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"Botley, You Need to Listen!" Exploring Young Children's Interactions With Robots While Learning To Code

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Exploring Young Children's Interactions with Robots while Learning to Code

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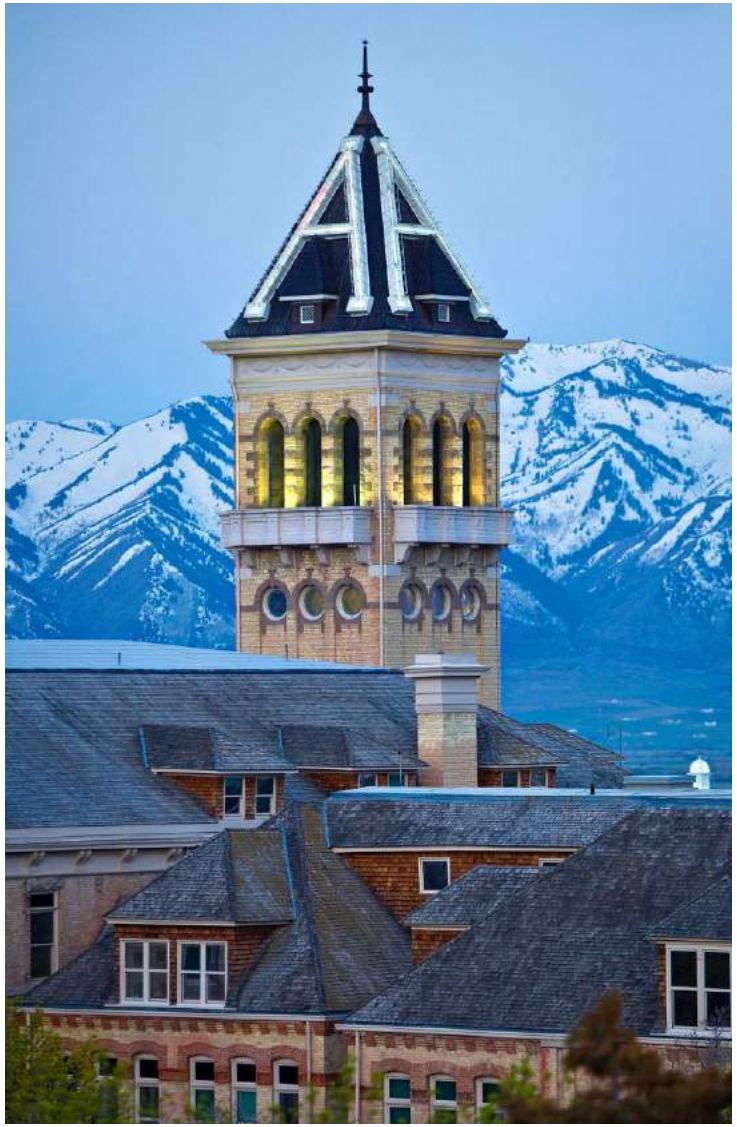
Fall Student Research Symposium, Dec 10, 2020



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Introduction

Problem and Purpose

Context: The surge of research about child-robot interactions as robots are being used in classrooms and homes in increasing numbers

