Ice Jams, Fungi, Roly-Polys: Enhancing Knowledge to Enrich Science Talk

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FUNDAÇÃO
Maria Cecilia
Souto Vidigal

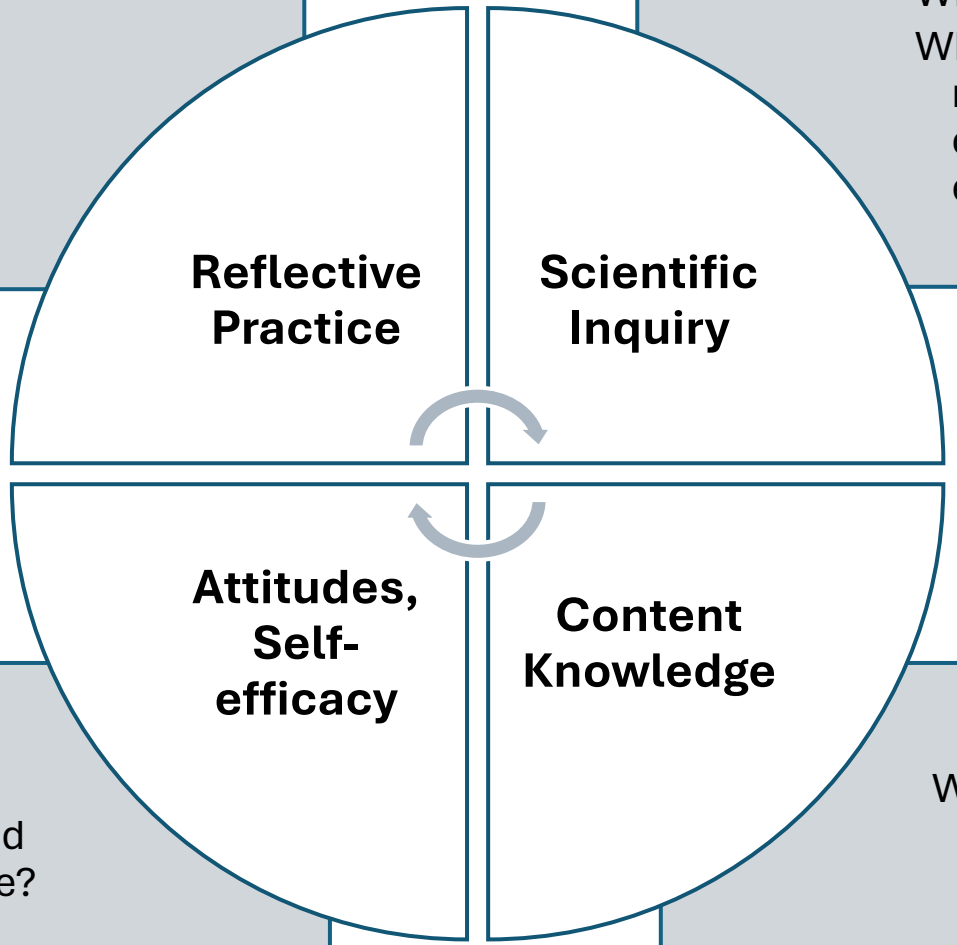
Questions Pondered

How do early childhood educators reflect on their science and engineering practice?

How does it inform their practice?

Who is in charge?

What support do educators need to encourage children's scientific and engineering inquiry?



Why are educators unsure about including science and engineering in their practice?

Why don't science and engineering happen in early care and education settings?

Setting the stage…

PreSTAR

Preschool Science Talk in Action and Reflection

Soo-Young Hong (US, PI)

Gisela Wajskop (Brazil, PI)

Additional Project Members:

US: Erin Hamel, Anna Burton, Yuenjung Joo, Sarah Paulos, Yao Yao, Kejin Lee

BR: Patricia Pastorello, Debora Mclean

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Project Description

- Funded by University of Nebraska-Lincoln & Fundacão Maria Cecilia Souto Vidigal (UNL – Brazil Pilot Impact Study)
- Participants: 8 preschool teachers
- Procedure and Data:
  - Pre- and post-intervention interviews and surveys
  - 4 observation sessions + 4 reflection sessions
    - Physical science concepts and science practice
    - Incorporation of ‘science talk’ in classroom interactions
    - Observations of and reflections on:
      - children’s interactions
      - teachers’ interactions with children

