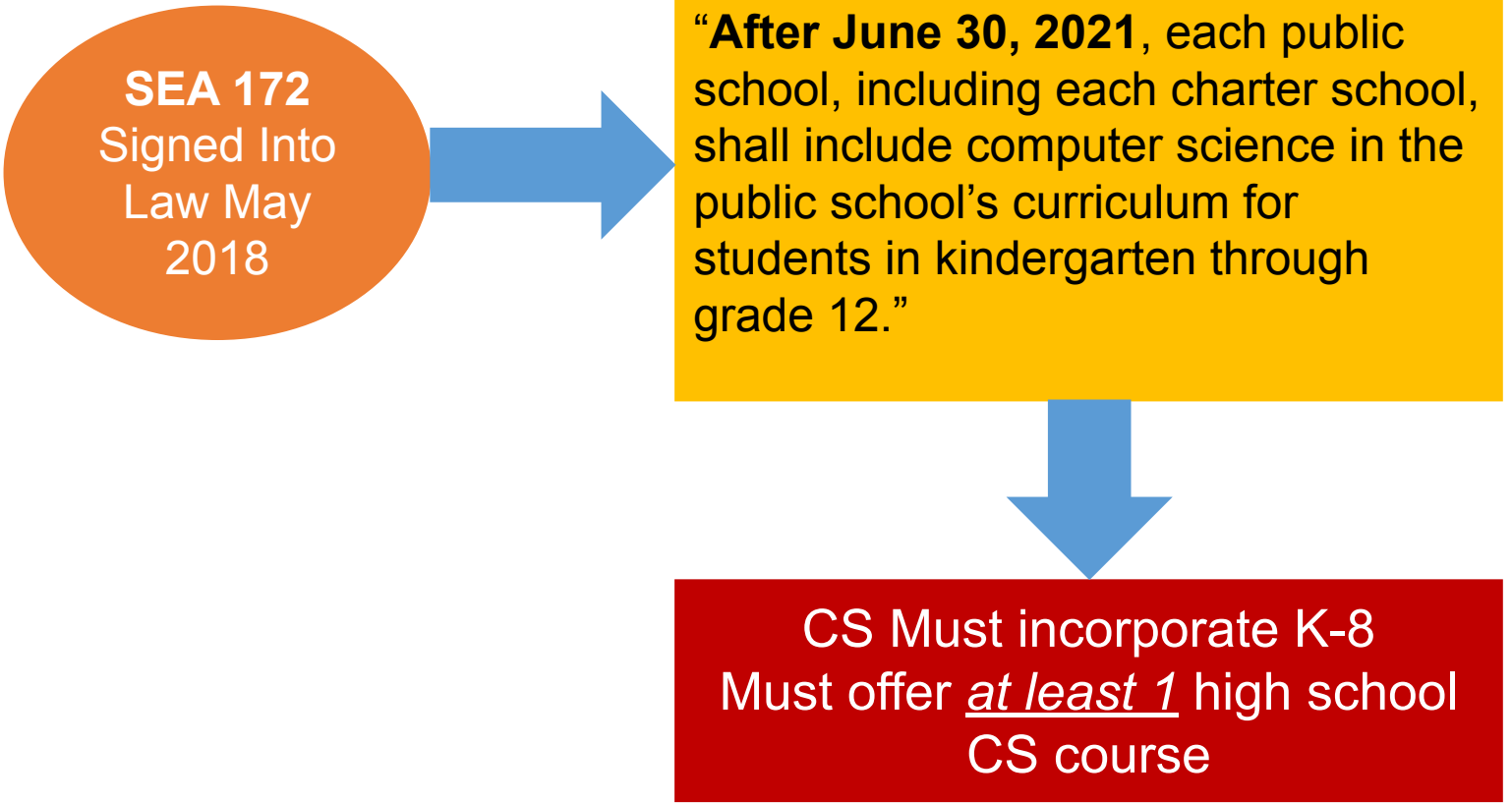
Professional Development

Background of CS in Indiana



Adapted from slide created by Jake Koressel

Diversity in the field of CS

There is a lack of diversity in the CS field, especially among women, as well as Black and Latinx people. There are several reasons for this, including **a lack of access to CS education in K-12 schools as well as a lack of encouragement to learn CS from adults (e.g., teachers)**(*Google Inc & Gallup Inc, 2016)*

In 1995, 37% of computer scientists were women. Today, it's only 24%. The percent will continue to decline if we do nothing.