Problem: Knowledge gap for children/robot interactions

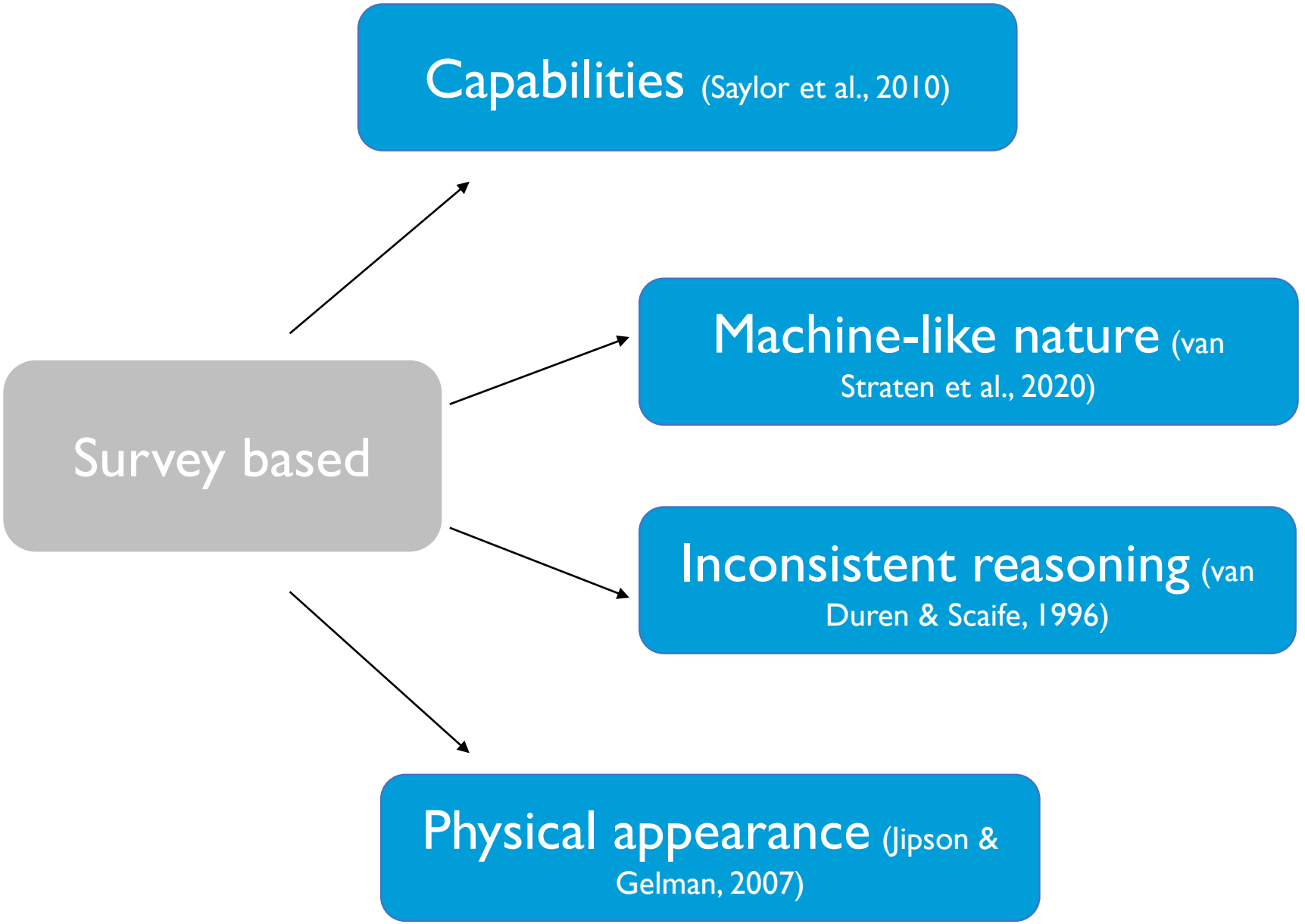
Purpose: Understand the ways students interact with and respond to the robots

Coding Toy Robots

Cubetto
by Primo Toys

Botley
by Learning Resources

Literature


Survey based
Capabilities (Saylor et al., 2010)
Machine-like nature (van Straten et al., 2020)
Inconsistent reasoning (van Duren & Scaife, 1996)
Physical appearance (Jipson & Gelman, 2007)

Methodology

Research Question:

In what ways do students interact with and respond to the robots?