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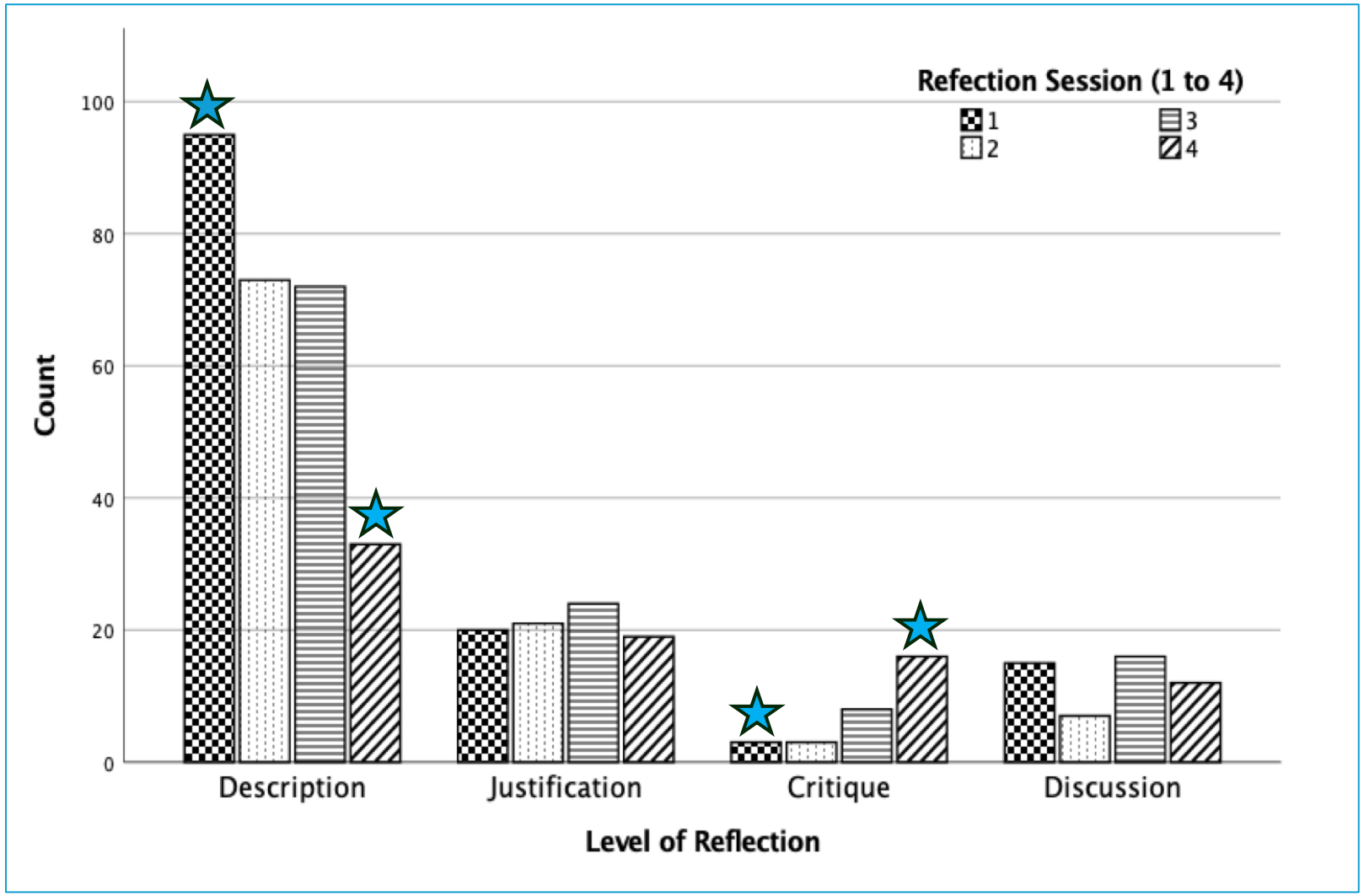
Findings



Hong, Hamel, Joo, & Burton (2023)

Frequencies of Level of Reflection across Reflection Sessions

- 1=Description
- 2=Justification
- 3=Critique
- 4=Discussion

★ Significant differences in levels of reflection between session 1 and session 4

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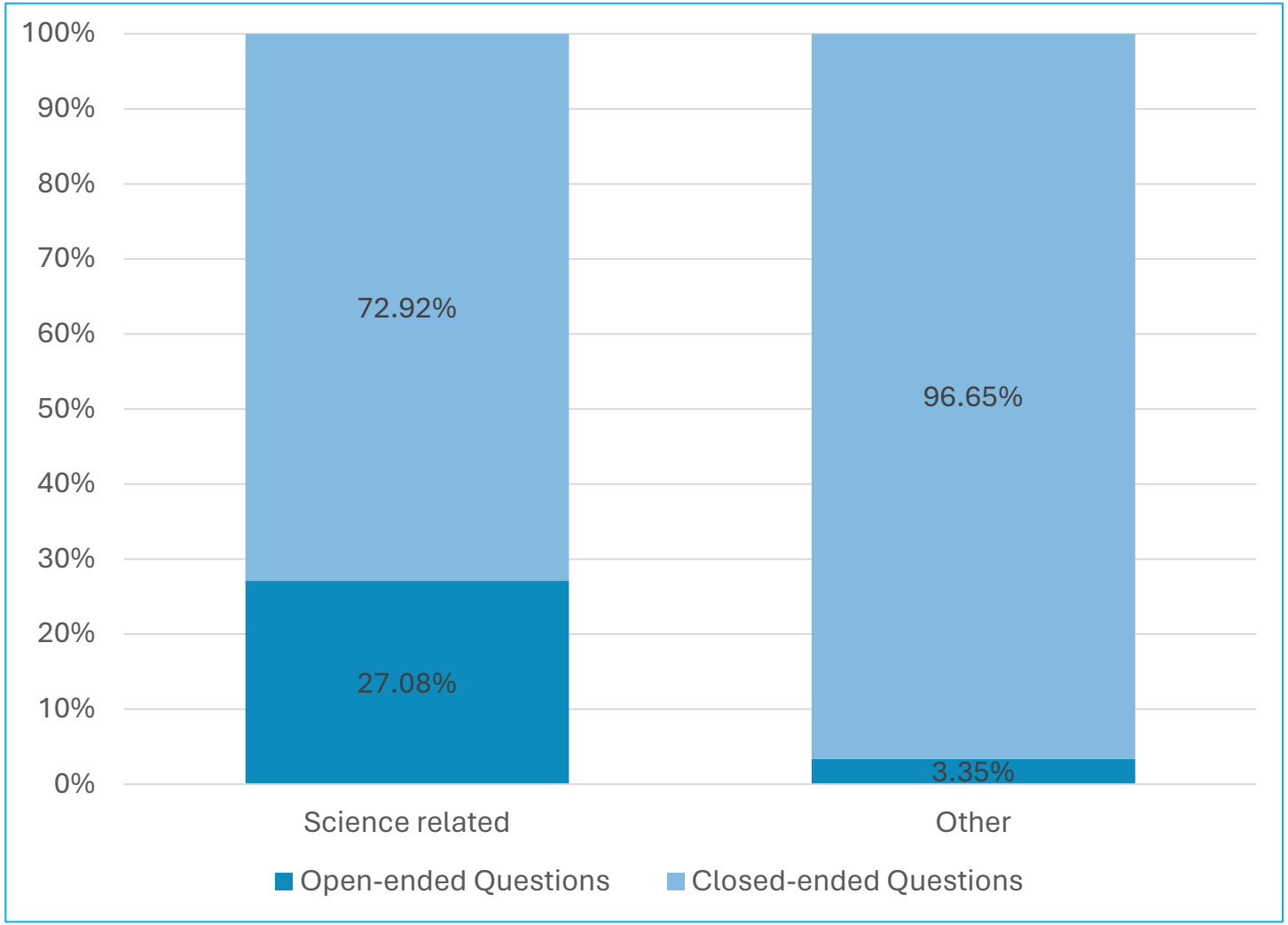
Findings



