Tangible Kindergarten: Developing Computational Thinking in a Robotics Context in the Early Childhood Classroom

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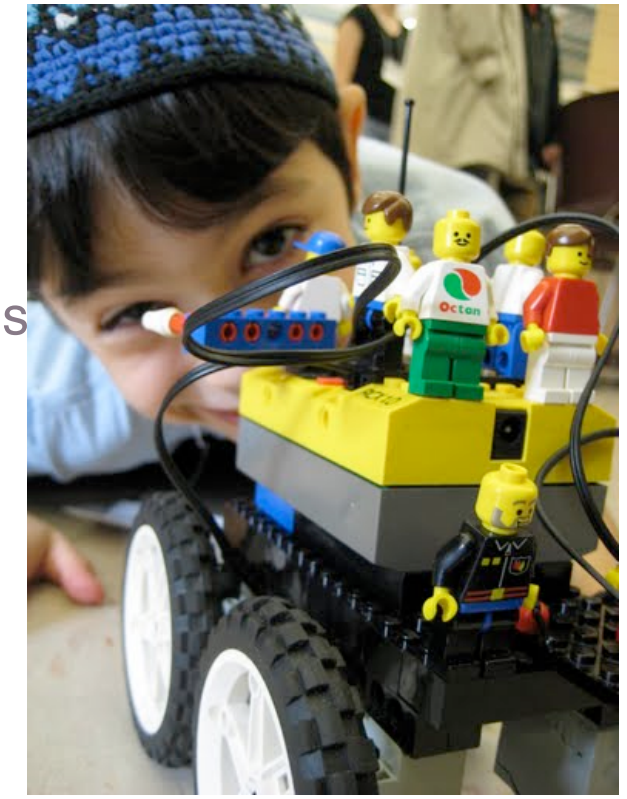


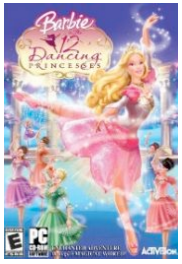
Two scenarios for playful learning

Playpens

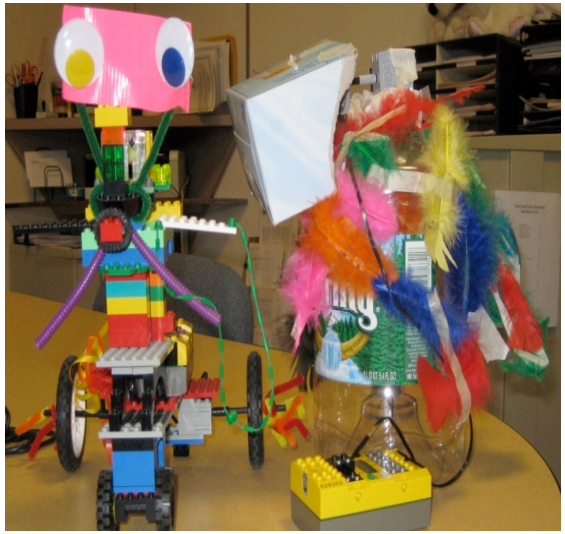
Playgrounds

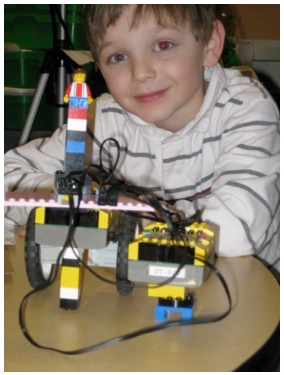
What is the connection with technology and young children?

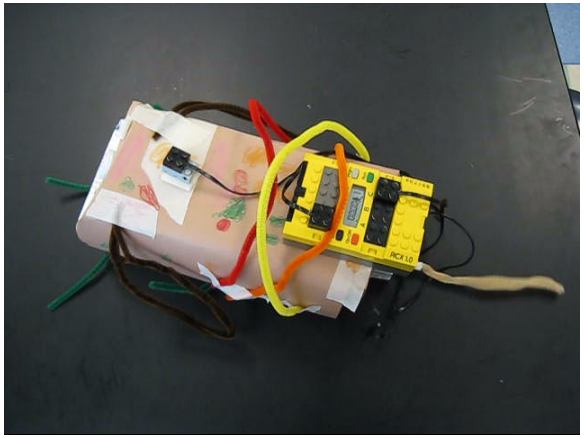
When most people think about technology and young children, they think about…..

