

Scaffolding Parent-Child Storytelling and Building Spatial Knowledge during Museum-Based Tinkering

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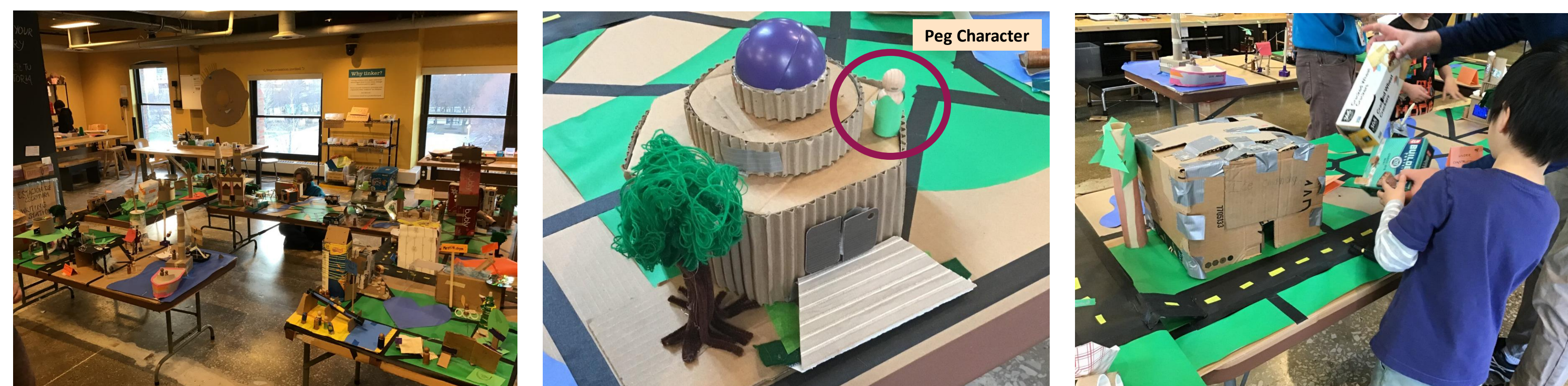


Introduction

- Family storytelling and connecting to children's prior experiences during informal STEM learning activities can support engagement (Callanan et al., 2017; Haden et al., 2023).
- Further, how activities are designed can influence families' STEM engagement and what they take away from these experiences (Marcus et al., 2021).
- Children's spatial language generation during informal STEM learning activities can promote engagement and improve overall spatial cognition (Pruden et al., 2011).
- We explored how families' use of story supports (i.e., toy characters) and program facilitation style (i.e., workshop vs. "drop in") impacted:
 - Families' associations to past experiences and fantasy elements while tinkering.
 - Children's use of spatial language when reflecting afterwards.