Hamel, Joo, Hong, & Burton (2021)

Open-ended Questions

Activity Types

- Science-related
- Other (non-science-related)

Preschool teachers were more likely to ask open-ended questions while engaging in science-related activities with children.

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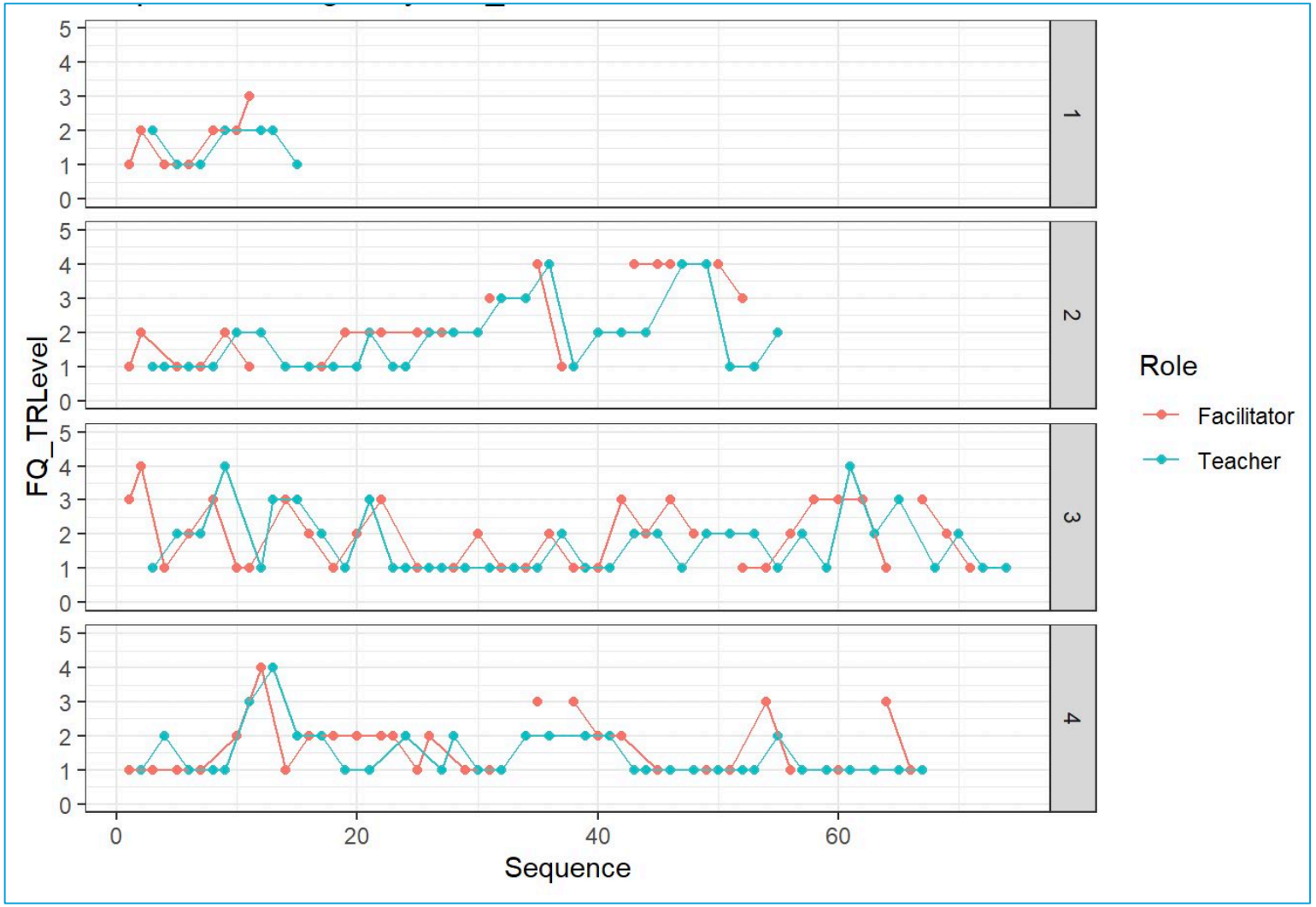
Findings



Hong, Wajskop et al. (in progress)

Facilitators' Level of Questions

- 1=Gathering Information
- 2=Eliciting Justification
- 3=Eliciting Critique
- 4=Inciting Discussion

Teachers' Level of Reflection

- 1=Description
- 2=Justification
- 3=Critique
- 4=Discussion

Preschool teachers were more likely to use high-level reflections when provided with higher-level facilitation questions.