The biggest drop off of girls in computer science is between the ages of 13 and 17.

How to teach CS in K-6?

What is CT?

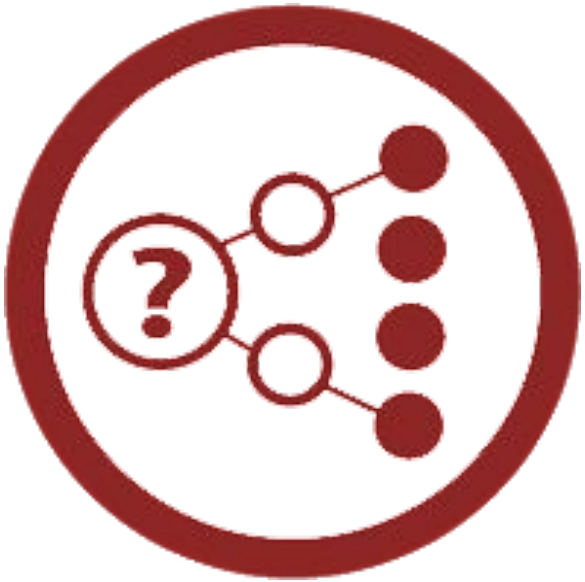
Computational Thinking (CT) is a set of characteristics needed to have a systematic way of approaching a problem so a computer could solve it.

Basic elements of CT:

- **Pattern Recognition**
- **Abstraction**
- **Decomposition**
- **Algorithm Design**
- **Debugging**

DECOMPOSITION

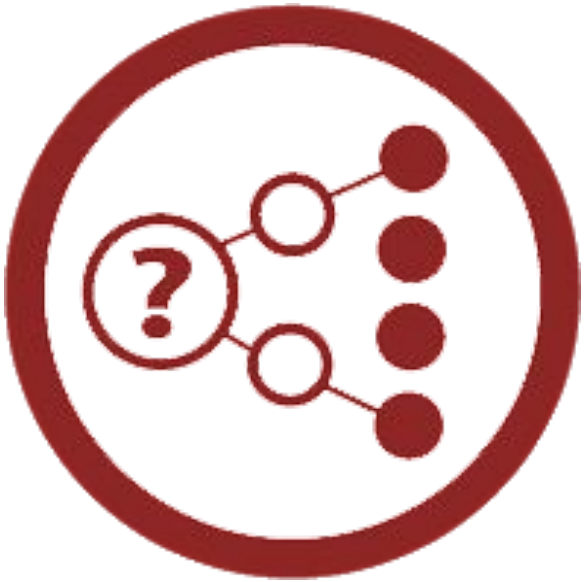
Breaking the problem into smaller, more manageable parts.



DECOMPOSITION EXAMPLE

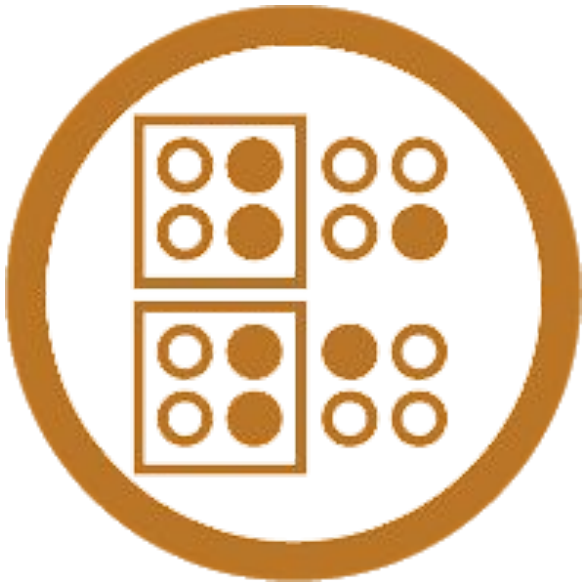
You want to go to a movie theater. Break down the problem into smaller parts.

