

# Spatial Thinking for Parents and Preschoolers: Benefits, Challenges, & Future Pathways

Funded by the  
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# Finding Our Way Around (FOWA)

- **Overall Goal:** produce and pilot test a digitally-enhanced, spatial thinking unit for preschoolers and their parents.
- **Spatial Learning Blueprint** - Articulates learning goals by age
  - Built off of Clements & Sarama (2009) Spatial Orientation Trajectory (did not address Spatial Visualization) & included information from literature review
- **Parallel development** of (1) unit activities and (2) child assessment
- **Formative Testing**
- **Pilot Study**

# FOWA Intervention Components

- 6 weeks @ home
- 3 Digital Games
  - Farm World
  - City World
  - Road Play
- 3 Books
- 15 non-digital activities (8 repeat)



**Spatial Thinking Activities Overview**  
Boost your child's math skills with these fun activities!

	Book Time	Meal Time	Paper Play Time	Out-and-About Time	App Time: Road Play	App Time: Map Adventure
<b>Week 1</b>	<i>The Cat in the Hat: There's a Map on My Lap!</i> (15 min)	Two Recipes (15 min)	Map Drawing (10 min)	Simon Says (10 min)	Road Play (10 min)	Map Adventure! (10 min)
<b>Week 2</b>	<i>The Cat in the Hat: There's a Map on My Lap!</i> (15 min)	Seat Swap (10 min)	Farm Adventure Game (15 min)	Neighborhood I Spy (10 min)	Road Play (10 min)	Map Adventure! (10 min)
<b>Week 3</b>	<i>Lucy in the City</i> (15 min)	Set the Table Please (10 min)	Map Drawing (10 min)	Landmark Run (10 min)	Road Play Play with the Gracie printout! (10 min)	Map Adventure! (10 min)
<b>Week 4</b>	<i>Lucy in the City</i> (15 min)	Two Recipes (10 min)	City World Maze (10 min)	Tour Guide (10 min)	Road Play Play with the Gracie printout! (10 min)	Map Adventure! (10 min)
<b>Week 5</b>	<i>Follow That Map!</i> (15 min)	Seat Swap (15 min)	Farm Adventure Game (15 min)	Scavenger Hunt (10 min)	Road Play Play in your world! (10 min)	Map Adventure! (10 min)
<b>Week 6</b>	<i>Follow That Map!</i> (15 min)	Set the Table Please (10 min)	Secret Map (15 min)	Right and Left Arrows (10 min)	Road Play Play in your world! (10 min)	Map Adventure! (10 min)

## Pilot Study Version of Farm World

In the Farm World prototype, children and parents visit farm animals by dragging their characters along the farm path. When the characters arrive at their assigned animal, children and parents take a picture of themselves and then play a spatial vocabulary interactive.