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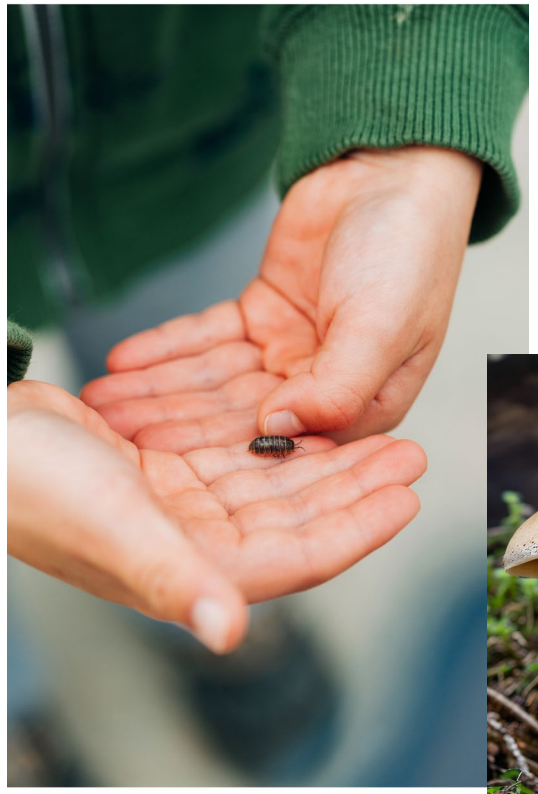
Enhancing Early Childhood Educators' Reflective Practice and Content Knowledge to Increase Children's Capacity for Science Talk
NSF DRK-12 No. 2300676

PreSTAR

Preschool Science Talk in Action and Reflection

Exploring Science and Engineering in Rural Nebraska



Roly-poly

Fungi

Ice Jams

Terraces

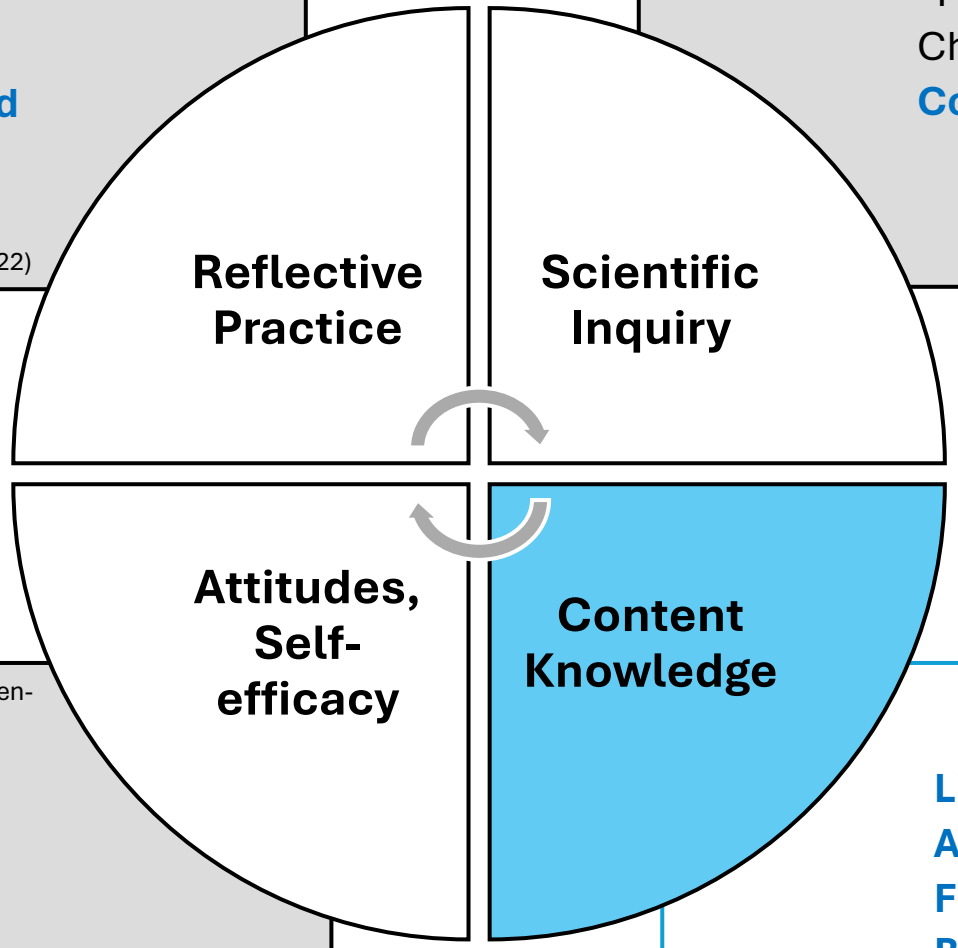
Foci of Inquiry

Cycle of Inquiry
Inductive Framework
Collaborative Reflection and Problem-solving

(e.g., Broderick & Hong, 2011; Jiang & Zheng, 2021; Liu et al., 2023; Luming & McFarland, 2022)

"I wonder..."
Children's interest and play
Collaborative investigation

(e.g., NASEM, 2023)



Feelings matter!
(e.g., Jiang & Zheng, 2021; Mezirow, 1997)

Meaningful & Relevant Experiences
(e.g., NASEM, 2022)

(e.g., Gerde et al., 2018; Smith, 2018; Tschannen-Moran & Hoy, 2001)