- What films are out now?
- Which film genres interest you?
- What time is the film on?
- How will you get to the theater?
- Do you have enough money for the ticket?



PATTERN RECOGNITION

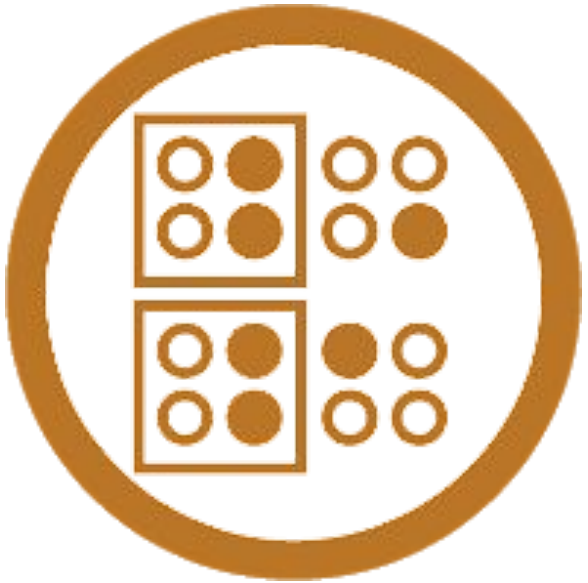
Recognizing which parts are the same and the various attributes that we can use to define them.



PATTERN RECOGNITION EXAMPLE

Our football team is playing their archrivals this weekend. What tactics will they use?

- What tactics worked well last time we played our rivals?
- What tactics didn’t work so well?
- Who are their best players?
- Our running back is fast and skillful, but short. Should we pass the ball or keep it on the ground?



ABSTRACTION

Filtering out the data you need and what you don’t based on the attributes.

ABSTRACTION EXAMPLE

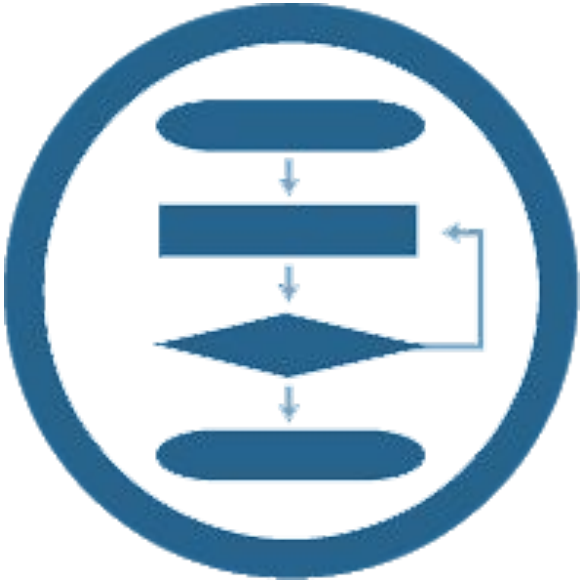
You have been asked to draw a cat. Your image must be representative of all types of cats.

To draw a basic cat, we **do** need to know that it has tail, fur, and eyes. These characteristics are **relevant**.

We **don't** need to know what sound a cat makes or that it likes fish. These characteristics are **irrelevant** and can be filtered out.

