Social Robotics

August 2nd, 2023

CIRCLS

Center for Integrative Research in Computing and Learning Sciences

Welcome! Please introduce yourself in the chat:

Name, Role, Institution/Organization

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EDC Education Development Center

University of Pittsburgh

SRI Education

Digital Promise

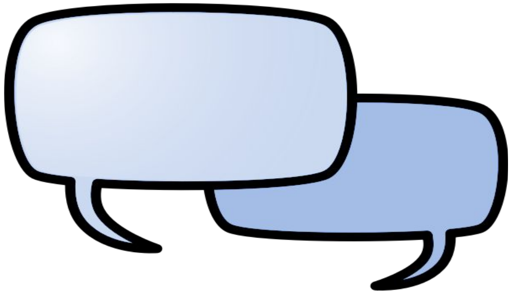
Introductions

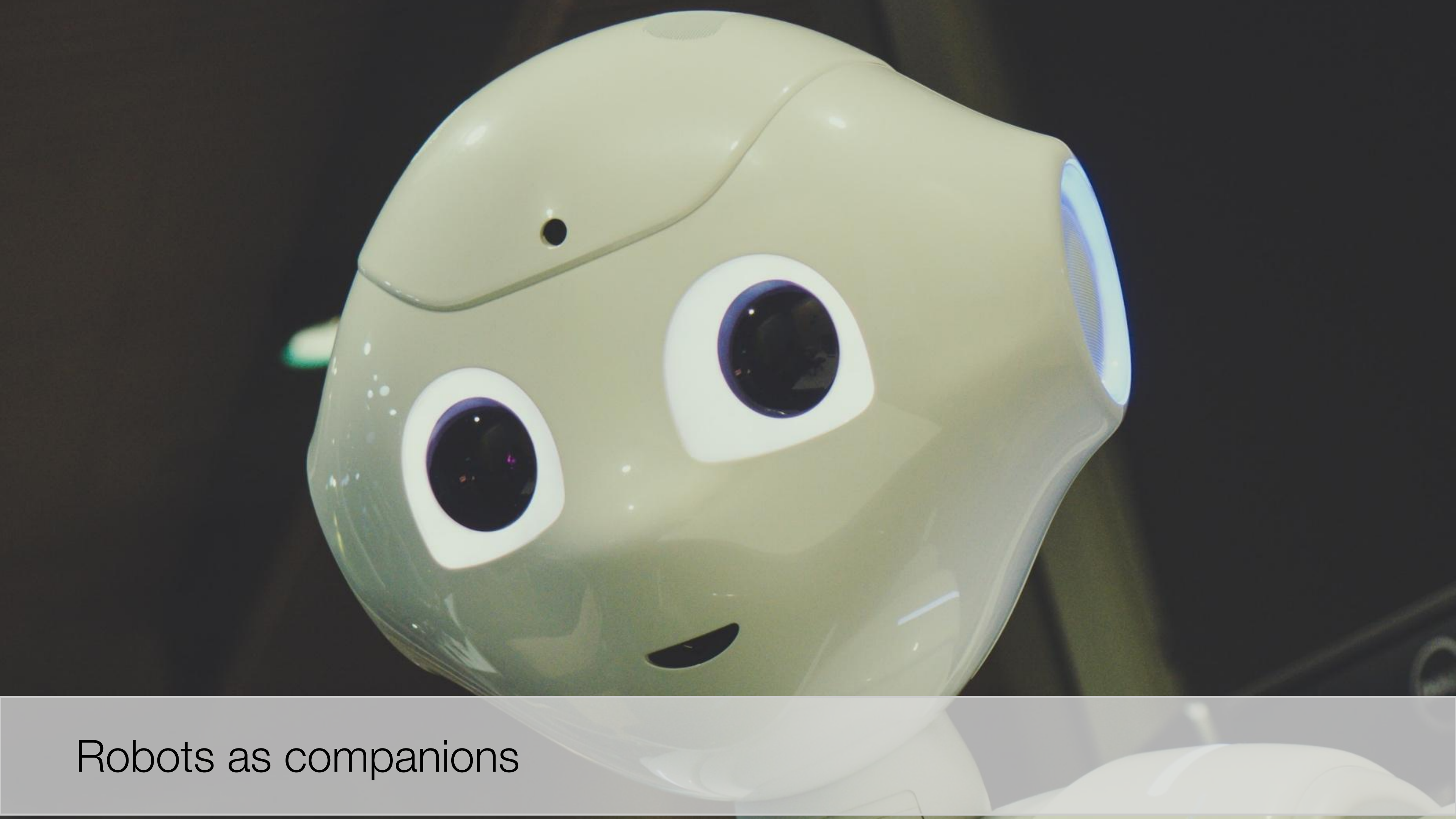