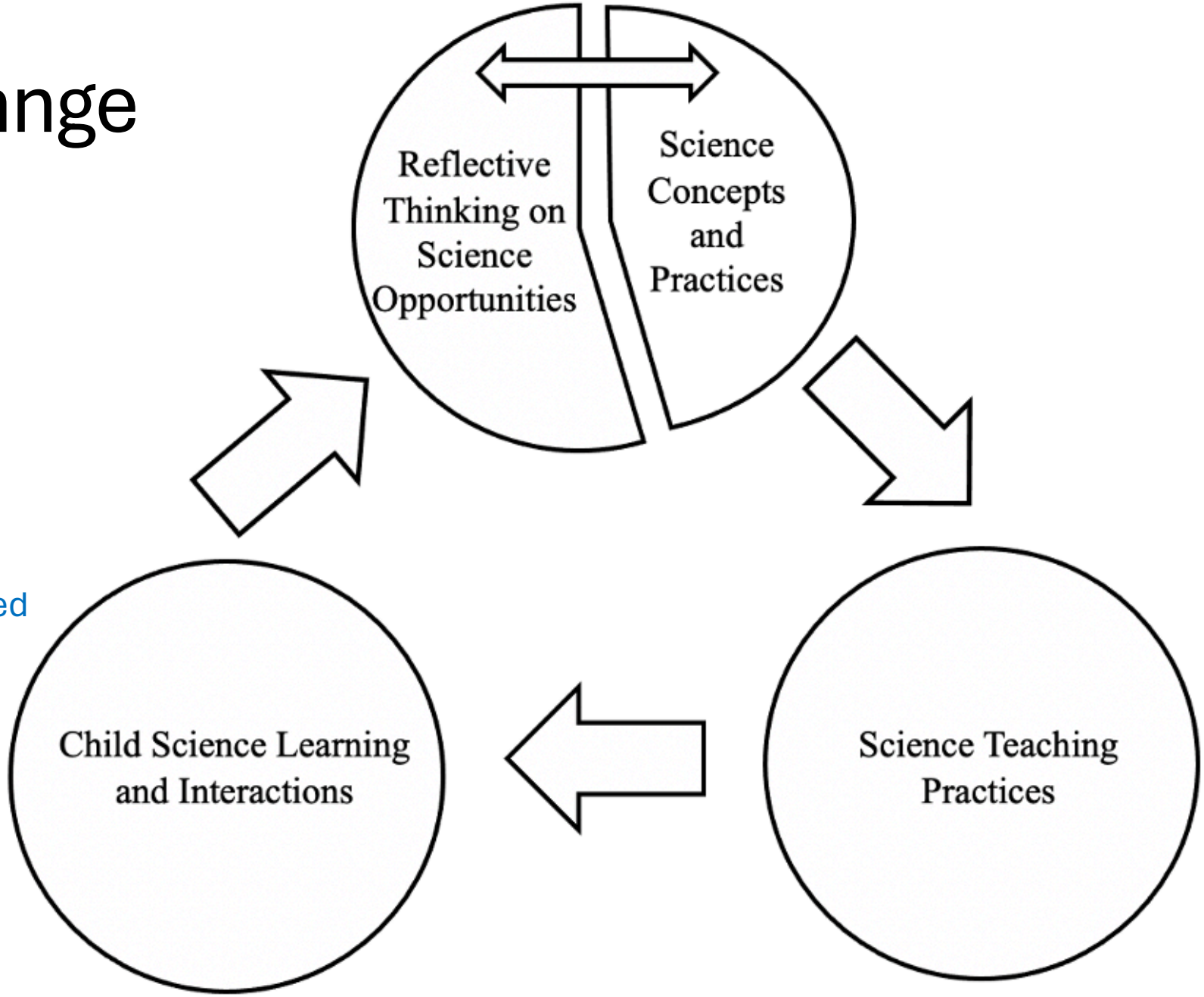
Children can do science and engineering.
I think I can do this (subject-specific self-efficacy).

Living Organisms
Arthropods
Force and Motion
Building Structures

Theory of Change

Intended Participants

- Early childhood educators working with children and families in rural Nebraska communities
- Both center- and home-based early care and education settings
- Preschool-aged children



Study Design

1. Pre-intervention assessments
   - Early childhood educators' self-efficacy and knowledge; Children's knowledge
2. Professional Development (x 2)
   - Science and engineering content; Reflective practice; Cycle of Inquiry
3. Observations and Reflections (x 6)
   - Children's interactions and play; ECEs' interactions with children
4. Post-intervention assessments
   - Early childhood educators' self-efficacy and knowledge; Children's knowledge

Study Design

1
- Pre-intervention assessments
  - Early childhood educators' self-efficacy and knowledge; Children's knowledge