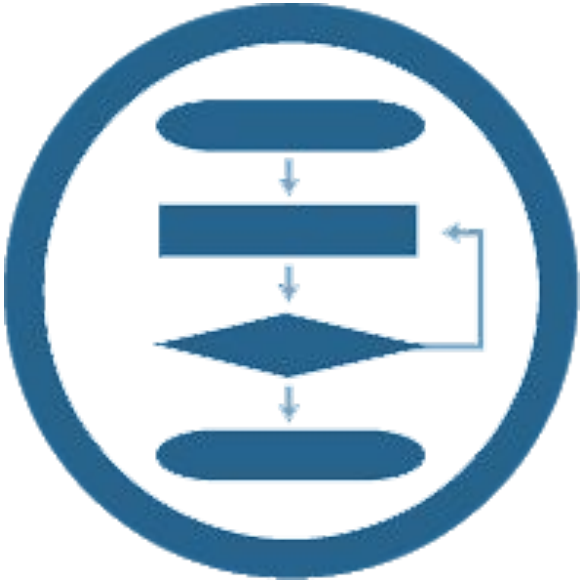
ALGORITHM DESIGN

Planning the step-by-step instructions that need to be carried out to achieve the goal.

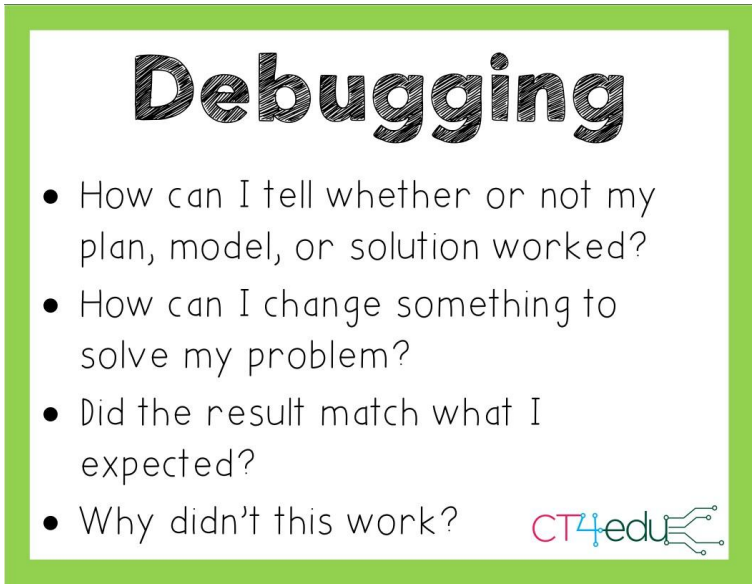


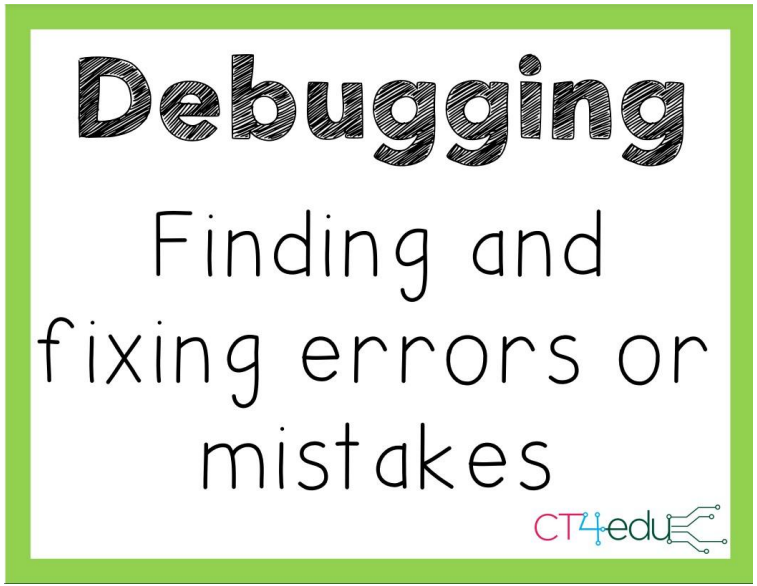
ALGORITHM DESIGN EXAMPLE

Someone stops you and asks for directions to the nearest shop. You need to give them clear, step-by-step instructions on the quickest route.