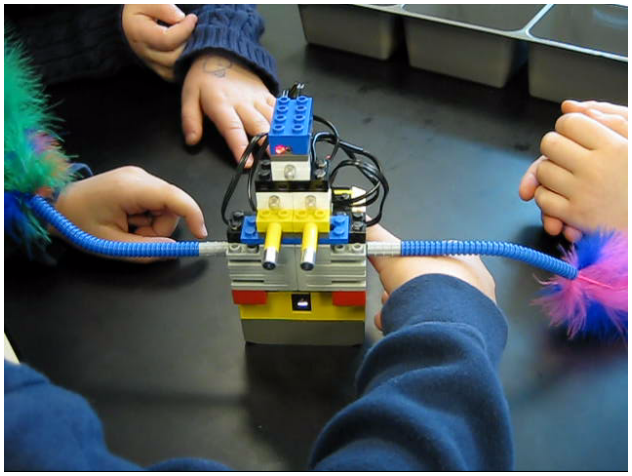


We also think about robotics…









Tangible Programming with CHERP

Programming robots with “smart” wooden blocks

Why robotics in early childhood?

Learning about:

The human-made world around us

A world of bits and atoms

Mechanics and electronics

Learning through:

Designing and programming

Problem posing and problem solving

Creating and testing

Robotics in early childhood education

In terms of development:

Social development (collaboration, team work)

Emotional development (perseverance, self-esteem, self-efficacy)

Cognitive development (sequencing, logical thinking involved in programming)

Sensori-motor development (building, using materials, engineering process)

In terms of executive functions

Goal setting and planning (engineering design process)

Organization of behaviors over time (project management)

Flexibility (debugging, adaptation)

Attention and memory systems (focusing on a project's full-cycle)

Self-regulatory processes (self-monitoring)

Tangible programming in Kindergarten

CHERP

Tangible Building Blocks

DevTech Research Group
Tufts University

Tangible Kindergarten Project

- To provide evidence of young children's understanding of robotics programming
- To develop young children’s learning trajectories about computational thinking in a robotics context
- To understand the relationship between robotics programming and:
    - literacy development
    - development of executive function
    - self-regulation
- To develop and test developmentally appropriate robotics curriculum
- To study how different interfaces (TUI/GUI) impact children's learning

A Curriculum of Powerful Ideas

Collection of activities organized around **powerful ideas** from computer programming and robotics:

- Computer Programming
- Engineering design process
- Command Sequences & Flow-of-Control
- Loops
- Sensors
- Parameters
- Conditional Branches