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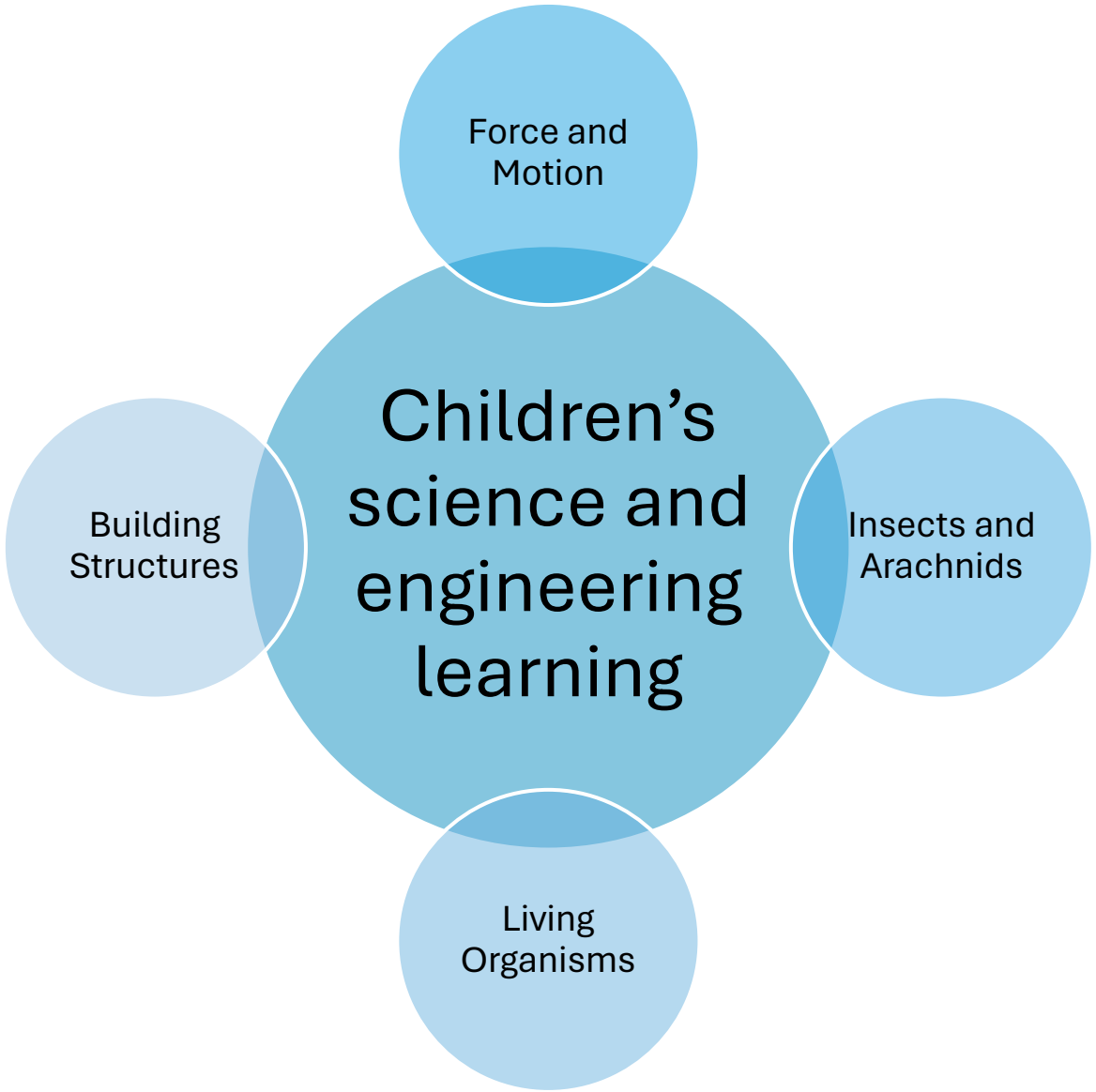
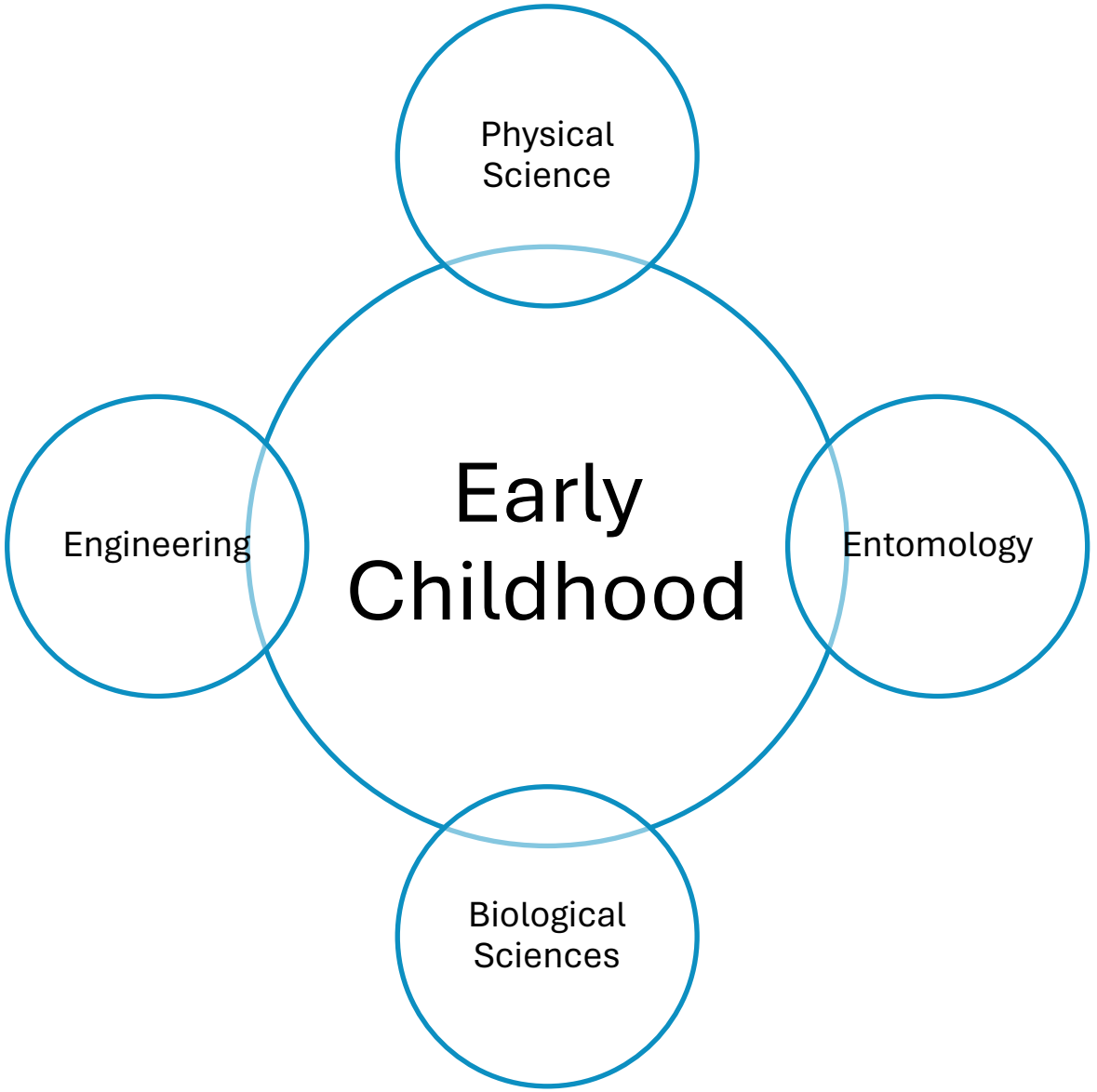
- Observations and Reflections (x 6)
  - Children's interactions and play; ECEs' interactions with children