Participants and Data Sets

32 Kindergarten Students

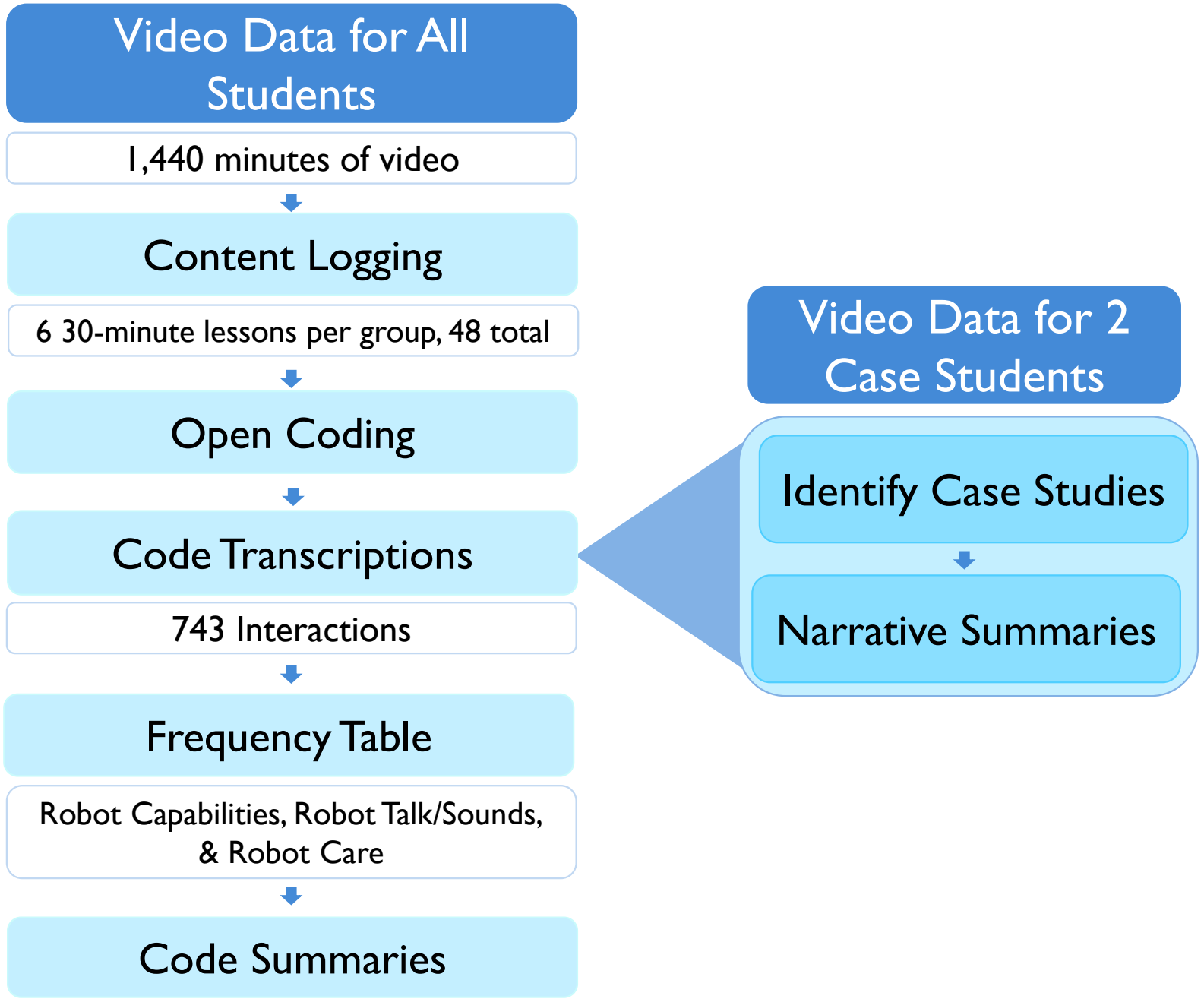
2 Public Elementary Schools

6 small group computer science lessons using robots

Case Study #1: Luke

Case Study #2: Lauren

Data Sources and Analysis



Results and Conclusion

Frequency Table

		School 1	School 2
Robot Capabilities	Robot Capabilities	5	6
	Personifications	2	5
	Anthropomorphizing	16	24
	Naming Robots	9	13
	What Robots Do	24	31
Robot Talk/Sounds	Addressing the Robot	1	19
	Interpreting Robot Sounds	1	5
Robot Care	Robot Care	4	17
	Concern for Robots	0	3
	Robot Maintenance	2	10
	Encourages	0	1
	Compliments	3	8

Robot Capabilities

Luke

"They move whatever you tell them to move."

"She's not listening!"