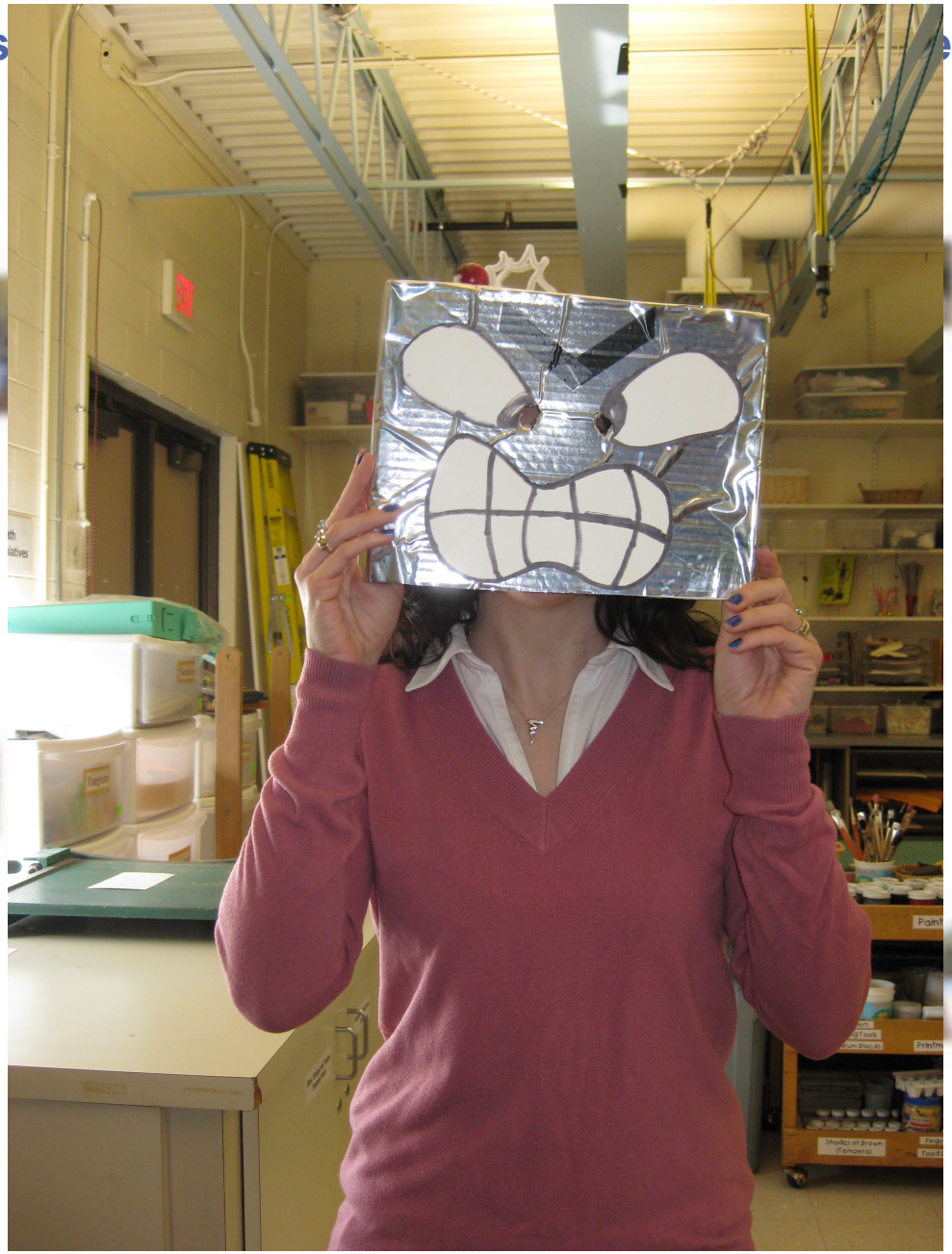
Computational thinking

"To reading, writing, and arithmetic, we should add computational thinking to every child's analytical ability. Just as the printing press facilitated the spread of the three Rs, computers facilitate the spread of computational thinking. Computational thinking involves solving problems, designing systems, and understanding human behavior, by drawing on the concepts fundamental to computer science."

(Wing, 2006)

abstraction

Programs evelopment framework

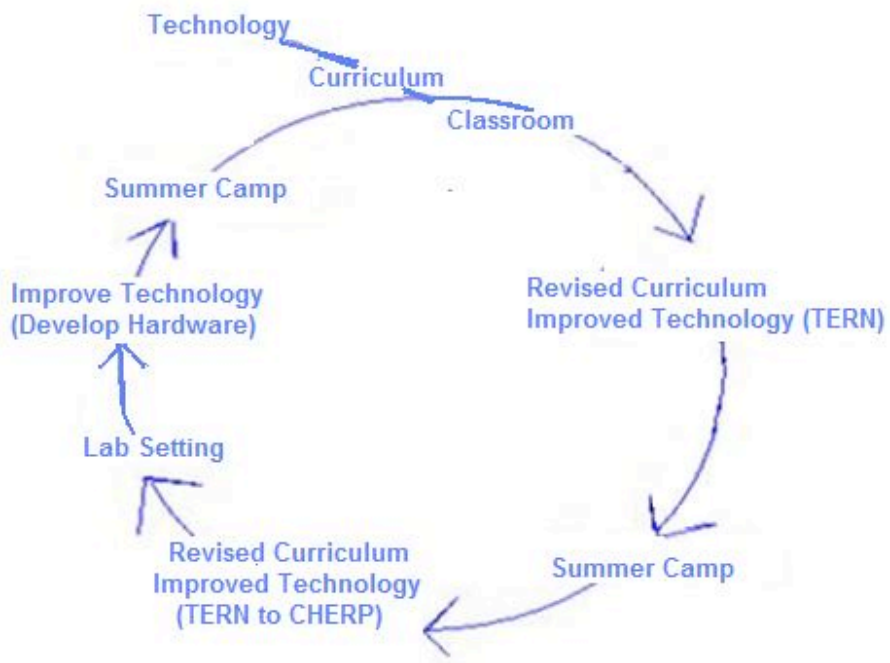


Research Design

Data collected through video-taping sessions, tasks and pre-post questionnaires and assessments, computer logs