DEBUGGING


Debugging
How can I tell whether or not my plan, model, or solution worked?
How can I change something to solve my problem?
Did the result match what I expected?
Why didn't this work?
CT4edu


Debugging
Finding and fixing errors or mistakes
CT4edu

CT + Literacy Examples

Introducing the Project

- Title: **Re**thinking **C**ircle **T**ime(ReCT): Integrating Computational Thinking into K-2 Literacy

- We are examining CT learning and how integrating CT learning into literacy contexts can help K-2 students, particularly girls, learn.

- Project goals:
  - Understand qualities of student CT learning tasks
  - Development of targeted CT and literacy tasks at each grade level - K, 1, 2
    - Focus #1: Sequencing
  - Understand the implementation of the CT learning tasks that allow for equitable access, participation, and experiences.

Task	Focus Area(s)	Description
#1: Cycle Diagrams	Simple Logic	A → B, B → C, C→ A Students use cards to showcase logic in order
#2: If you Give a Mouse a Cookie	Simple Logic + Literacy	If you give a Mouse a Cookie Pictures/Sentences with Arrows (retelling) Circular Diagram
#3: Robot Mouse	Reverse Sequencing	Robot Mouse (Unplugged, Embodied, CT Toy)
#4: Joey and Jet	Reverse Sequencing + Literacy	Forward and Backwards Pictures/Sentences with Arrows (retelling)
#5: Robot Mouse Obstacles Part 1 | Part 2	Sequencing with Multiple Logic Paths	Robot Mouse with multiple options (Unplugged, Embodied, CT Toy)
#6: Snowy Day Part 1 | Part 2	Sequencing with Multiple Logic Paths + Literacy	Pictures of Dressing in Winter Gear (unplugged, Embodied, perhaps ScratchJr?)
#7: ScratchJr: Frog Hopping	Sequencing with Programmed Multiple Logic Paths + ScratchJr	Using ScratchJr to create a frog hopping sequence including a loop.
#8: ScratchJr: Three Little Pigs	Sequencing with Programmed Multiple Paths + Literacy + ScratchJr	Using ScratchJr to recreate the Three Little Pigs' story.

Task 1 & 2

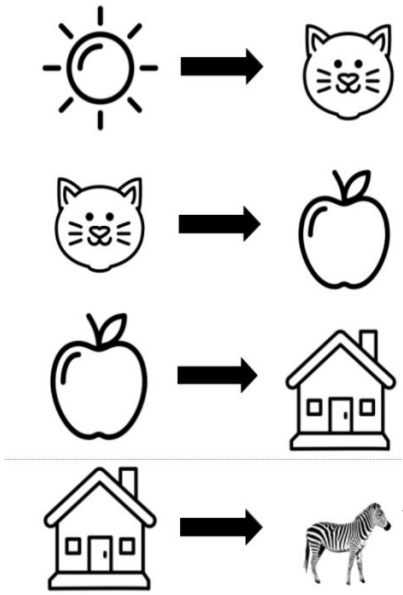
Task	Focus Area(s)	Description
#1: Cycle Diagrams	Simple Logic	A → B, B → C, C→ A Students use cards to showcase logic in order
#2: If you Give a Mouse a Cookie	Simple Logic + Literacy	If you give a Mouse a Cookie Pictures/Sentences with Arrows (retelling) Circular Diagram