Lauren

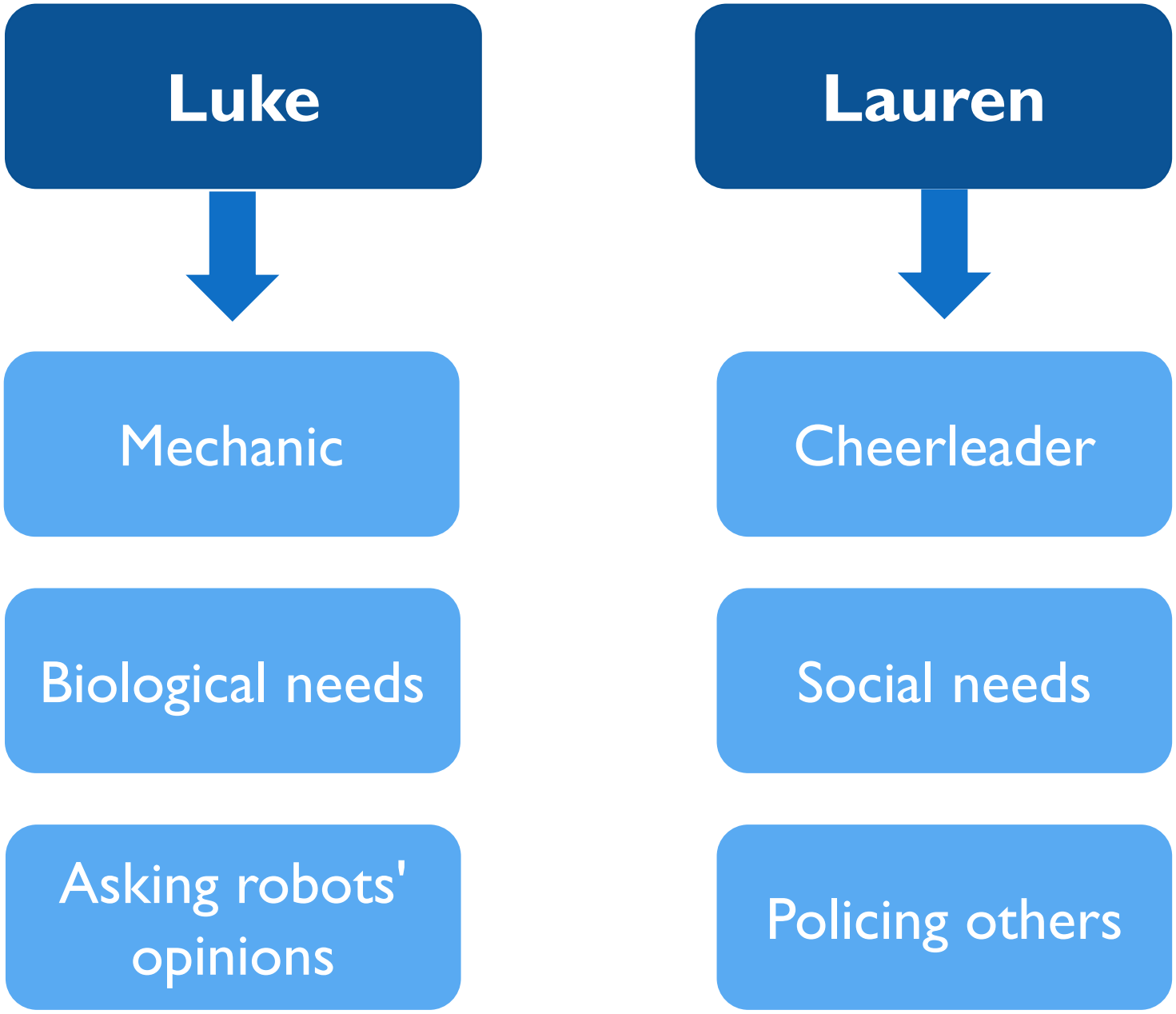
Robots have wants and feelings

"Botley, you have to listen!"

