

INVESTIGATING THE ROLE OF PHYSICAL INTERACTIONS IN DEVELOPING MEANING IN CHILDREN'S MATHEMATICAL PLAY

Paul N. Reimer
AIMS Center for Math and Science Education

OVERVIEW

Play-based pedagogies are often seen in tension with increasing accountability for young children's academic readiness, even though scholars have suggested that play is a critical disposition in STEM learning. Our research group is engaged in a multiyear partnership with two Head Start preschool centers to explore opportunities for embodied mathematics learning in various seeded interest areas that encourage mathematical play (Wager, 2013). In this poster, I present one case of how a preschool child made use of sensory-motor schemes in interaction with elastic bands to ground conceptions of rectangles during self-directed play.

PURPOSE & PERSPECTIVES

This study draws on embodiment pedagogical design principles that include **artifact-mediated activity, materials, and facilitation** (Abrahamson & Lindgren, 2014). Given that this framework was implemented in preschool classrooms, design elements centered around **child-initiated activity during construction play** (Wager, 2013) in which conceptual meanings arose from the designed objects and ideas children developed while interacting with the objects. This study builds on work that highlights the interconnectedness of these resources and suggests that human bodily experiences form the basis of conceptual understanding (Núñez, Edwards, & Matos, 1999).

Case Study

Lily explored rectangles on the geoboard in a small group interest area.



Fig. 1.1 In her first attempt to create a rectangle, Lily began by stretching the band with her index fingers to match the length between two corners.



Fig. 1.2 She then incorporated her thumbs into the stretched figure in order to increase the width of the rectangle.



Fig. 1.3 Lily realized she could not place the band on the board with her fingers pointing upward.



Fig. 1.4 Lily reshaped the rectangle with her thumbs and fingers pointing downward and places the rectangle on the geoboard.



Fig. 1.5 As she continued to make rectangles, Lily's activity shifted. She started by hooking the band onto two corners.



Fig. 1.6 She then used her thumbs to stretch the band around two additional corners.



Fig. 1.7 Lily's activity continued with the replication of rectangles across the geoboard by stretching the band one corner at a time.

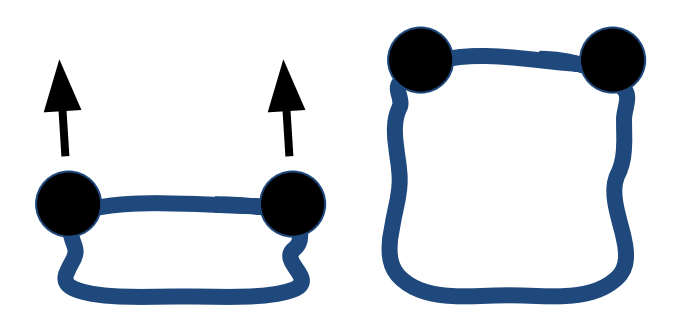
METHOD

I analyzed preschool children's (n=12) play as they engaged in 15 minute sessions of self-directed play in several interest areas within preschool classrooms at two Head Start centers.

FINDINGS

Lily's exploration of rectangles involved a shift in object-mediated activity that suggests a developing conception of properties of rectangles. Her bodily actions with the elastic band began to take advantage of the anchoring of two vertices and manipulating of the other two.

Fig. 1.8 Two vertices are stretched upward while maintaining parallel opposite sides.



Ongoing implementation of this pedagogical design involves 1) facilitation that encourages young children to reflect on their activity and resulting constructions, and 2) exploration of the residual effects of interactions with the elastic bands that may persist in their absence.

IMPLICATIONS

Broadly speaking, young children's bodily engagement with materials and their own gesturing supported the development of meaningful contexts for learning. Findings affirm the relevance of embodiment design principles that allow young children to enact playful interpretations of activity based on bodily interactions with objects in their environments.

REFERENCES

- Abrahamson, D., & Lindgren, R. (2014). Embodiment and embodied design. In R. K. Sawyer (Ed.), *The Cambridge Handbook of the Learning Sciences* (pp. 358–376). Cambridge: Cambridge University Press.
- Núñez, R. E., Edwards, L. D., & Matos, J. F. (1999). Embodied cognition as grounding for situatedness and context in mathematics education. *Educational Studies in Mathematics*, 39, 45–65.
- Wager, A. A. (2013). Practices that support mathematics learning in a play-based classroom. In L. D. English & J. T. Mulligan (Eds.), *Reconceptualizing early mathematics learning* (pp. 163–181).