Erin Walker

Cassandra Kelley

Waterfall Activity:

What comes to mind when you think about robots in the classroom?





Robots as companions

How do we design robotic companions to foster student learning?

Social Behaviors

Collaborative Scenarios

Programmable Features

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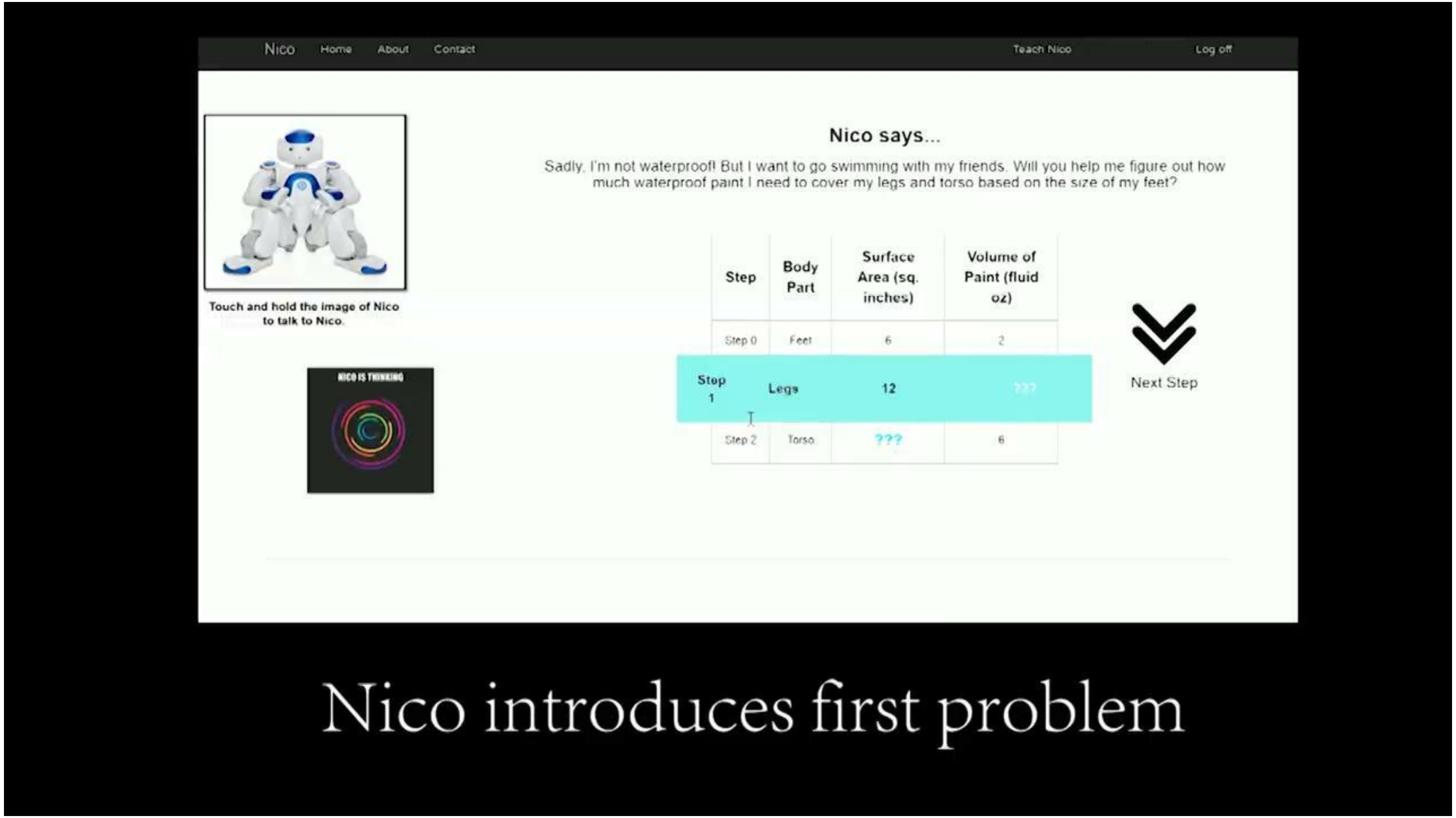
Team: Dr. Nichola Lubold, Dr. Amy Ogan, Dr. Heather Pon-Barry