Robot Talk/Sounds

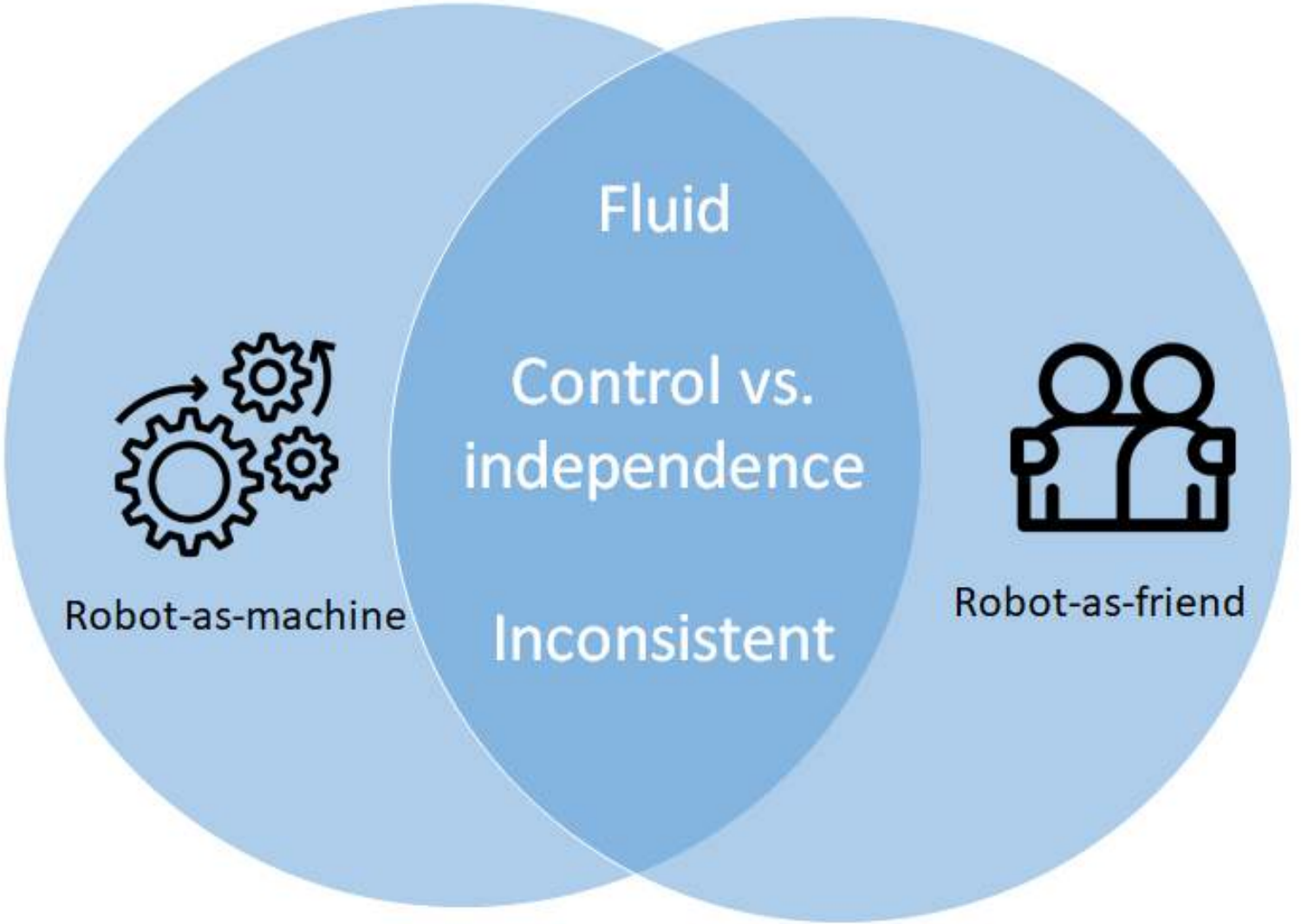
Luke	Lauren
"Do you want to go to the cheese factory?"	Directly addresses robot multiple times
Gets on robot's "visual" level	Gets on robot's "visual" level
Describes what the robot is doing without noises	Uses noises to describe what the robot is doing

