

Using Vignettes to Explore Student Perceptions of Computational Thinking

Nellie Rushton, Hannah Smith, Luisa Perez,
Francisco Castro, Gillian Smith

Worcester Polytechnic Institute





Table of contents



01. What is CT?



Table of contents

01. What is CT?

02. Survey Design



Table of contents

01. What is CT?

02. Survey Design

03. Current Study



Table of contents

- 01. What is CT?**
- 02. Survey Design**
- 03. Current Study**
- 04. Coding Guide**



Table of contents

- 01. What is CT?**
- 02. Survey Design**
- 03. Current Study**
- 04. Coding Guide**
- 05. Results**



Table of contents

- 01. What is CT?**
- 02. Survey Design**
- 03. Current Study**
- 04. Coding Guide**
- 05. Results**
- 06. Discussion**

**Do you think the following is
an example of *computational*
thinking? Why?**

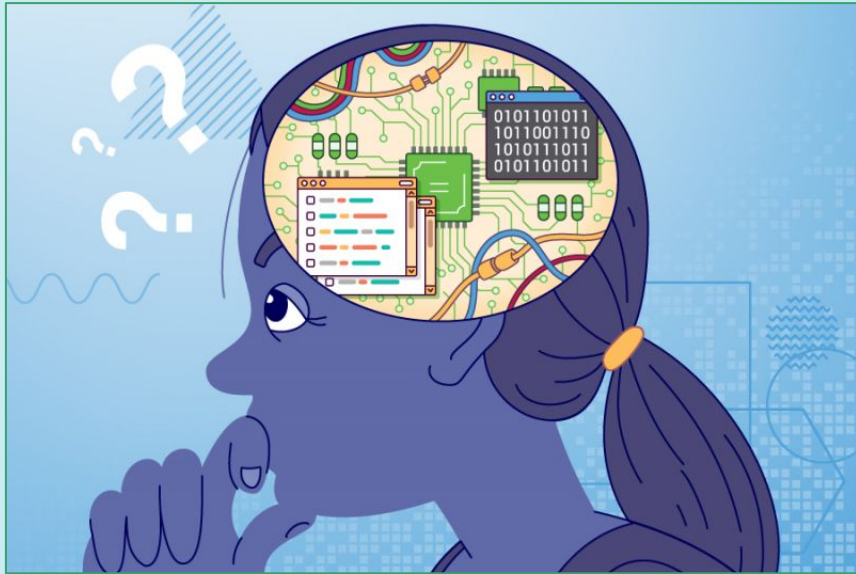
Preschoolers track the growth of their classroom plant. Each day they measure the height with a ruler and record that height in a notebook. They also draw daily pictures of what the plant looks like. On day 20 they compare their notes to see who's plant is the tallest.



01

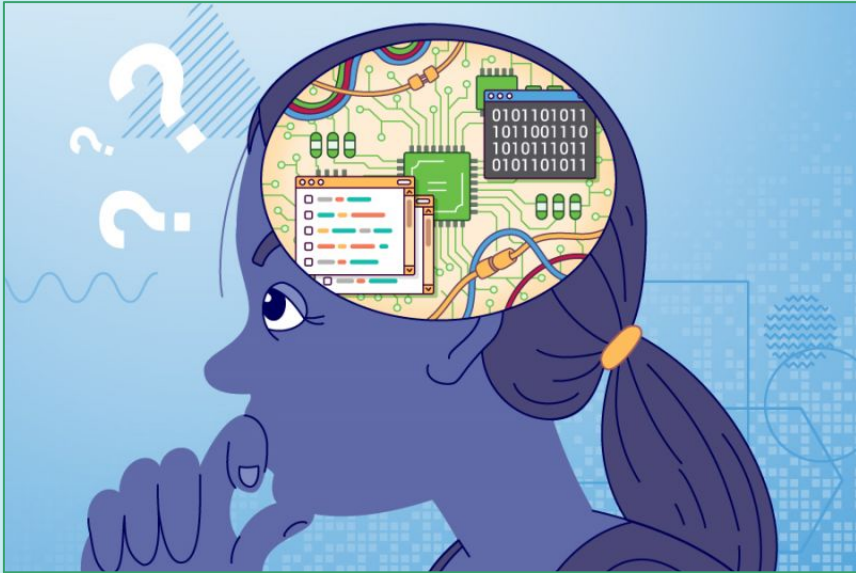
What is Computational Thinking (CT)?