Participants & Method

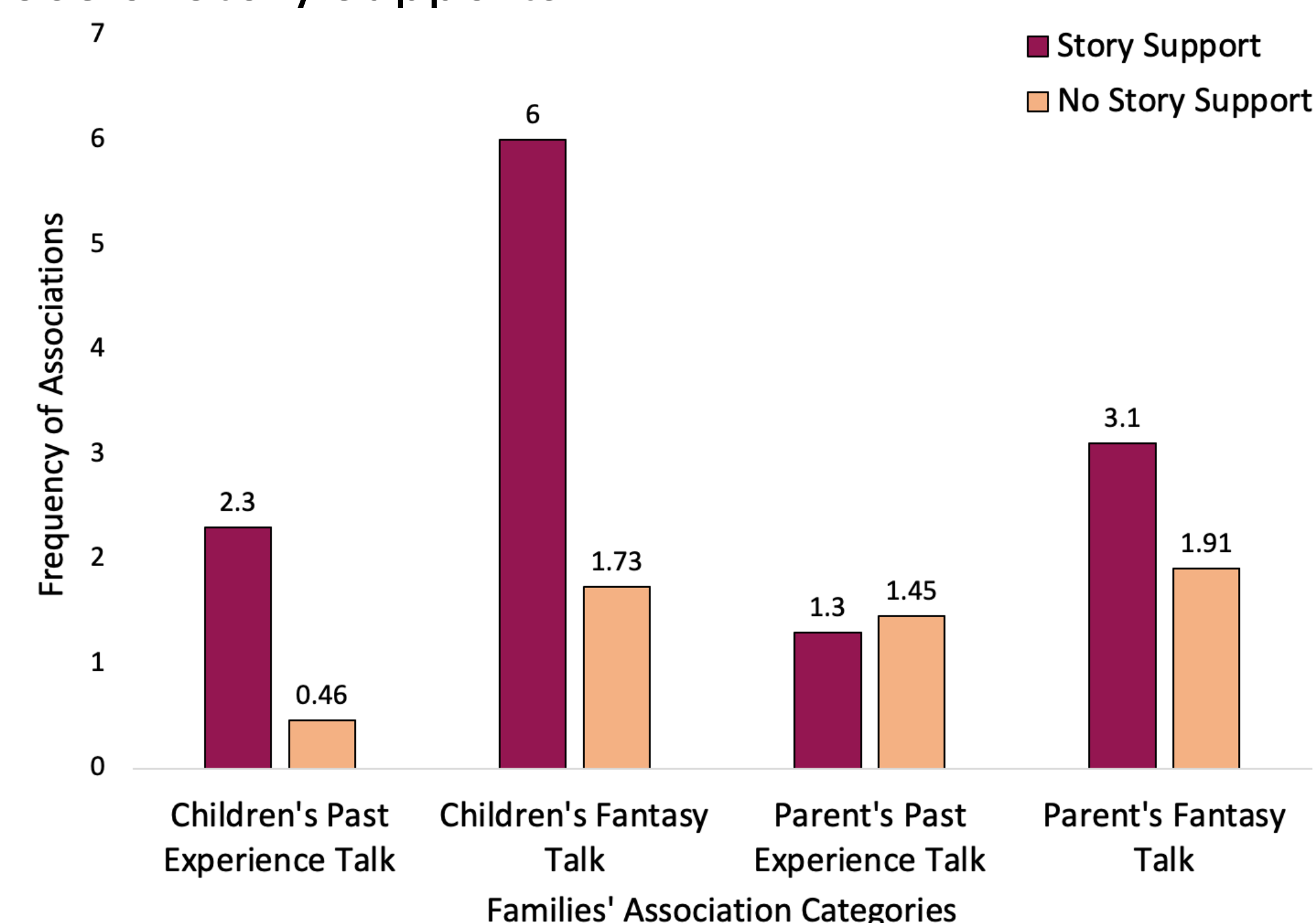
- Tinkering Activity:** 23 families with children between 4-10-years-old ($M = 7.22$) were asked to create a structure for an evolving cardboard neighborhood.
 - 65% male, 35% female children
 - 43% Caucasian, 17% Asian, 13% Latine, 13% More than one, 13% Unreported
- Facilitation:** Families participated in the activity as either a drop-in ($n = 15$), where they received an individual orientation from a facilitator, or a workshop ($n = 8$), where several families received a group orientation to the activity.
- Story Supports:** Families either incorporated wooden peg characters into their creation ($n = 11$) or did not use wooden peg characters ($n = 12$).
- Post-Tinkering Reflections:** After tinkering, a researcher interviewed the child about their creation (e.g., Why did you decide the neighborhood needed this?).



Category	Codes	
Families' Tinkering Interactions		
Fantasy Associations	Frequency of talk about framing the task through fantastical storytelling (e.g., fictional characters and locations/places).	
Past Experience Associations	Frequency of talk connecting the task to their past experiences or activities (e.g., "Are they gonna have umbrellas for the rain, like your team does?").	
Children's Post-Tinkering Reflections		
Spatial Talk (Cannon et al., 2007)	Spatial Dimensions	Big, long, narrow, size
	Shapes	Circle, rectangle, cylinder
	Locations/Directions	From, under, left
	Orientations/Transformations	Turn, tilt
	Continuous Amounts	Part, more, room, inch
	Deictics	Here, there, wherever
	Spatial Features	Side, curve, angle
Patterns	Next, before, repeat	