Robot Care

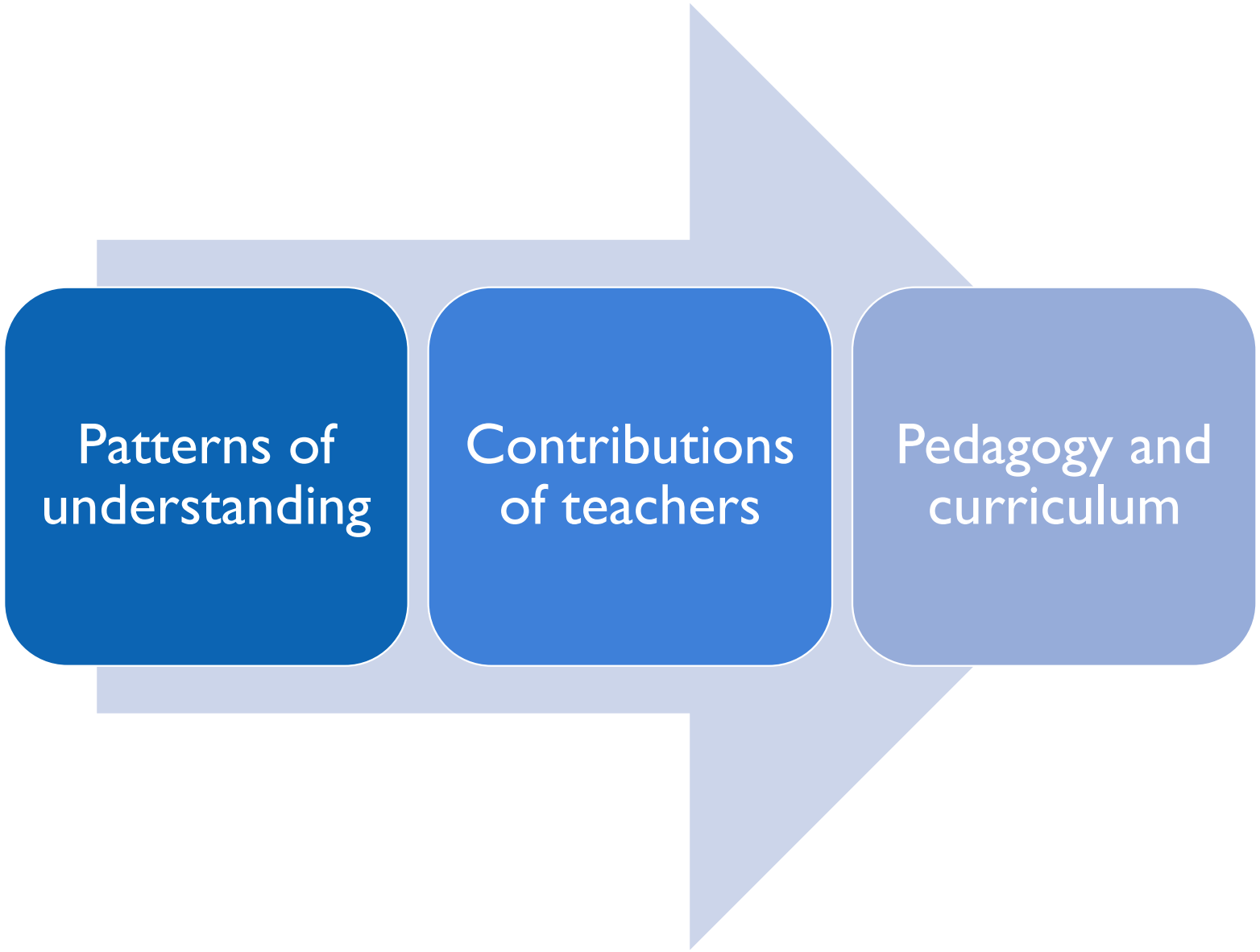

Luke
Mechanic
Biological needs
Asking robots' opinions
Lauren
Cheerleader
Social needs
Policing others

Conclusions

In what ways do students interact with and respond to the robots?



Implications and Future Research



Other work by the Coding in Kindergarten (CiK) research team, funded by the National Science Foundation grant #1842116

Clarke-Midura, J., Lee, V. R., Shumway, J. F., & Hamilton, M. M. (2019). The Building Blocks of Coding: A Comparison of Early Childhood Coding Toys. *Information and Learning Science*.