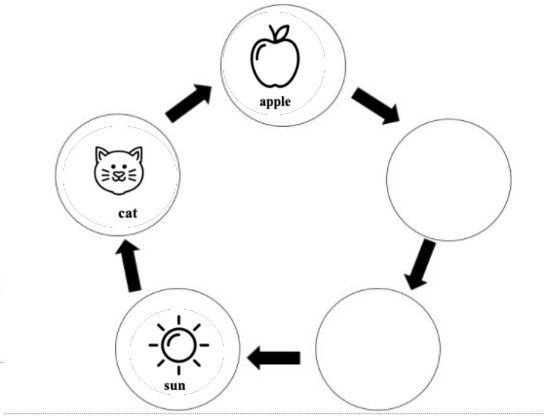
Task 1: Cycle Diagrams - Simple Logic

Version 1 - 5 Items: sun, cat, apple, house, zebra

Version 2: 10 Items: bee, elephant, hat, glasses, lion, flower, dog, apple, monkey, pencil

Version 3: 15 Items: cat, sun, kite, fish, tree, orange, umbrella, pig, rainbow, shoe, notebook, pencil, apple, ball, key

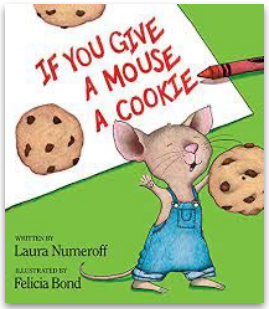


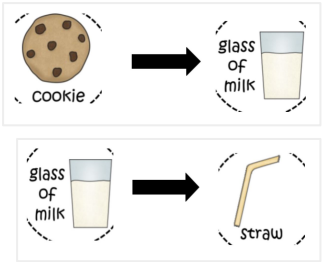


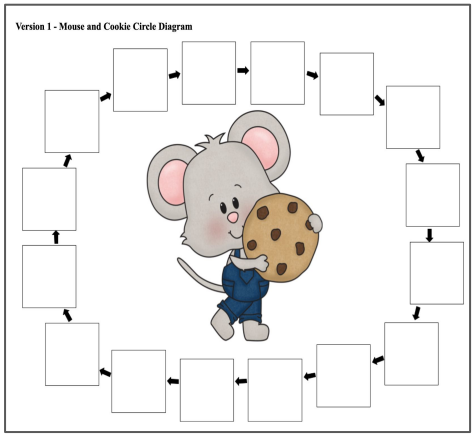
Task #2: Simple Logic + Literacy: *If you Give a Mouse a Cookie*

Overview:

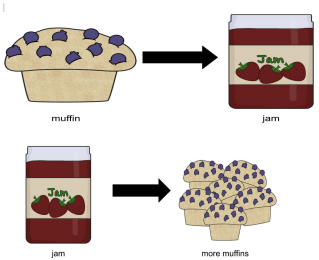
Version 1 - Read then use story and direction cards to sequence

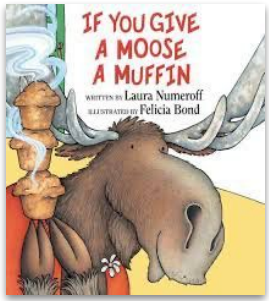






Version 2- Use the direction cards to sequence, then read the story and check





How can literacy help CT?

Or is it other way around?

Your Turn!