Computational Thinking



- **Thinking like a computer by breaking down problems in a logical manner**

Computational Thinking



- Thinking like a computer by breaking down problems in a logical manner
- **A set of skills playing a vital role not only STEM fields, but problem solving across all disciplines**



Computational Thinking



“solving problems, designing systems, and understanding human behavior by drawing on the concepts fundamental to computer science”

– Jeanette Wing (2006)

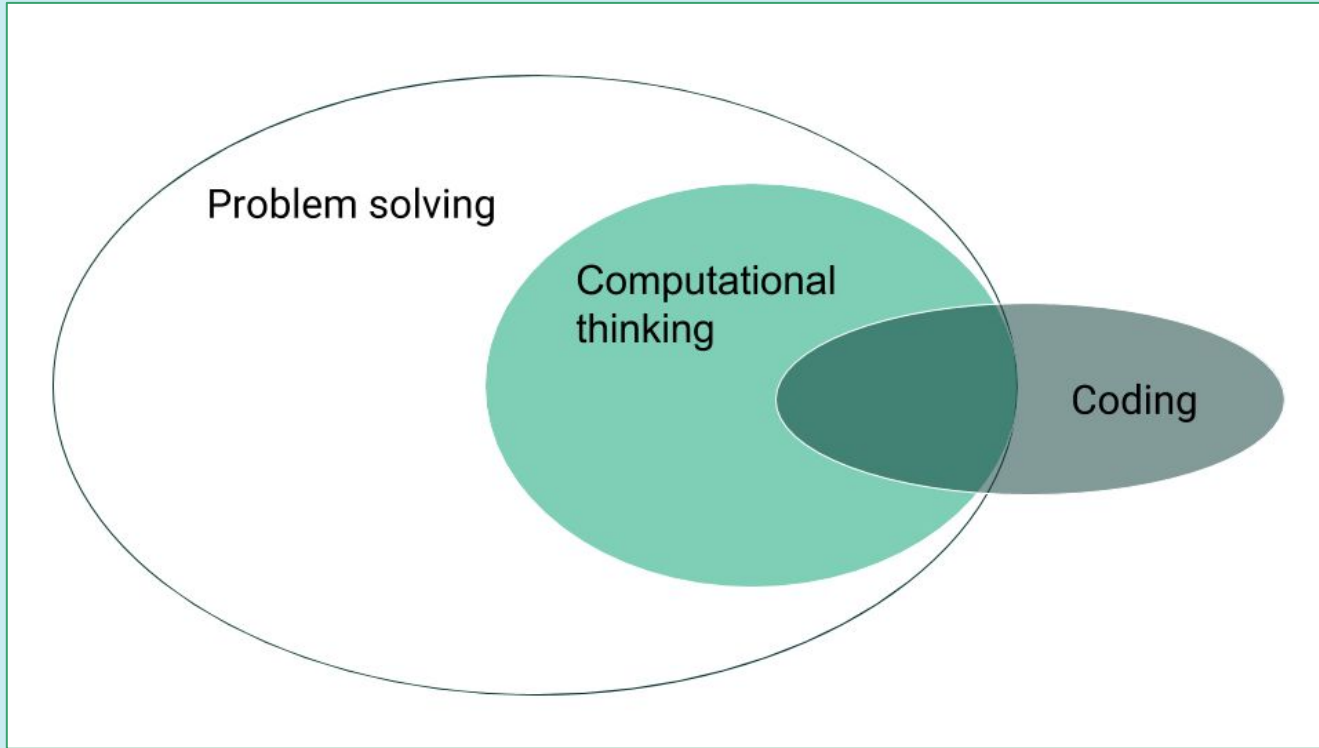
Importance of Computational Thinking

CT skills enable people to

**“systematically and efficiently
process information and tasks”**

(Lu & Fletcher, 2009)

Ambiguity in CT's Definition



(Berry, 2019)

Technology Biases in Computational Thinking



- CT is not only relevant in STEM fields but for everyone

Technology Biases in Computational Thinking



- CT is not only relevant in STEM fields but for everyone
- **While CT *may* use or lead to the creation of digital products, processes and systems, technology is not required at all**

Why explore student perceptions of CT?