Can we leverage the benefits of learning by teaching?

Roscoe & Chi, 2007; Leelawong & Biswas, 2008

Meet Nico


Nico
Home
About
Contact
Teach Nico
Log off
Touch and hold the image of Nico to talk to Nico.
Nico says...
Sadly, I'm not waterproof! But I want to go swimming with my friends. Will you help me figure out how much waterproof paint I need to cover my legs and torso based on the size of my feet?
Step
Body Part
Surface Area (sq. inches)
Volume of Paint (fluid oz)
Step 0
Feet
6
2
Step 1
Legs
12
???
Step 2
Torso
???
6
Next Step
Nico introduces first problem

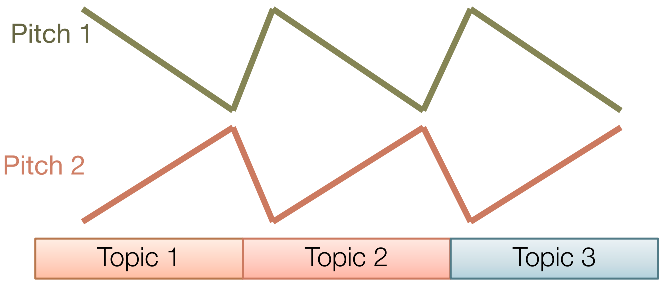
Social Behaviors Design

Social Dialogue

Yuliana Because we know that 2.5 can go into 10 four times

Nico Oh, I get it! Thank you for explaining, Yuliana. You’re a great tutor. So, then we have 1 over 4?

Pitch Entrainment

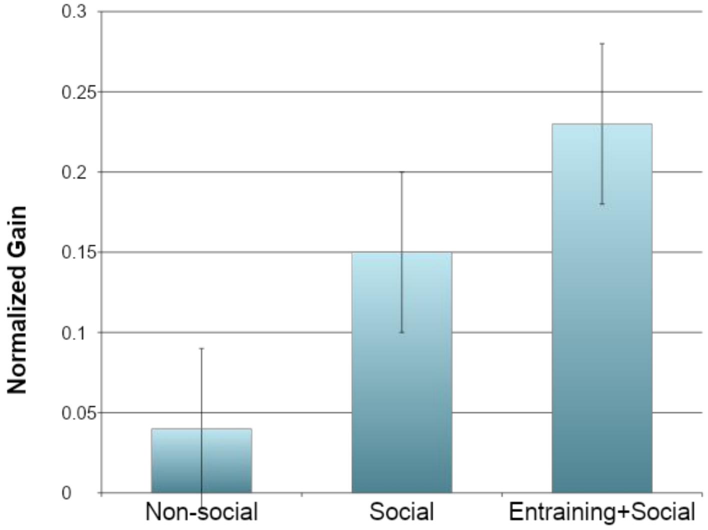


Study

69 middle school students taught Nico in 1 hour sessions across three conditions: non-social, social, and entraining+social.

Students in the entraining+social condition learned the most.

Some evidence that the more social the condition, the more rapport students experienced.



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Team: Tristan Maidment, Yuya Asano, Nhat Tran, Jay Patel, Dr. Nikki Lobczowski, Dr. Adriana Kovashka, Dr. Tim Nokes-Malach, Dr. Diane Litman

What if two students work together to teach the robot? *Chi & Wylie, 2014; Miller & Nourbakhsh, 2016; Lubold 2018*

Ongoing Exploratory Analysis

14 undergraduate dyads taught Emma ratio problems over zoom in 90 minute sessions.