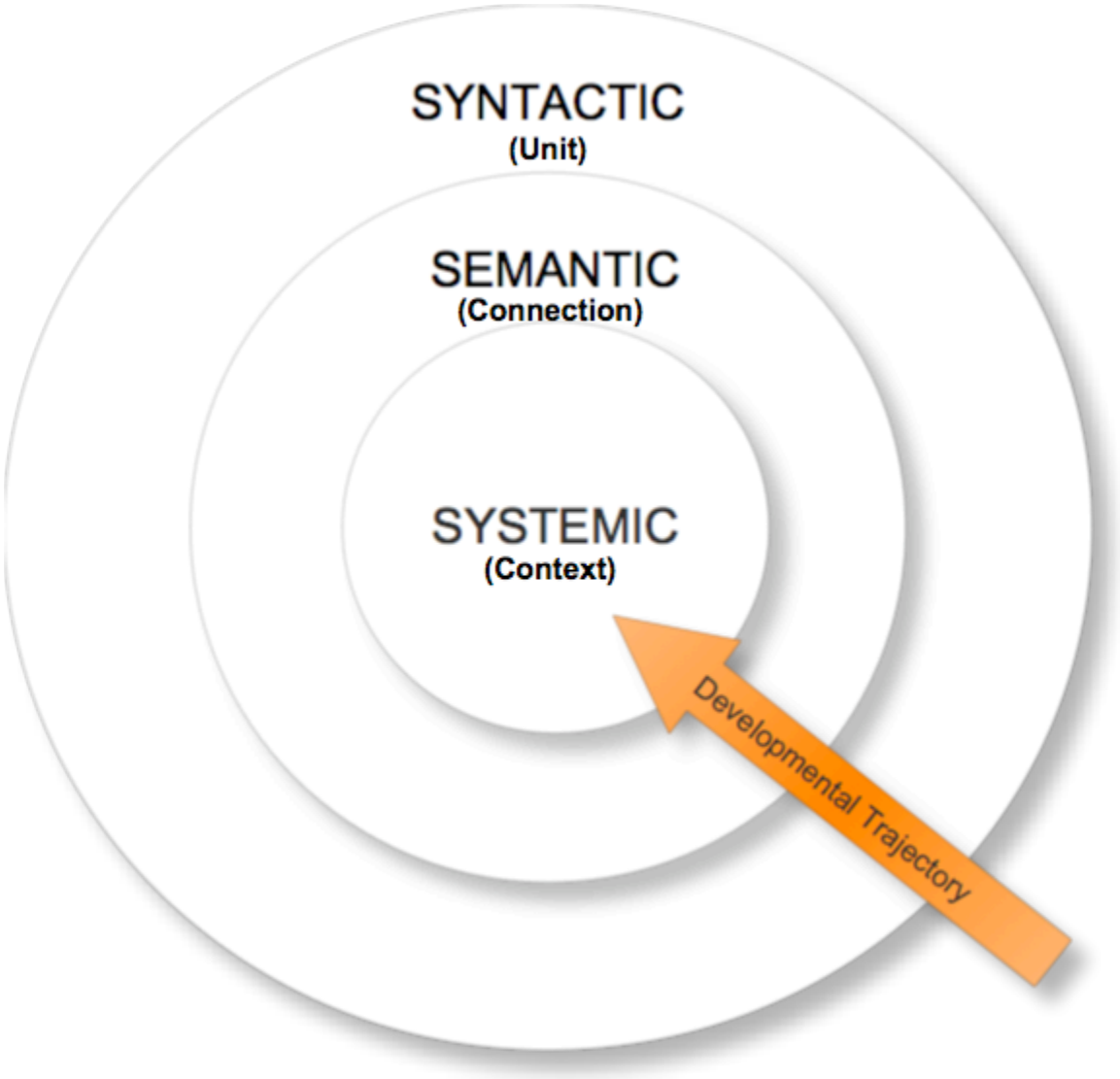
Year 1 (2008-2009)
Natural setting
4 Kindergarten Classrooms
(n=80)
Summer Camp (n=41)