Hamilton, M. M., Clarke-Midura, J., Shumway, J. F., & Lee, V. R. (2019). An Emerging Technology Report on Coding Toys and Computational Thinking in Early Childhood. *Technology, Knowledge, and Learning*.

Shumway, J. F., Clarke-Midura, J., Lee, V. R., Hamilton, M. M., & Baczuk, C. (2019). Coding Toys in Kindergarten. *Teaching Children Mathematics*, *25*(5), 314-317.

Further questions can be directed to
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References

van Straten, C. L., Peter, J., Kuhne, R., & Barco, A. (2020). Transparency about a Robot's Lack of Human Psychological Capacities: Effects on Child-Robot Perception and Relationship Formation. *ACM Transactions on Human-Robot Interactions,* 9(2), pp. 1-22.

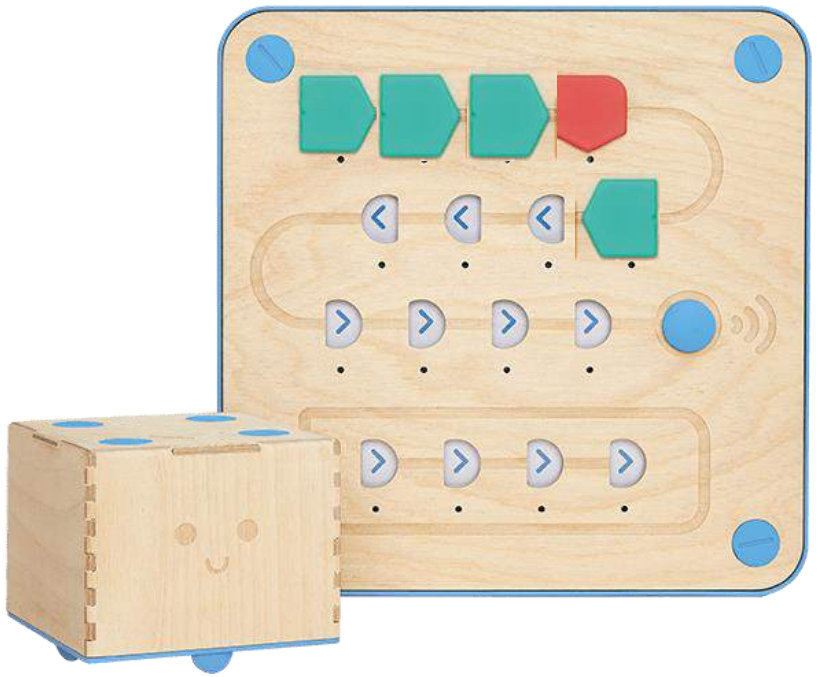
van Duuren, M., Scaife, M., 1996. "Because a robot's brain hasn't got a brain, it just controls itself"-children's attributions of brain related behaviour to intelligent artifacts. *European Journal of Psychology of Education* 11, 365–376.