Currently exploring how group dynamics might predict outcomes of interest.

For example, the more similar students' prior knowledge, the more they perceive rapport with Emma and with each other.

Some groups had one student dominating the interactions, or had students simply alternating between steps without interacting with each other.

What if Emma could learn how to improve group dynamics?

SA:	You take that number and multiply at by 3, because 15 times 3 is 45
Emma:	So, is this a multiplication problem? <u>Student B</u>, so, what do we do?
SA (to SB):	We take the total cost and multiply it by 3.
SB:	We take the total cost and multiply it by 3.
Emma:	We can just multiply $32.25 by 3? How do you know we can do that?
SA (to SB):	Because we know that 15 times 3 is 45, so we can do the same thing to the other side.
SB:	Because we know that 15 times 3 is 45, so we have to do that to the other side.
Emma:	If we have three times as many hot dogs, it will cost three times as much.
SA (to SB):	Yes.
SB:	Yes, correct.
Emma:	So then 3 times 32.25 is $96.75. Student B, is that how much it will cost?
SB:	Yes, correct, that is the total cost.

By referencing a particular student, Emma involves that student in the interaction.

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Team: Yinmiao Li, Jennifer Nwogu, Amanda Buddemeyer, Jaemarie Solyst, Dr. Angela Stewart, Dr. Tara Nkrumah, Dr. Amy Ogan, Dr. Kimberly Scott

Culturally-Responsive Computing

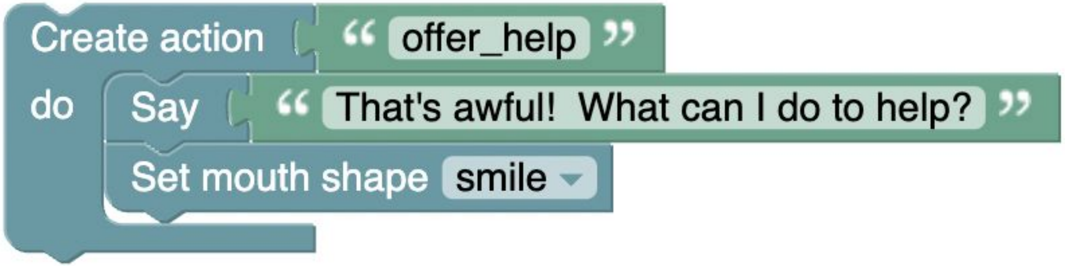
Can't learn about technology without thinking about who designs it and who benefits.

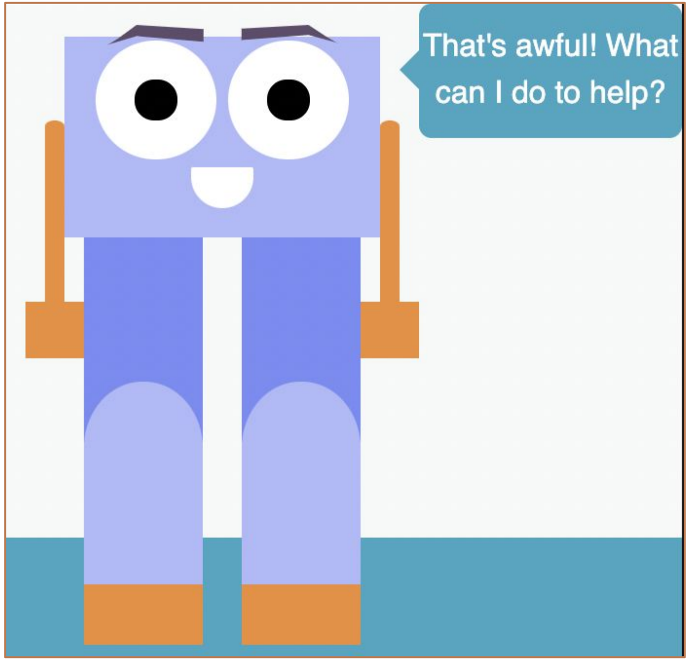
Goal: technosocial change agency

Learners switch between reflections on power & identity, community-building activities, & meaningful tech-related tasks.