- If we want to integrate CT into classrooms, it is important for teachers to understand student perceptions

Why explore student perceptions of CT?



- If we want to integrate CT into classrooms, it is important for teachers to understand student perceptions
- **To inform future pedagogical design, we must first identify where misconceptions toward CT lie**



02

Survey Design



Vignette Survey Study



12 Vignettes



Vignette Survey Study



12 Vignettes

*Do you think the following is an example of
computational thinking?*

BRIEFLY explain why you selected "Yes" or "No"



Vignette Survey Study

Do you think the following is an example of computational thinking?

BRIEFLY explain why you selected "Yes" or "No"

12 Vignettes

4 Non-CT Designed

8 CT Designed



Vignette Survey Study



Do you think the following is an example of computational thinking?

BRIEFLY explain why you selected "Yes" or "No"

12 Vignettes

4 Non-CT Designed

8 CT Designed

4 Technology-related

- a

4 Non-technology related

- Debugging
- Data practices
- Decomposition
- Iteration

Four CT Core Concepts

(Weintrop et al., 2016)

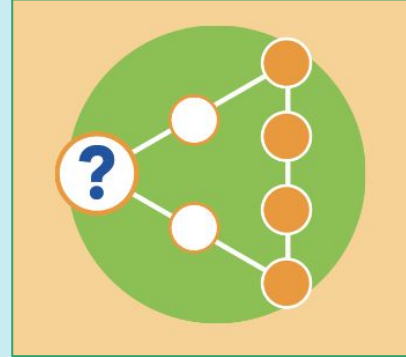
Debugging



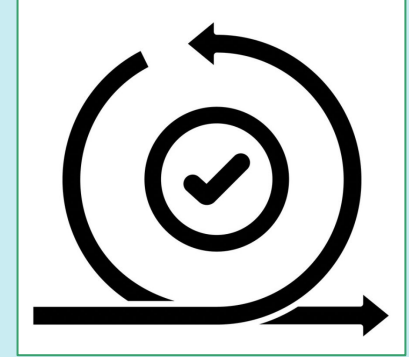
Data practices



Decomposition



Iteration



Four CT Core Concepts (Weintrop et al., 2016)

Debugging



Four CT Core Concepts (Weintrop et al., 2016)

Debugging



Data practices



Four CT Core Concepts

(Weintrop et al., 2016)

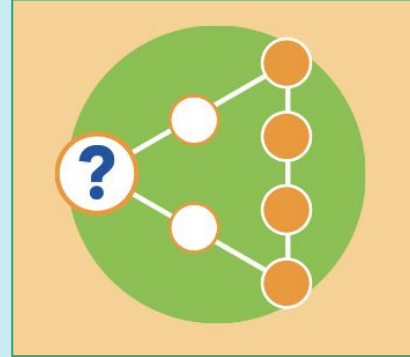
Debugging



Data practices



Decomposition



Four CT Core Concepts

(Weintrop et al., 2016)

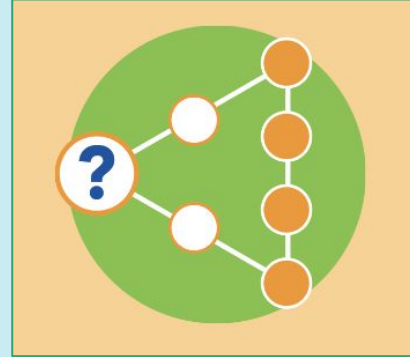
Debugging



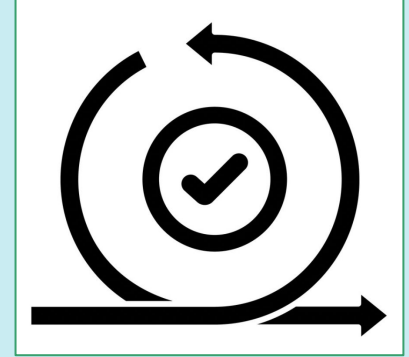
Data practices



Decomposition



Iteration





03

Current Study



Research Questions



RQ1.) Do student answers to whether they thought a vignette represented CT largely agree with researcher designed intentions?

