An Exploration of Kindergarten Students’ Use of Perspective and Computational Thinking

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Overview

Theoretical Grounding
- Perspective
- Computational Thinking (CT)
- Mathematics and CT

The Problem
- Limited research on CT
- Even Less in Early Childhood

Research Questions
- Perspectives
- CT Skills

Methodology
- Participants
- Data Sources
- Procedures
- Data Analysis

Results
- Perspectives
- Debugging
- Procedures
- Data Analysis

Future Direction
- Implications
- Practical
- Research
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Focus

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Positioning in the Literature

- Computational thinking (CT) is arguably one of the most critical twenty-first century skills (NRC 2010, 2011; Ioannou & Makridou, 2018; Wing, 2006).

- Common elements of CT are: abstraction, decomposition, algorithms, and debugging (Angeli, 2016; Shute et al., 2017; Weintrop, 2016).

- Limited research on CT in early childhood (Bers et al., 2014).

- The available CT research is focused on middle level, high school, and college aged individuals (Yadav et al., 2018).
Problem and Purpose

- High school students’ ability to transition from allocentric (3rd) to egocentric (1st) perspectives helped guide them in coding tasks (Smith, Berland, & Martin, 2014).

- The field has limited knowledge of how kindergarten students’ perspective is related to their CT skills.

- Better understand kindergarten CT skills as they interact with coding robots.
Operationalizing Perspectives

Egocentric (1\textsuperscript{st}) Perspective
- Crawling behind the robot
- Gestures and body positioning

Allocentric (3\textsuperscript{rd}) Perspective
- Remaining in original position to watch progression
Operationalizing one CT Skill

Debugging

- Identifying and modifying an algorithm in attempt to complete a task.
- Identifying, monitoring steps, adjusting codes in sequence
Research Questions

**Research Question #1:** How do kindergarten students engage in egocentric and allocentric perspectives when engaged in a coding robot task?

**Research Question #2:** What computational thinking skills emerge during an allocentric or egocentric perspective?
Methods
Participants

1. 4 Students
   (Beginning of larger scale study)

2. Small, Private Kindergarten Classroom

3. 5 Years Old
Coding in Kindergarten Progression of Tasks

Our selection for data analysis:

Coding Robot Task 5
How do Students use Code-a-Pillar?

Run the code on the grid to complete a challenge

Students attach code pieces on the body
Data Sources

- Video and Audio Recording
- Two Camera Views:
  - Ground Floor View
  - Researcher Held
**Data Analysis**

**RQ 1:** Frequency counts of perspectives with pivot tables
- Double coded 50%

**RQ 2:** Qualitative iterative coding process for CT skills
- Determined debugging as *critical event* (Powell, Francisco, & Maher, 2003) *emerging within egocentric perspective (1st)*
Results
## Perspectives

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<thead>
<tr>
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Emergence of CT Skill within Egocentric (1\textsuperscript{st}) Perspective

- From coding perspectives, debugging emerged as a critical event while students were engaged in an egocentric (1\textsuperscript{st}) perspective.

- Examples will illustrate this CT skill while students interact with the coding robot.
Shift from Allocentric to Egocentric

- Student tries to code [straight, rotate left, straight].
- Figure 1 is initial code.
- Figure 2 is debug while maintaining allocentric perspective.
- Figure 3 is debug while shifting into egocentric perspective.
Egocentric Helped Debug

• This student engaged in egocentric (1st) by crawling behind the robot and looking straight down his line-of-sight.
• Doing this with her initial incorrect code, she proceeded to successfully debug and create an accurate sequence.
Student Struggled to Debug in Allocentric

- A student attempted to complete a puzzle with a correct sequence of [straight, right turn, straight] while maintaining an allocentric (3rd) perspective.
- She kept her body in her original position as the robot completed the sequence as well as when she put a new code on the robot.
Summary

A Practical Take-Away:
Kindergarteners’ ability to engage in an egocentric (1st) person perspective may help with debugging of coding robots

Future Directions

- Increase Sample Size
- Quantify Effect of Perspective on Debugging
- Other CT or Mathematical Skills
Questions?

If you have any further questions, please feel free to contact us at jkozlowski@aggiemail.usu.edu.

In addition, please see other work by the Coding in Kindergarten (CIK) research team, funded by a USU Research Catalyst grant.


References


