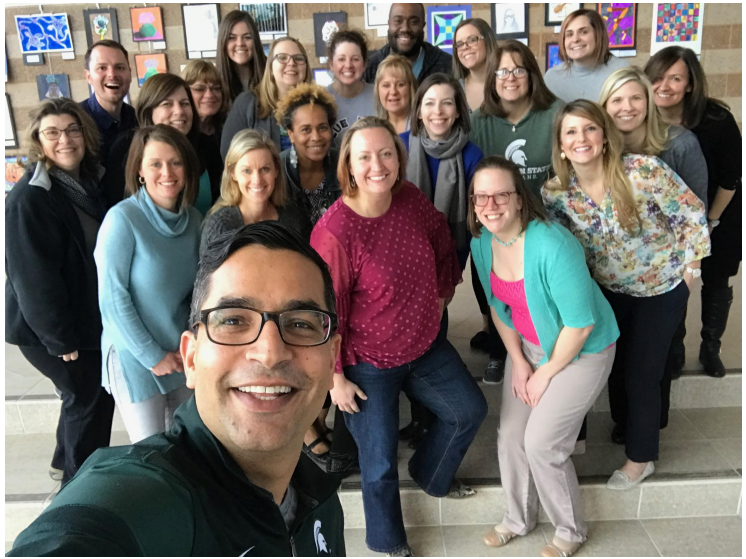
How might these patterns of implementation related to if and how students develop CT understanding?

Pattern A: With no explicit reference to CT in the classroom, are kids learning CT? Is there any impact on their math learning?

Pattern B: Student exposure to CT is tightly tied to math and science. What does this mean for how kids will (or won't) apply these ideas to computer science?

Pattern C: Student exposure to CT is only loosely tied to math and science. Might this help or hinder them in applying the ideas to computer science?

Thanks!



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