RQ2.) In what ways do students connect technology use with computational thinking?



Participant Overview



Data Collection

- Survey administered online in Spring 2021 via Qualtrics

Participants

- 37 college students from a small private, STEM-focused university



04

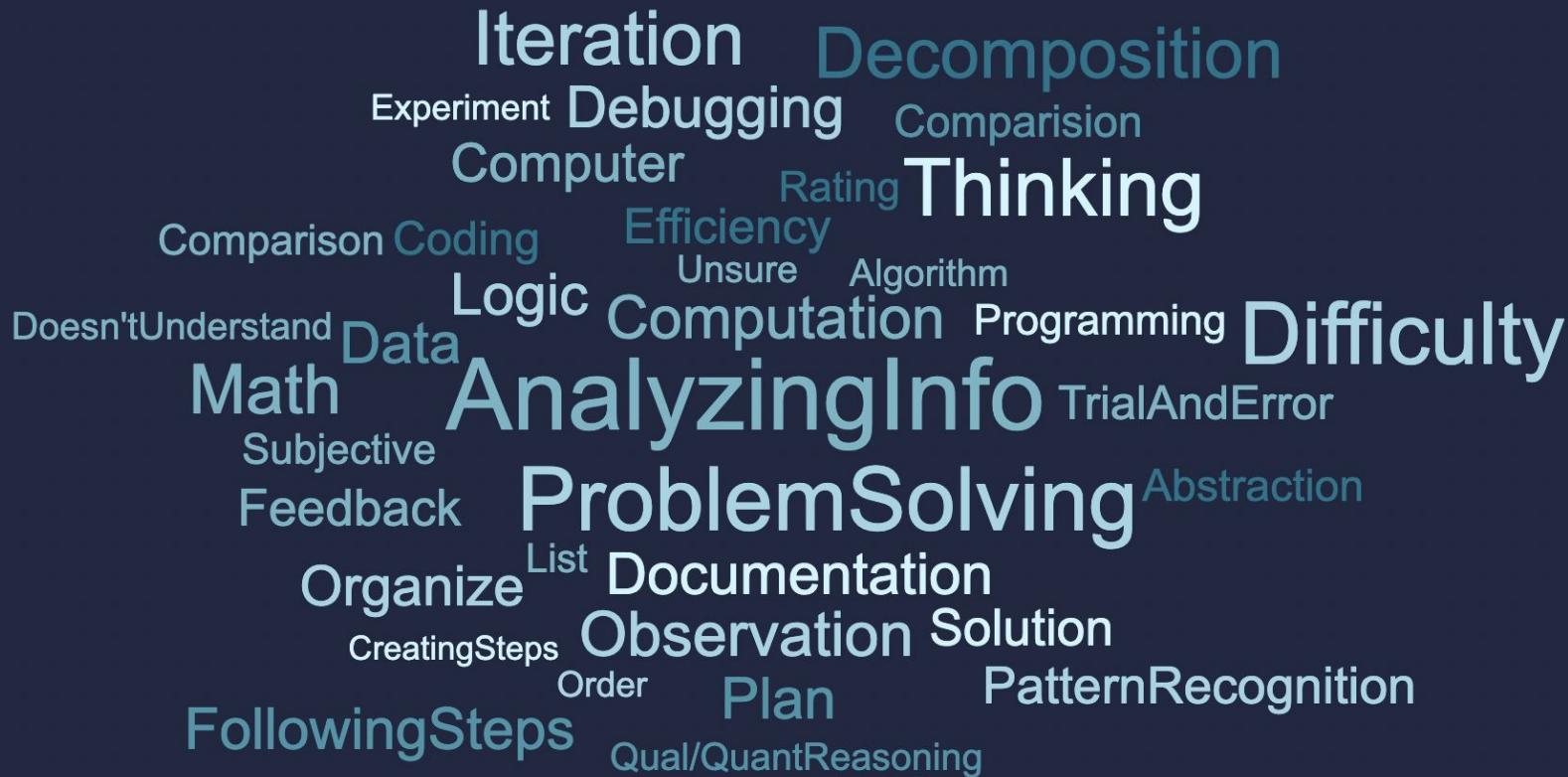
Coding Guide



Qualitative Coding Process



- Grounded theory approach (Hunter et al., 2011) to identify emergent themes from student explanations
- Three iterations → individual coding, meeting deciding on concurrent codes and recoding, and then finalizing codes and definitions





