STEM + C
Infusing Computing

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Computational Thinking

What is it?

Image from Dong & Cateté, SIGCSE, 2019
How can we incorporate it into classrooms? **PRADA**

- **Pattern Recognition**
- **Abstractions**
- **Decomposition**
- **Algorithms**

Energy Resource Management in Cellular
Scaffolded Instructions - Piloted for NSF RPP

Provide support to help minimize effects of preparatory privilege

- Students may have varying levels of computing experience going in
- Hour of Code, Summer Camps, Computing electives

Recommended progression ->

Figure 5: Use-Modify-CREATE Learning Progression
Use, Modify, Create

Unplugged modeling activity, pseudocode

Use a simple simulation to get students familiar with the coding environment

Modify simulation code to align more with student mental modes

- fix buggy code
- provide starter code
- minimize extraneous cognitive load

Create your own extensions

Starter Code
From Instructing to Facilitating Student Creations!

What if students don't know what to add?

What if teachers don't know the answer?

Provide a list of recommended extensions

- Include important code blocks that should be used
- Give teachers a demo answer for each option
- Teachers can help facilitate student CT
- Students get to choose their own model extensions
- Allows for wide-range of backgrounds to explore/succeed
Infusing Computing PD - STEM+C Grant

240 teachers completed summer PD over the last two years

Daily Structure 3C:

**Code** - Teachers learn coding skills by completing CT assignments with UMC

**Connect** - Teachers group by discipline and work with facilitators to make connections between their discipline and CT

**Create** - Teachers develop team CT projects, by school or discipline
This year 40 team projects were created. Teachers have started implementing their own CT coding activities that meet their own learning objective requirements within their own classroom. Several teacher groups have requested PDs for their entire school or for STEM teachers at middle school/high school pairs. Teachers are becoming owners and champions of CT in their discipline.
Ongoing Research

- Instructor Influence on student programming behaviors
- Design patterns of CT in teacher projects
- Data driven analysis of student code shapes, how they go about completing sub goals, get stuck, or find efficient paths
- Best practices for design of CT coding activities in infused classrooms
QUESTIONS? - mhill@ncsu.edu

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