Year 2 (2009-2010)
DevTech Lab setting
35 kindergarten students
(5 – 6 years old)
1 session in group of 4 children
3 sessions one-on-one, 1.5 hours each, held within 1 month
Community Outreach Summer Camp

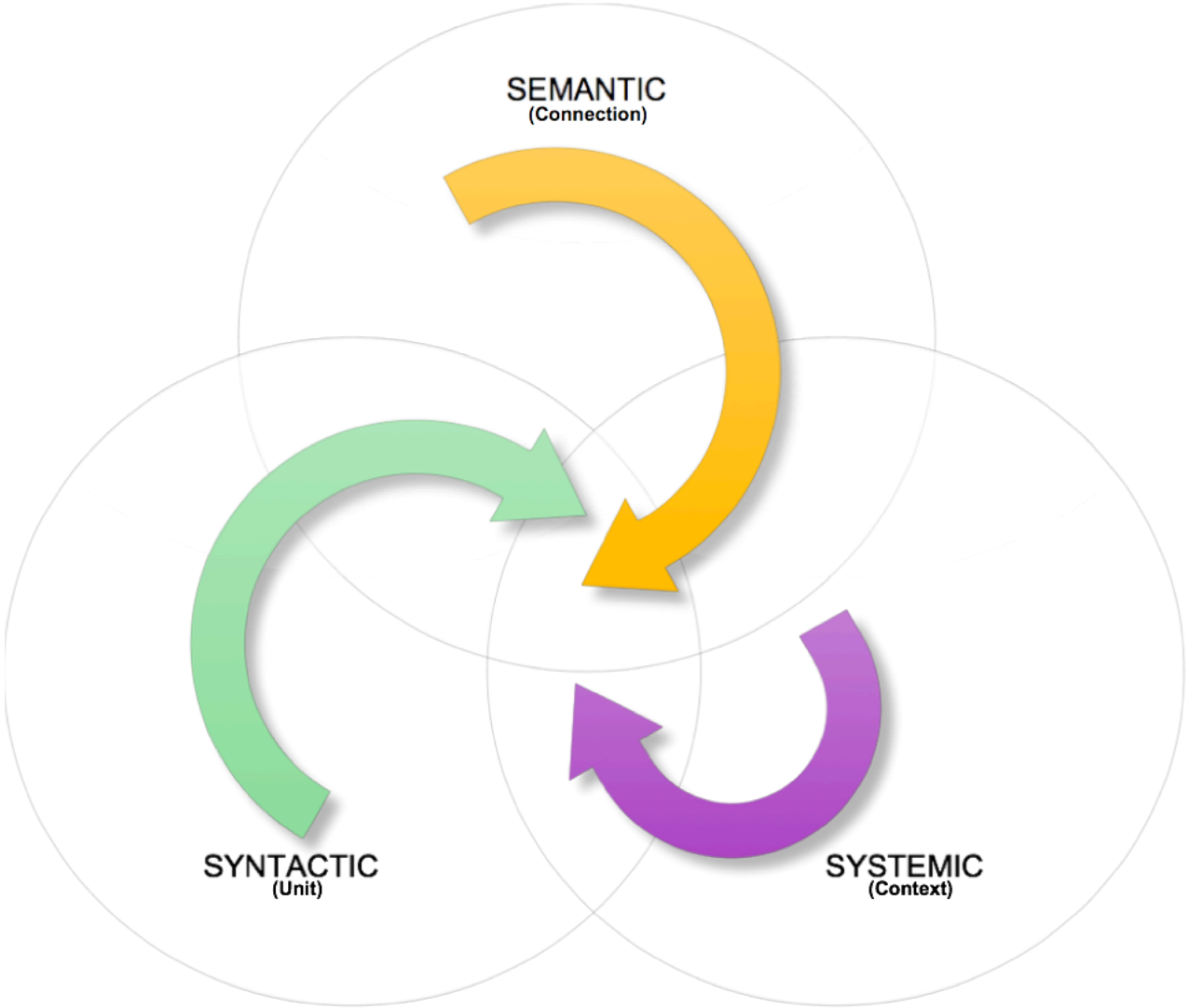


Year 3 (2010 – 2011)
Natural Setting
3 Kindergarten classrooms
Kindergarten Teachers Facilitating

Levels of understanding: trajectories



Levels of understanding: trajectories



Questions? More information?

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