4
- Post-intervention assessments
  - Early childhood educators' self-efficacy and knowledge; Children's knowledge

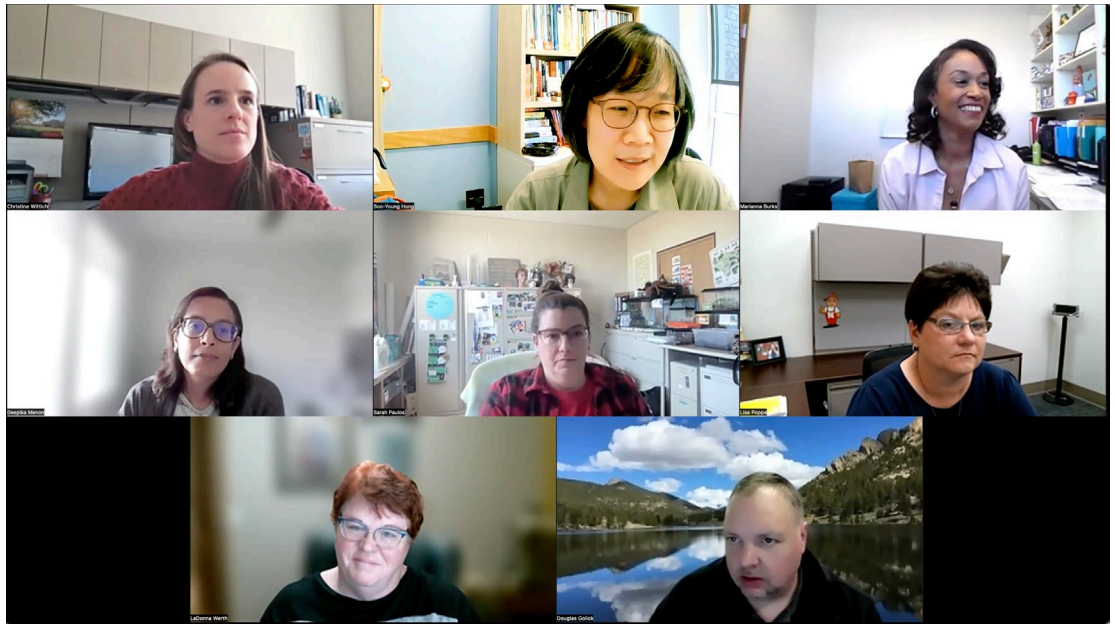
Multidisciplinary Collaboration





Collaborative Learning Sessions

- Science and engineering content sharing with adult learners



Living vs. non-living organisms (p. 16 of First Encyclopedia of Science)
- Plants are living even though you may not see them move (they move very slowly this really considered 'moving' though? They do not move, but they are alive. What would be some other examples like this?)
  - They grow
  - They eat (absorb nutrients)
    - They make their own food (photosynthesis)
  - They breathe (they need air)
  - They react to changes in their environment (temperature, light) – homeostasis
  - Something about water consumption – cellular respiration
  - They get rid of waste
  - Has mass / weight (we can weigh living things)
- This could be made into a "checklist" of sorts for kids to practice with
- Living things that we wouldn't necessarily think as living?
  - Examples: bacteria, fungus, mushrooms, etc.
  - Viruses are not living because they need a host. They wait until they get picked up.

Arthropods
- A group of animals that have a hard outer layer or covering, kind of like an armor (an **exoskeleton**)
- Arthropods include **insects** (flies, beetles, butterflies, bees, ants, termites), **crustaceans** (crab, lobster, shrimp, roly poly / pill bugs – isopods(also sowbugs which are different, pillbugs and roly pollies can roll into a ball (or pill) and do not have appendages out their

What kind of forces are *outside* that can
weather can there be outside?) (ex. Wind, sto
- Could mimic this by having child build a sm
build a structure that might survive strong wind.
Gravity

Important words:

Axial force – A piece of the structure has force applied to it lengthwise (pushi
spaghetti noodle; it will bend or break)
- The **pushing** can lead to something called compression, or the force of an obje
squished, squeezed, or made to be smaller than it is
- **Pulling** can lead to something called tension, or the force of an object being pulled apart, and the object straining to stay in one piece
  - When tension occurs, the object tries its best to hold itself together
- *this made me think of using a stress ball, squeezing it to make it smaller and pulling it to see the material stretch

Slime, small twist balloons,

Shear – pieces of structure sliding apart from each other (the block on top is sliding apart from the block below it)
- This made me think of the game Jenga, and how when we slide a piece of the structure out, it causes instability with the rest of the structure