Scott, Sheridan, & Clark, 2015; Scott & Garcia, 2016

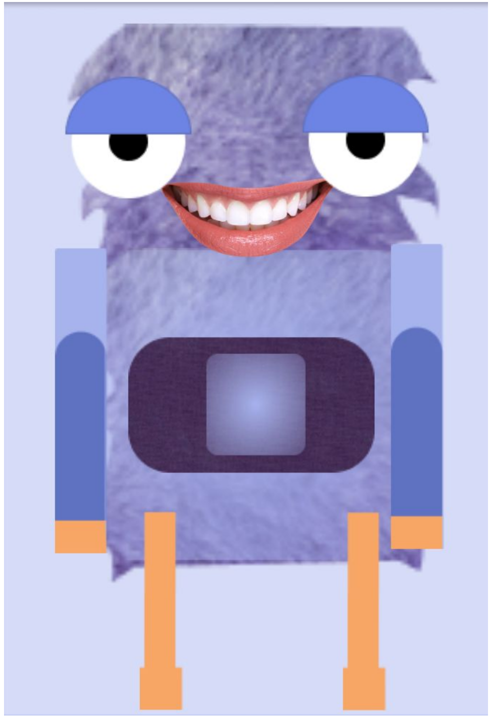
What are the benefits of making a social robot programmable?





In this example, the robot and the student might work together to **co-create** a robot’s dialogue behaviors.

Co-Design: What does it mean to be a co-creator?



15 middle school girls participated in 5 participatory design sessions.

I was thinking the robot would be a bit sassy, so I chose the eyes that looked annoyed.

[allowing robots to decide their] clothes, how they act, preference for name, gender, who they make friends with is a way to express itself

Overall, participants gave robots a limited amount of agency as long as they remained in control over the robots' tasks and functionality.

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Ethics of robotic learning companions

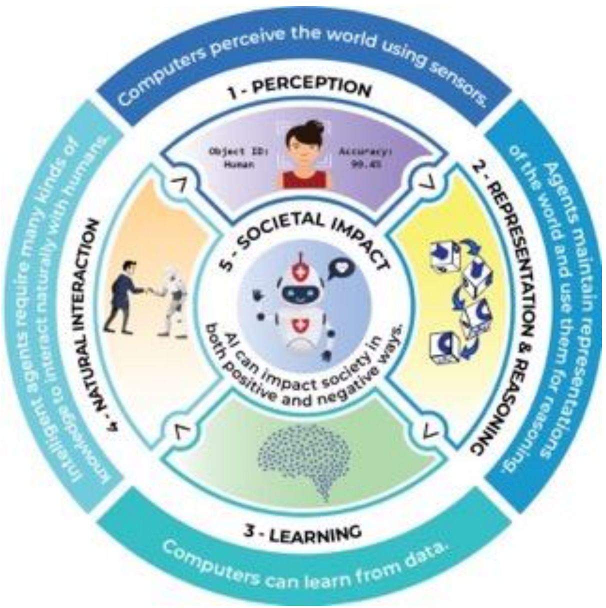
Transparent behavior

Yields agency

Promotes AI literacy

https://circls.org/ai-and-education-policy

Sharing Research as Curriculum



The Concepts and Practices of the K–12 Computer Science Framework

Core Concepts

1. Computing Systems
2. Networks and the Internet
3. Data and Analysis
4. Algorithms and Programming
5. Impacts of Computing

Core Practices

1. Fostering an Inclusive Computing Culture
2. Collaborating Around Computing
3. Recognizing and Defining Computational Problems
4. Developing and Using Abstractions
5. Creating Computational Artifacts
6. Testing and Refining Computational Artifacts
7. Communicating About Computing

Example Learning Outcomes:

- **Understand and explain key terminology** associated with the field of AI, including describing what natural language processing is and how it works.
- Solve a math problem step-by-step and through the process, **develop a natural language dialogue script using keywords and conditional statements** (e.g. if/then format).
- **Add social elements** (e.g. gaze, gesture, movement, pitch, positive words or praise, etc.) to the natural language dialogue and **run a sentiment analysis** to determine the emotional state of the virtual agent. Discuss how the virtual agent’s sentiment might make others who interact with it feel.
- **Test the natural language dialogue script developed using an AI simulation** to evaluate if it seems human-like.
- Explore other students’ natural language dialogue scripts to provide peer feedback and evaluate strengths/weaknesses.
- Reflect on “aha moments” from this process and brainstorm ideas for how artificial intelligence might help students with learning. Share ideas and **participate in a culminating discussion about the impact AI can have in education and society overall**.