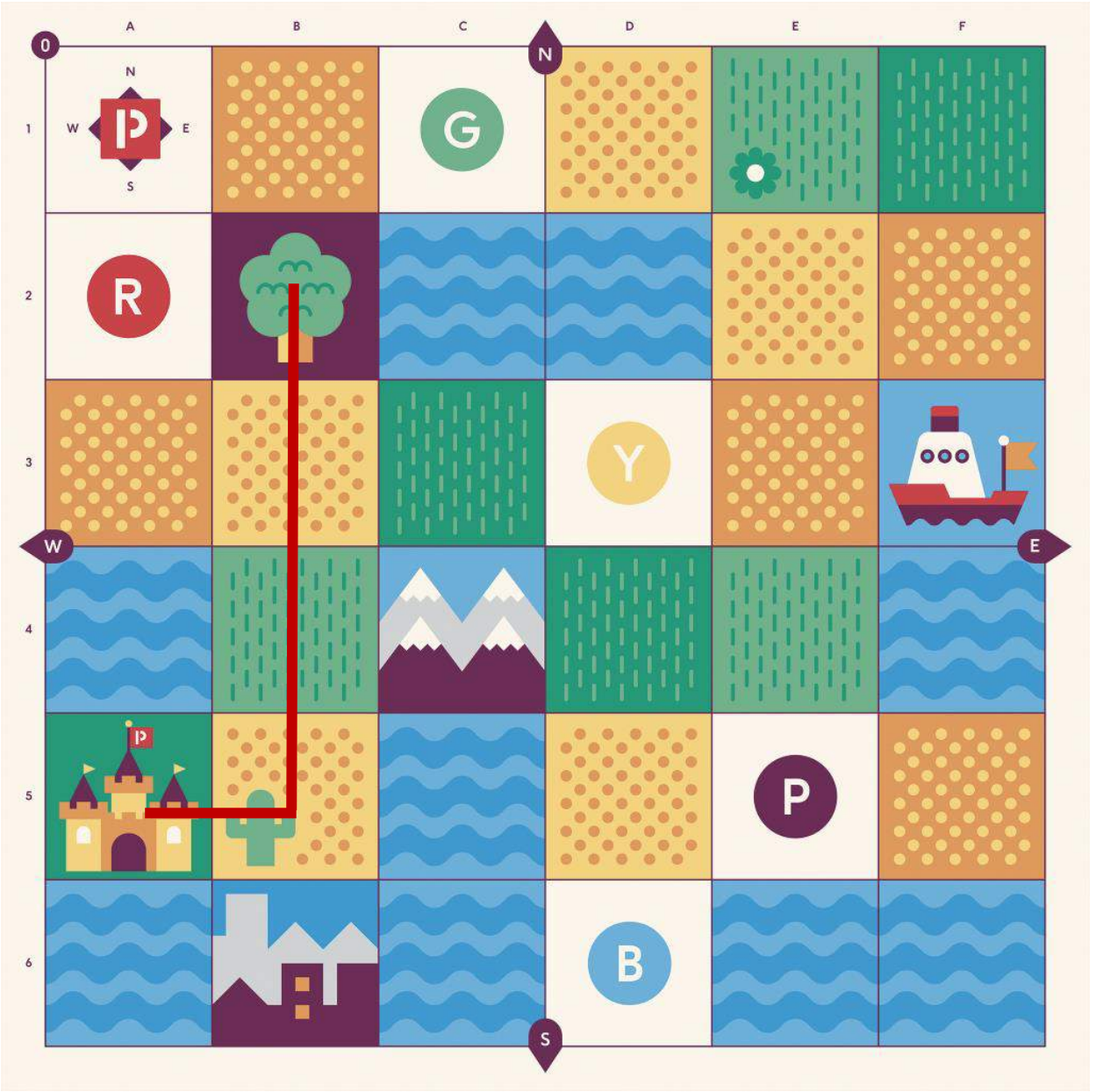
Saylor, M. M., Somanader, M., Levin, D. T., & Kawamura, K. (2010). How do young children deal with hybrids of living and non-living things: The case of humanoid robots. *British Journal of Developmental Psychology*, 28(4), 835-851.

Jipson, J. L., Gelman, S. A. (2007). Robots and Rodents: Children's Inferences and Nonliving Kinds. *Society for Research in Child Development,* 78(6), 1675-1688.

Shute, V. J., Sun, C., & Asbell-Clarke, J. (2017). Demystifying computational thinking. *Educational Research Review, 22*, 142–158.

Wood, T., Williams, G., & McNeal, B. (2006). Children's mathematical thinking in different classroom cultures. *Journal for Research in Mathematics Education* 37(3), 222-225.

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Computational Thinking

Definition

"The conceptual foundation required to solve problems effectively and efficiently (i.e., algorithmically, with or without the assistance of computers) with solutions that are reusable in different contexts" (Shute, Sun, & Asbell-Clarke, 2017).

Mathematical Thinking

Definition:

The "mental activity involved in the abstraction and generalization of mathematical ideas" (Wood, Williams & McNeal, 2006), and our study includes the processes of numerical reasoning, spatial reasoning, and problem solving as students construct mathematical understandings individually and with peers.