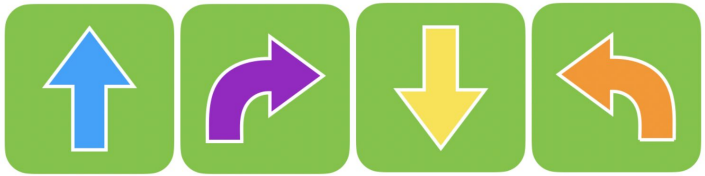
CT Activities and Literacy

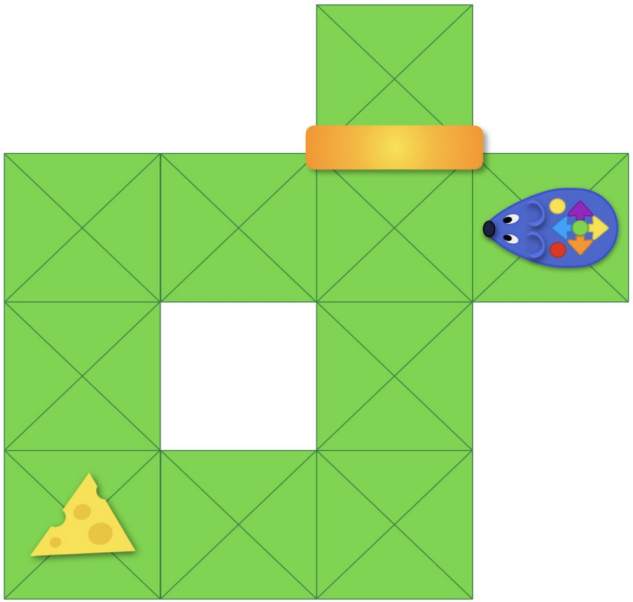
1. Select two CT activity examples, one with only CT, another one with CT and literacy.
2. Complete the two activities.
3. Discuss and reflect.

Task 3: Reverse Sequencing - Robot Mouse

3 versions

- **Unplugged version**: Students use a board-game setup to move the mouse piece through a version of the map used in the coded version
- **Embodied version**: Students enacting themselves as the mouse with the pieces of the board, tunnel and cheese mapped out on the floor as a version of the map used in the coded version
- **Robot mouse coded version**: Planning with direction cards then programming the mouse and running it

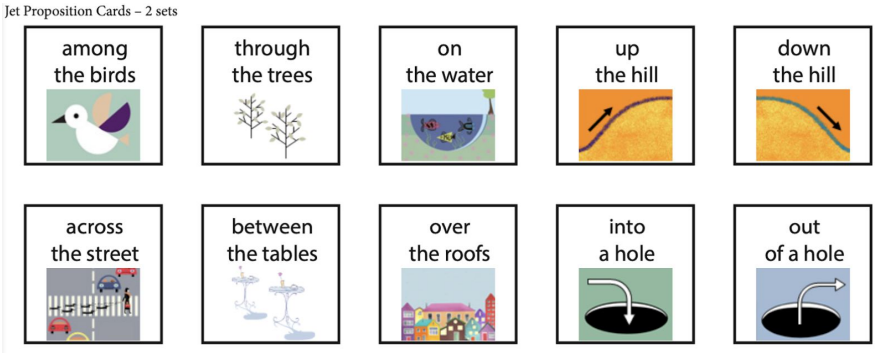


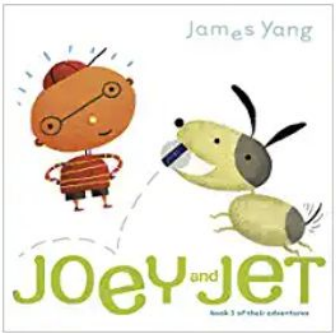


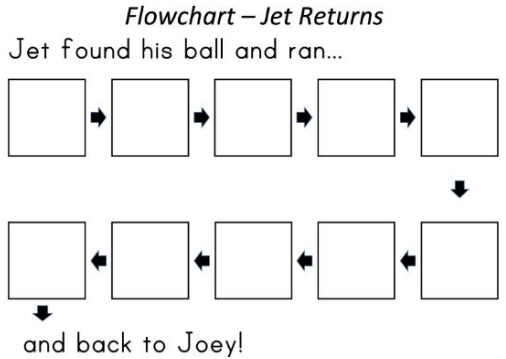
Task 4: Reverse sequencing + Literacy: *Joey and Jet*

Activity target

- Learning what the students know about forward and reverse sequences
- This exercise is the same CT content as Task #3 - Reverse Sequence embedded in a literature context
- There is ONE right answer to this task
    - Pay attention to the student's sense of the order and logic - especially for "into a hole," "out of a hole," "up the hill," and "down the hill"