05

Results



RQ1: Do student answers to whether they thought a vignette represented CT largely agree with researcher designed intentions?



RQ1: Do student answers to whether they thought a vignette represented CT largely agree with researcher designed intentions?



CT-intended

Vignette	Anticipated Response	N Responses	Student Agreement	
			Agree	Disagree
DEBUGGING_NONTECH	Yes	34	67.6%	32.4%
DEBUGGING_TECH	Yes	34	70.6%	29.4%
DATA_NONTECH	Yes	34	73.5%	26.5%
DATA_TECH	Yes	36	100.0%	0.0%
DECOMP_NONTECH	Yes	35	83.3%	16.7%
DECOMP_TECH	Yes	34	82.4%	17.6%
ITERATION_NONTECH	Yes	36	85.3%	14.7%
ITERATION_TECH	Yes	34	88.9%	11.1%



Tech/Data Practices Vignette - CT +100% Agreement



"The local coffee shop owner wants to know how many customers she has on each day of the week to help her plan staffing. She graphs the daily cash register purchases in a histogram on Excel and uses this to conclude that she has the most customers on Wednesdays. She decided to add an extra barista on Wednesdays to cover the busy crowd"



Tech/Data Practices Vignette - CT +100% Agreement



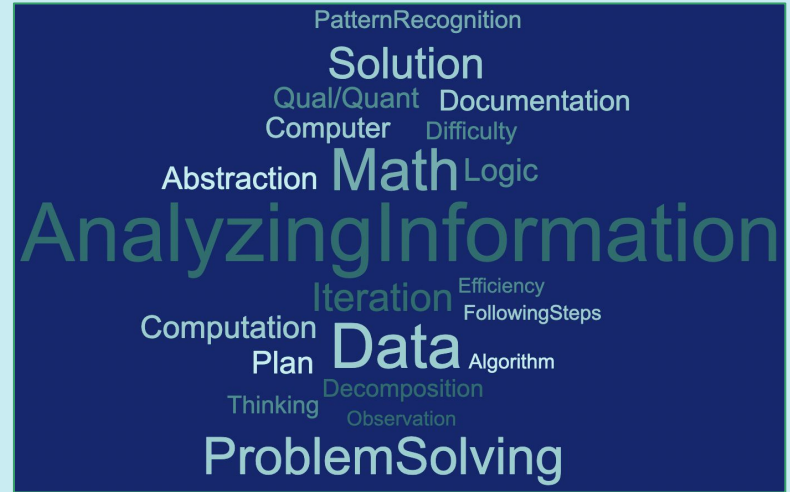
"The local coffee shop owner wants to know how many customers she has on each day of the week to help her plan staffing. She graphs the daily cash register purchases in a histogram on Excel and uses this to conclude that she has the most customers on Wednesdays. She decided to add an extra barista on Wednesdays to cover the busy crowd"

"She is analyzing data and uses that data in a way to solve a problem or improve a system. It requires more thought process and creativity"

Tech/Data Practices Vignette - CT +100% Agreement

"The local coffee shop owner wants to know how many customers she has on each day of the week to help her plan staffing. She graphs the daily cash register purchases in a histogram on Excel and uses this to conclude that she has the most customers on Wednesdays. She decided to add an extra barista on Wednesdays to cover the busy crowd"

"She is analyzing data and uses that data in a way to solve a problem or improve a system. It requires more thought process and creativity"



Codes



RQ1: Do student answers to whether they thought a vignette represented CT largely agree with researcher designed intentions?