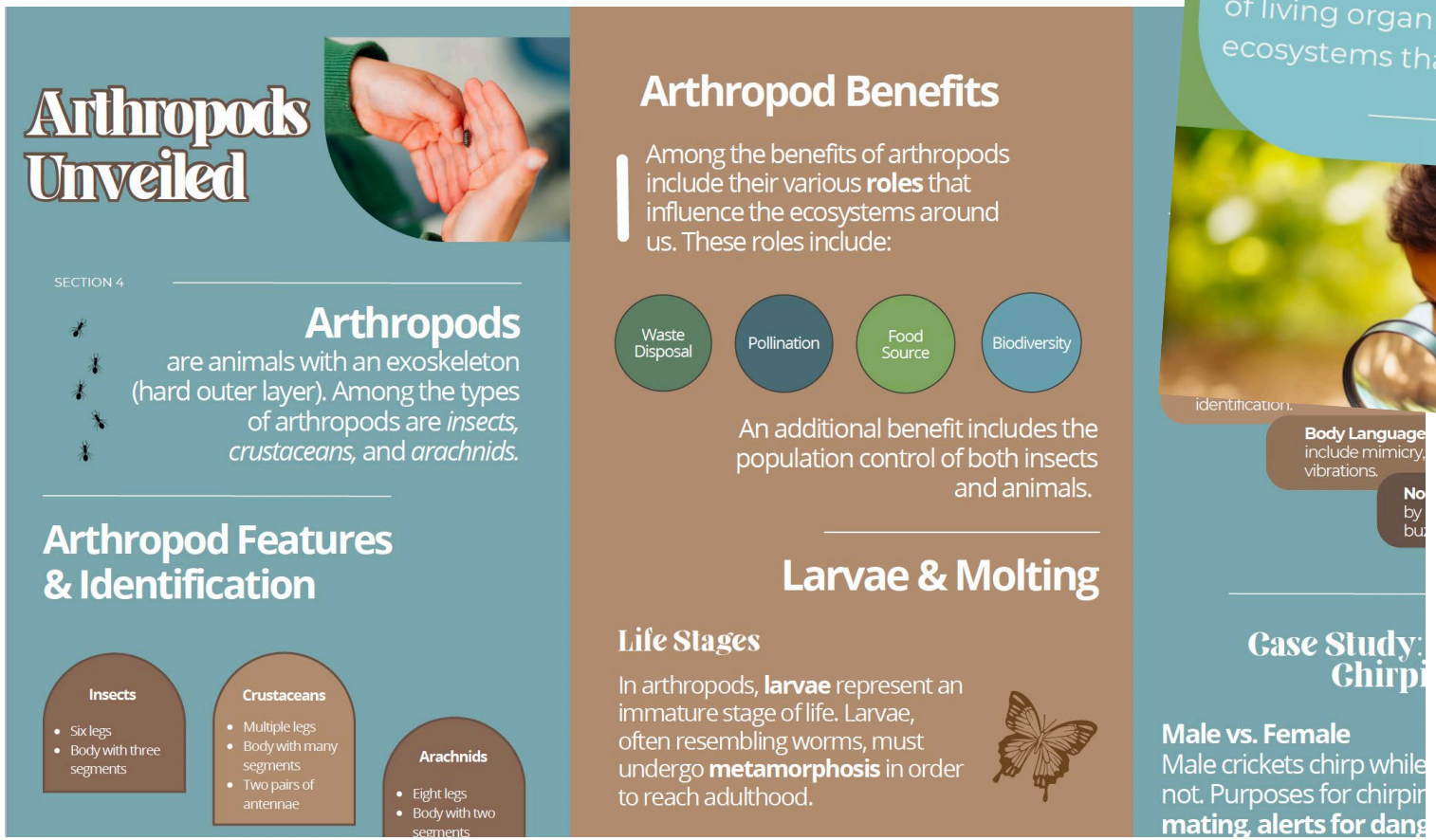
Earthquake
ice jams (? relevant) – water cannot flow through the ice → flooding (bridge, community, houses); force onto bridge

Resource Collection

- Early childhood books and curricula
  - Young Investigators
  - Preschool Pathways to Science
  - Ramps and Pathways
  - Big Questions for Young Minds
  - Making and Tinkering with STEM, etc.
- Professional magazine articles
  - Young Children
  - Teaching Young Children
  - Science and Children
- Nebraska Extension resources
  - STEM Imagination Guides
  - Little Wings Pollinator Science Explorations, etc.

Content Brochures

- Living Organisms & Arthropods



Content Brochures

- Force and Motion & Building Structures

Exploring Force, Motion, and Building Structures with Young Minds

Unlocking the Wonders of Force and Motion

Relative Motion & Position Section 1

Discovering the Ball

- Explore the ball's placement relative to other objects.
- Experiment with moving the ball using various body parts and external objects.
- Understand how properties like weight, size, and texture affect the ball's motion.

Questions to consider:

Where is the ball?
What is the ball doing?
Is the ball to the right or left of (object)?
How can you move the ball?

When we push the
from us, or towa
we pull?

Gravity's Influe

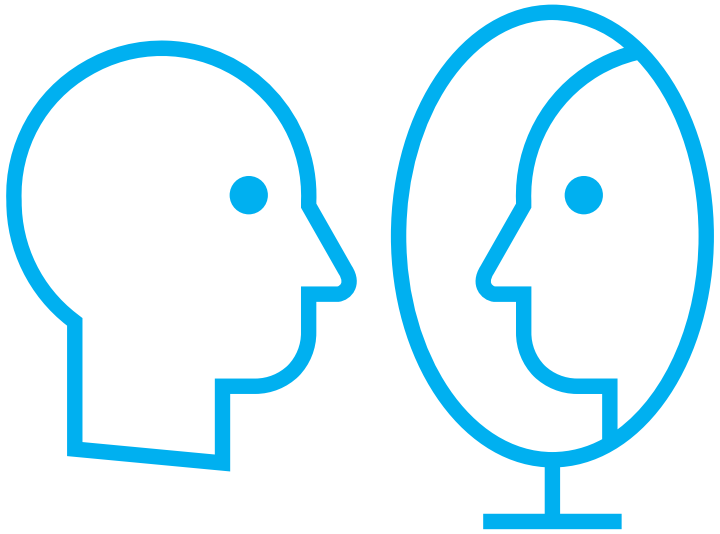
- Visualize gravity as the forc
pulling objects toward th
ground.
- Understand its impact on th
movement of everyday items.

Questions
consider:

Think about gravity by toss
ball in the air. What happens
the ball is tossed? Does it
back down on its own?

Reflections from the Team

What we have learned so far…



Next Steps

Spring 2024	Summer 2024	Early Fall 2024	Mid-Fall 2024 to Spring 2025	2025-2026
• Finalization of PD resources and assessment measures	• Feasibility test with four early childhood educators	• Revisions to PD resources and assessment measures	• Implementation of the PD in rural Nebraska communities	• Data coding and analysis • Proposal for a larger-scale project

See you at 2026 EC Research Summit!

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Thank you!
Questions?

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