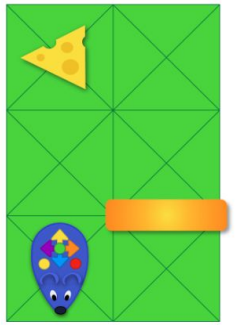


ReCT
Rethinking Circle Time

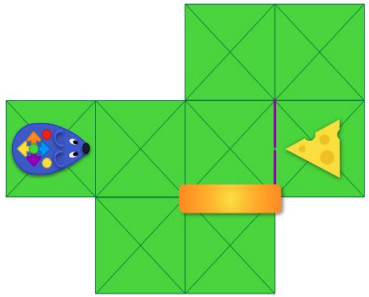
Task 5: Sequencing with Multiple Logic Paths – Robot Mouse

- Target: Robot mouse game with a preexisting map - multiple logic paths
  - Order that matters: students are required to hit all of the obstacles (tunnels) before they can get to the cheese
  - Order that does not matter: students can hit the obstacles in whatever order in whatever direction they choose
- 3 versions with 3 different course options
  - Unplugged, embodied, robot mouse

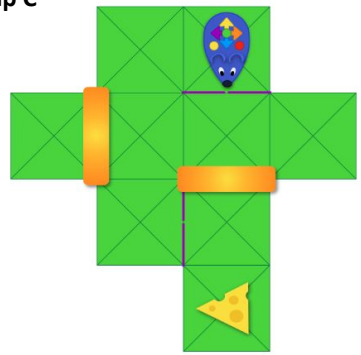
Map A



Map B



Map C

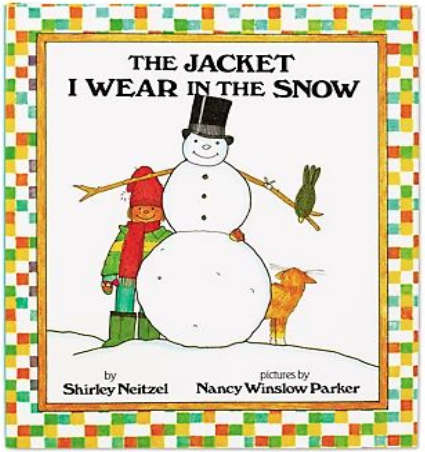


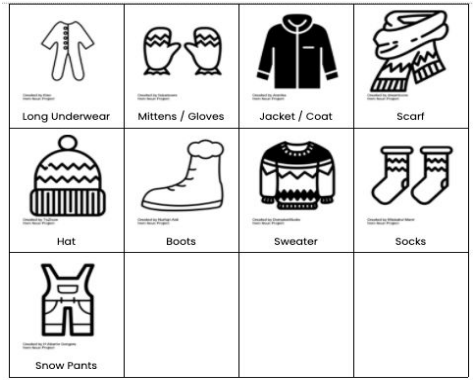
Task 6: Sequencing with Multiple Logic Paths + Literacy

Snowy Day & The Jacket I Wore

Background

- Putting on your snow gear (e.g., long underwear, socks, boots, snow pants, jacket etc.). For some of these items, the order will matter and others do not. But IA and IN students should have experiences with snow gear.
- There is not one right answer, we are interested in getting students' ideas and processes.





Turn this sideways to be the same width as the cards

Peter Wakes Up								Peter Ready for Snow!

Task 7: Sequencing with Programmed Multiple Logic Paths + ScratchJr

Frog Hopping

Using ScratchJr to create a frog hopping sequence including a loop.

Level 1 - walk - sequence	Level 1 - walk - loop
	

Task 8: Sequencing with Programmed Multiple Logic Paths + ScratchJr + Literacy

Three Little Pigs

Using ScratchJr to recreate the Three Little Pigs' story.

Questions

What kind of CT concepts did you use? How did they help you to solve the problems?

Did you encounter any difficulties?

When including literacy content, did it help you to solve the problems?

Application for future teaching

Which CT concept do you think you can integrate into your future teaching?

How would you integrate the activities into your future teaching?