Non-CT Intended

Vignette	Anticipated Response	N Responses	Student Agreement	
			Agree	Disagree
NON_CT 1	No	37	51.4%	48.6%
NON_CT2	No	35	58.8%	41.2%
NON_CT3	No	34	58.8%	41.2%
NON_CT4	No	34	85.7%	14.3%



Non-tech Vignette - Non-CT + 85.7% Agreement



"Luisa just finished her senior capstone project in psychology. As part of the project, she watched online interviews and typed up transcriptions from 50 participants' interviews"



Non-tech Vignette - Non-CT + 85.7% Agreement



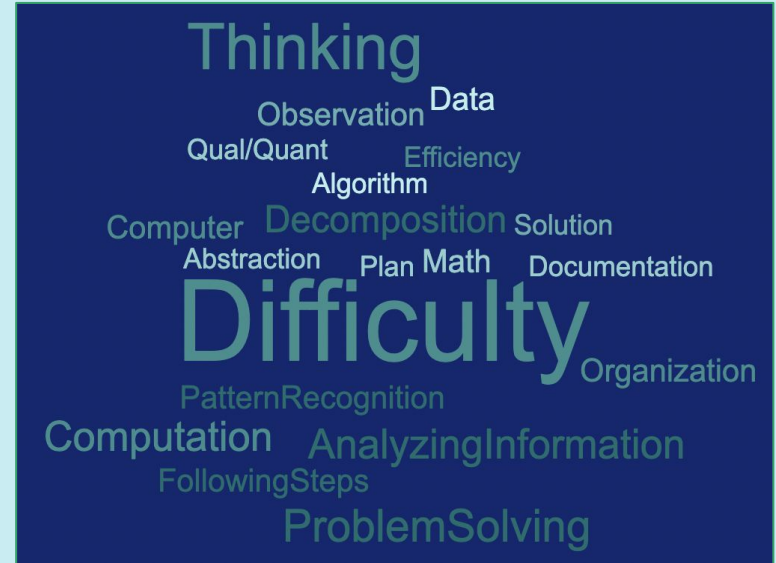
"Luisa just finished her senior capstone project in psychology. As part of the project, she watched online interviews and typed up transcriptions from 50 participants' interviews"

"She is not creating patterns, recognizing important information, or working with an algorithm. She is just following basic steps to complete a project. "

Non-tech Vignette - Non-CT + 85.7% Agreement

"Luisa just finished her senior capstone project in psychology. As part of the project, she watched online interviews and typed up transcriptions from 50 participants' interviews"

"She is not creating patterns, recognizing important information, or working with an algorithm. She is just following basic steps to complete a project."



Codes

**RQ2: In what ways do students
connect technology use with
computational thinking?**

**RQ2: In what ways do students connect technology
use with computational thinking?**

For vignettes that featured an example with
technology:

71.2%

responded that the example did
represent CT

RQ2: In what ways do students connect technology use with computational thinking?

For vignettes that did not feature an example with technology:

63.0%

responded that the example did represent CT



06

Discussion



Discussion



RQ 1

Aligns with the general ambiguity in what is actually considered CT and the lack of a formal definition for CT

RQ 2

Common misconception that CT skills require solutions that can also be run through a computer program



Future Directions



- Expanding this work to examine the effect of perceived gender in vignettes and technology presence across vignettes in student perceptions
- Further explore the extent of the misconception that technology use is a requisite for CT as well as whether gender prejudices present in other STEM topics transfer to CT
- Demographics will also be collected (major, gender, age, etc) and data will also be collected from a liberal arts college in addition to a STEM-targeted institution

Vignette Conditions	Tech	Non-tech
Female	Female-tech	Female-NT
Male	Male-tech	Male-NT



WPI

Thank you!

We would love to hear any of your questions!

nrushton@wpi.edu

(508) 948-7894



[@nellierushton](https://twitter.com/nellierushton)

[linkedin.com/in/nellierushton](https://www.linkedin.com/in/nellierushton)

hsmith@wpi.edu

(508) 463-8253



[@hansmith1123](https://twitter.com/hansmith1123)

[linkedin.com/in/hannah-smith](https://www.linkedin.com/in/hannah-smith)