Questions?

We can use robotic learning companions to support learning via social behaviors, collaborative scenarios, and adding programmable features.

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Learning Research & Development Center

Discussion

What is your experience with robots or teaching robotics curriculum?

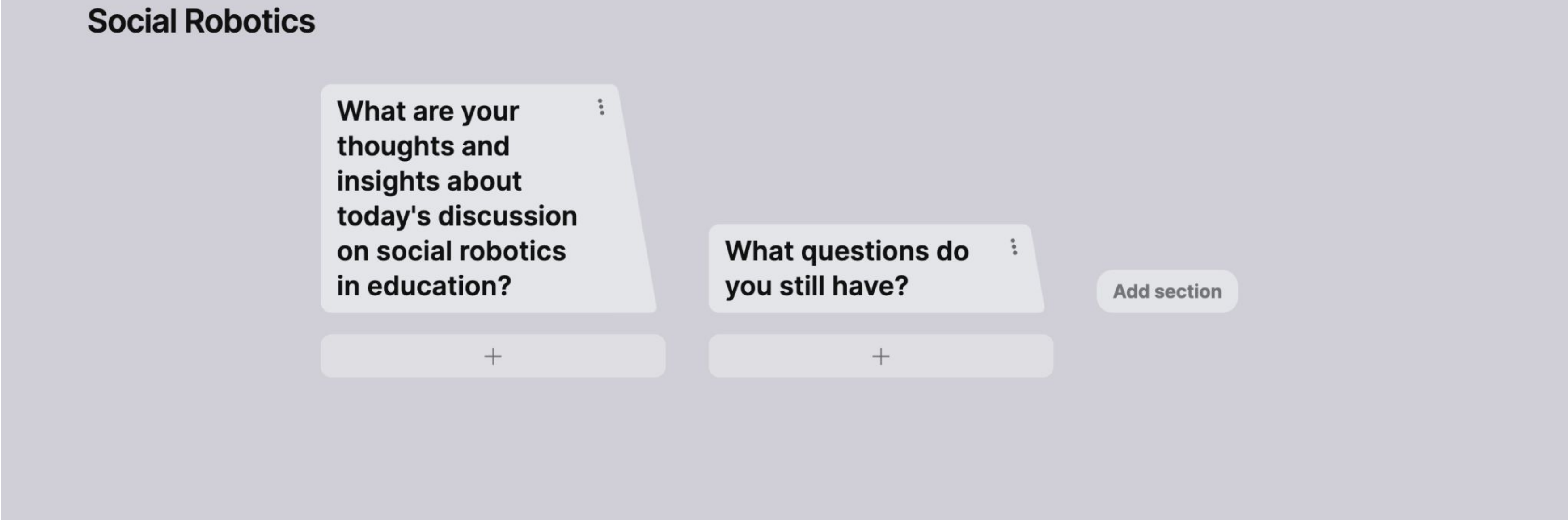
How might robots be helpful in your school/classroom in the future?

What are your current needs from robotics-related curriculum?

What do you wish researchers and developers knew when developing these technologies and curricula?

Reflection:

What insights or questions do you have?



Share your thoughts

Summer Discussion Series

Upcoming Sessions

July 18th: *Overview of Emerging Technologies and AI in Education*

July 20th: *Assessment, Identity and Agency*

July 25th: *Collaborative Learning and Community Building*

July 27th: *Equitable and Ethical Practices and Interactions*

August 2nd: *Social Robotics*

August 15th: *Learning and Productivity*

Learn more and register

Everyone is welcome! You do NOT need to apply for or attend the convening to participate!

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[August 3rd, 1-2PM ET]: Drop in to ask about the CIRCLS ‘23 Convening and learn how to apply.

Thank you

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How to Share This Presentation