Coding to Develop Early Mathematical and Computational Thinking in Kindergarten: A Case Study

Lise E. Welch, Joseph S. Kozlowski, Hannah Evans
Mentors: Drs. Jessica F. Shumway, Jody Clarke-Midura, Victor R. Lee
Graduate Student Research Symposium, April 11, 2019
Introduction
Problem and Purpose for this Case Study

Problem:

- Increasing need to meaningfully integrate computer science skills with mathematics (Weintrop et al., 2016)
- The integration of computational thinking and mathematics skills is an area lacking in early childhood.

Purpose:

- Investigate a situation in which CT and mathematics skills might manifest in a complementary way
- Describe how CT and mathematics skills interplay within a technology task
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” (Schute, Sun, & Asbell-Clarke, 2017).
Methodology
Research Question

What mathematical thinking (MT) and computational thinking (CT) skills arise when a pair of five-year-old kindergarten students participate in a series of robotics coding tasks?
Participants and Setting

- One pair of students (Bowen and Chloe)*
- Five-year old children
- Private preschool kindergarten

*Each child is given a pseudonym for anonymity. The pair of students in this study are not pictured in this presentation.
### Tasks

<table>
<thead>
<tr>
<th>Programmer Says</th>
<th>Get Moving</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crack the Code</td>
<td>Introduction to Code-a-pillar</td>
</tr>
<tr>
<td>Code-a-pillar Challenges</td>
<td></td>
</tr>
</tbody>
</table>
Each task, with the exception of the first, was video-taped with both a stationary and a roving camera.
Data Analysis

- Major elements identified using knowledge, skills, and abilities
- Coded video clips exhibiting these elements
- Coding analyzed for pattern emergence, then categorized into major themes
Results and Conclusion
Research Question

What MT and CT skills arise when a five-year-old kindergarten student participates in a series of robotics coding tasks?

MT and CT Themes

MT:
- Iterations and Spatial Reasoning

CT:
- Debugging and Problem-Solving
MT

Iterations and Spatial Reasoning
CT

Debugging and Problem-Solving

1. Identified a problem
2. Planned a solution strategy
3. Enacted the plan
4. Tinkered with the code
5. Tested the new code
6. Tested the new code
Other work by the Coding in Kindergarten (CIK) research team, funded by a USU Research Catalyst grant.


Further questions may be directed to our team at lisewelch@hotmail.com.