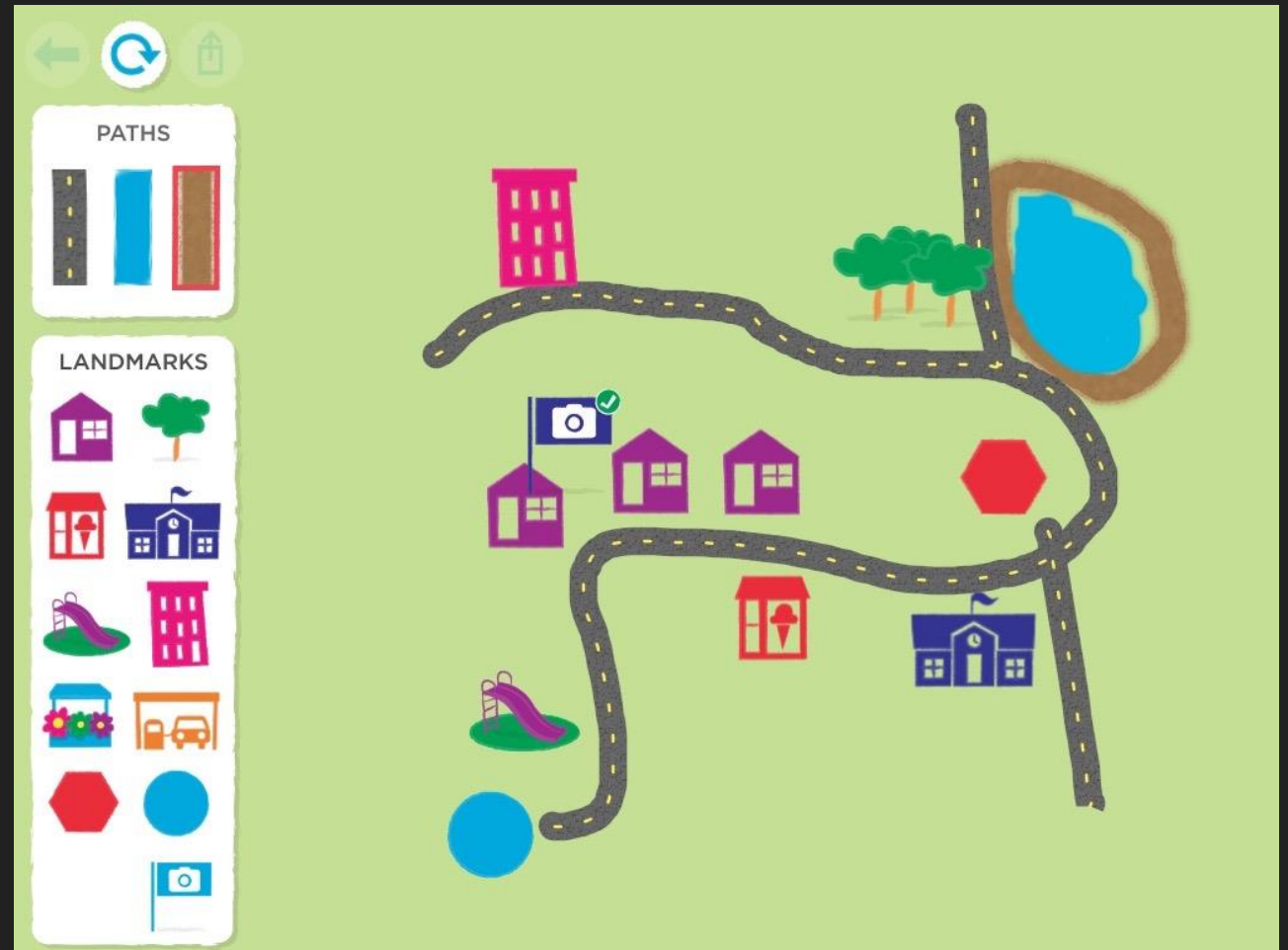
## Pilot Study Version of City World

In the City World prototype, children and parents can drag their cars to navigate to different landmarks on the city map. When the cars arrive at the assigned landmark, children and parents take their picture together and then play a spatial vocabulary interactive.



## Pilot study Version of Road Play

In the Road Play prototype, children can place icons on the screen and draw paths (either road, dirt, or water) around and through the landmarks to create their own maps of real or imaginary places. Children and parents also have the ability to add a photograph to a landmark by placing the photo flag to the screen, thus documenting their real world in their map creations.



# FOWA Pilot Study

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Preparation				Study Implementation						Post			
Child pre-Assessment		Parent Orientation		Full implementation of weekly digital and non-digital activities in the home						Child post-assessment		Parent Surveys	
Dyad pre-assessment		Parent survey								Dyad post-assessments		Parent interviews	

- **49 Dyads** – Parent/Caregiver + Preschool Child
- Data Collected:
  - Child assessment (individually administered) – pre- and post-intervention
  - Dyad activity observation (parent + child) – pre- and post-intervention
  - Parent surveys and interviews

# FOWA Findings 1

- **Child Assessment:** children made significant improvements from pre- to post-testing sessions,  $t(34) = 4.98, p < .001$ .
- ***Children learned!***



# FOWA Findings 2

- **Dyad Observation:** several indicators of parental support during the activity significantly decreased
  - frequency of assistance,
  - verbal directions,
  - physical directions,
  - navigation strategies, and
  - feedback (all  $p=.000$ ).
- **Children did not need as much support after the intervention to engage in the spatial thinking activities successfully!**

# FOWA Findings 3

- **Parent Feedback:**

- Overall enjoyable activities that the parents felt helped their child learn math skills,
- Parent guide was useful and met their needs (except for language) but they preferred the paper version,
- Parents reported that they learned new strategies for working with their children,
- Parents requested more and harder digital activities,
- Most parents want to use these activities in the future.

# FOWA Findings 4

- **OVERALL** – A parent intervention that is designed specifically for preschoolers provides an engaging experience and is promising for impacting math learning happening at home.
- **Limitation:**
  - no comparison group in this study
  - Current intervention does not link learning in the classroom with learning at home

# Implementation in homes of DLLs

- While study did not purposefully recruit DLLs, children who met criteria (fluent in English) were in various contexts in terms of use of language. For example, some:
  - Children were fluent in English but preferred to speak Spanish at home with their family
  - Children were fluent and preferred English, but had parents who were fluent in English but preferred speaking in Spanish
  - Children and parent were fluent and preferred English, but interacted with other family members who spoke only Spanish (and hence interactions occurred in Spanish)

# Data Collection Implications

- Observations Issues/Findings

- Even when child and parents reported as fluent in English, interactions occurred in Spanish and hence having a bilingual assessor would have been beneficial
- Q&A: How should researchers make a priori decisions about this? Should there be questions about comfort/preference rather than fluency/ability?



# Data Collection Implications

- Survey Issues/Findings

- Providing survey in both languages may be best when working with families that speak more than one language, even if one caregiver reports being fluent in English
- Q&A: What are best formats to guarantee maximum response...should questions in various languages be provided side by side or should different forms be available for each language. These may seem like unimportant issues but they may influence responses.

# Data Collection Implications

## ○ Assessment Issues

- Assessments of learning not always available in both languages
- Additionally, many children switch between Spanish and English so an assessment of either language may underestimate their ability (conceptual score models are probably ideal but not as available).
- Q&A: What assessment procedures are best under current constraints?

# Technology Implications

- Provides new forms of well-designed, repeatable, scaffolded activities
  - games support practice and provide feedback
  - Same content addressed in various contexts/formats
- Supports Joint Engagement with Media
  - Collaborative games support discussions and social skills between parents and preschoolers
- This adds credence to our approach of selectively integrating tablet-based games into the preschool learning experiences.

## Final Game

The final game combined farm world, city world, the interstitial activities (short activities), and added the “goat challenges” in response to parents request for more challenging activities. The goat challenges require two players to collect animals without running into moving goats. This is a 2 player game!



# For more information:

- Activities and links to Apps: <http://first8Studios.org>
- Related project info:
  - <http://cct.edc.org/projects/finding-our-way-around>
  - <http://cct.edc.org/projects/next-generation-preschool-math>
  - <http://www.sri.com/work/projects/next-generation-preschool-math>
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