Results

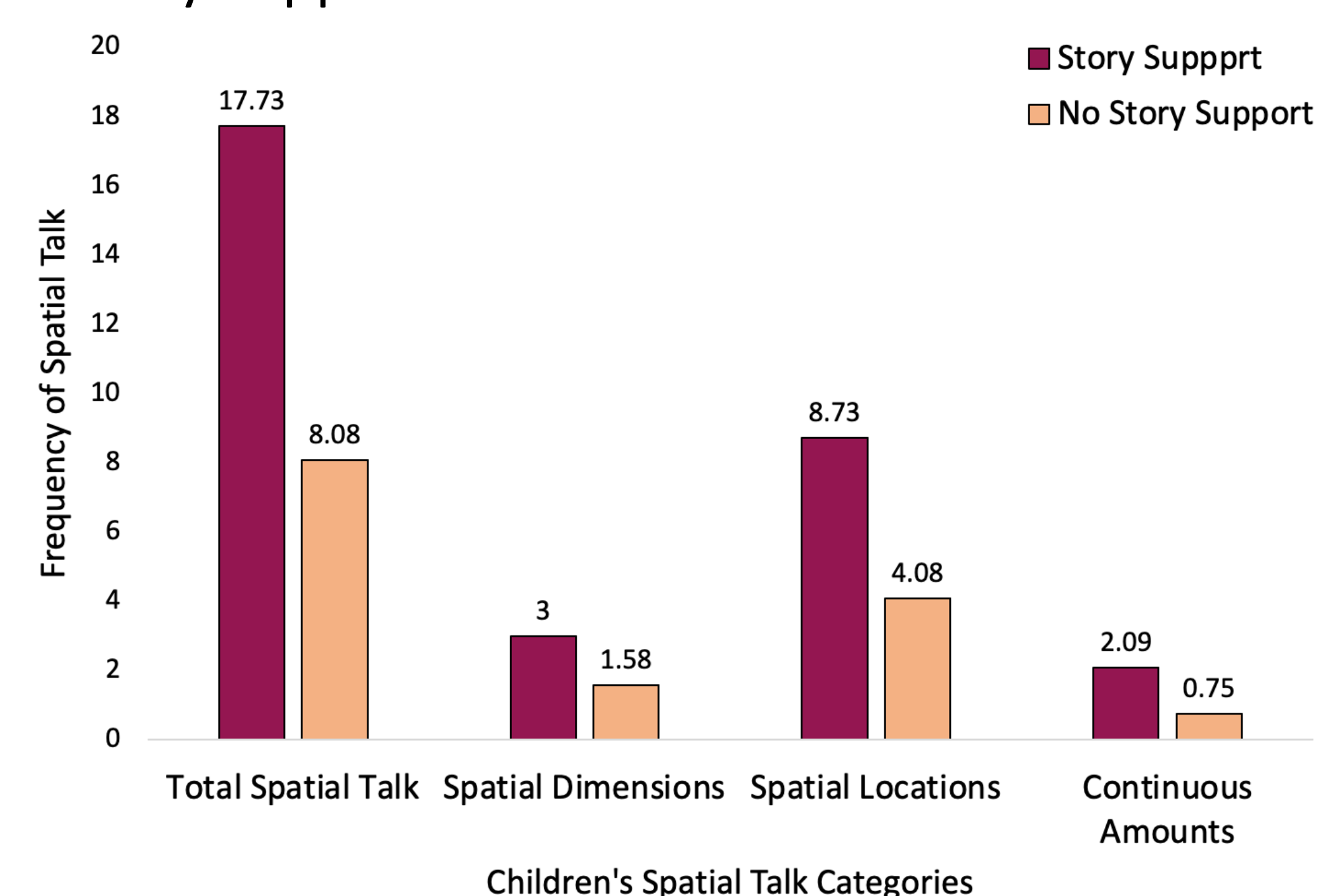
Figure 1. Families' Associations During Tinkering by Use of Story Supports



- As shown in Figure 1, families who used story supports talked more about fantasy elements, compared to those who did not: Parents, $F(1, 16) = 4.44, p = .05$, and children, $F(1, 16) = 14.96, p = .001$.

- Children who used story supports also made more associations to past experiences, compared to those who did not, $F(1, 16) = 8.00, p = .01$ (see Figure 1).

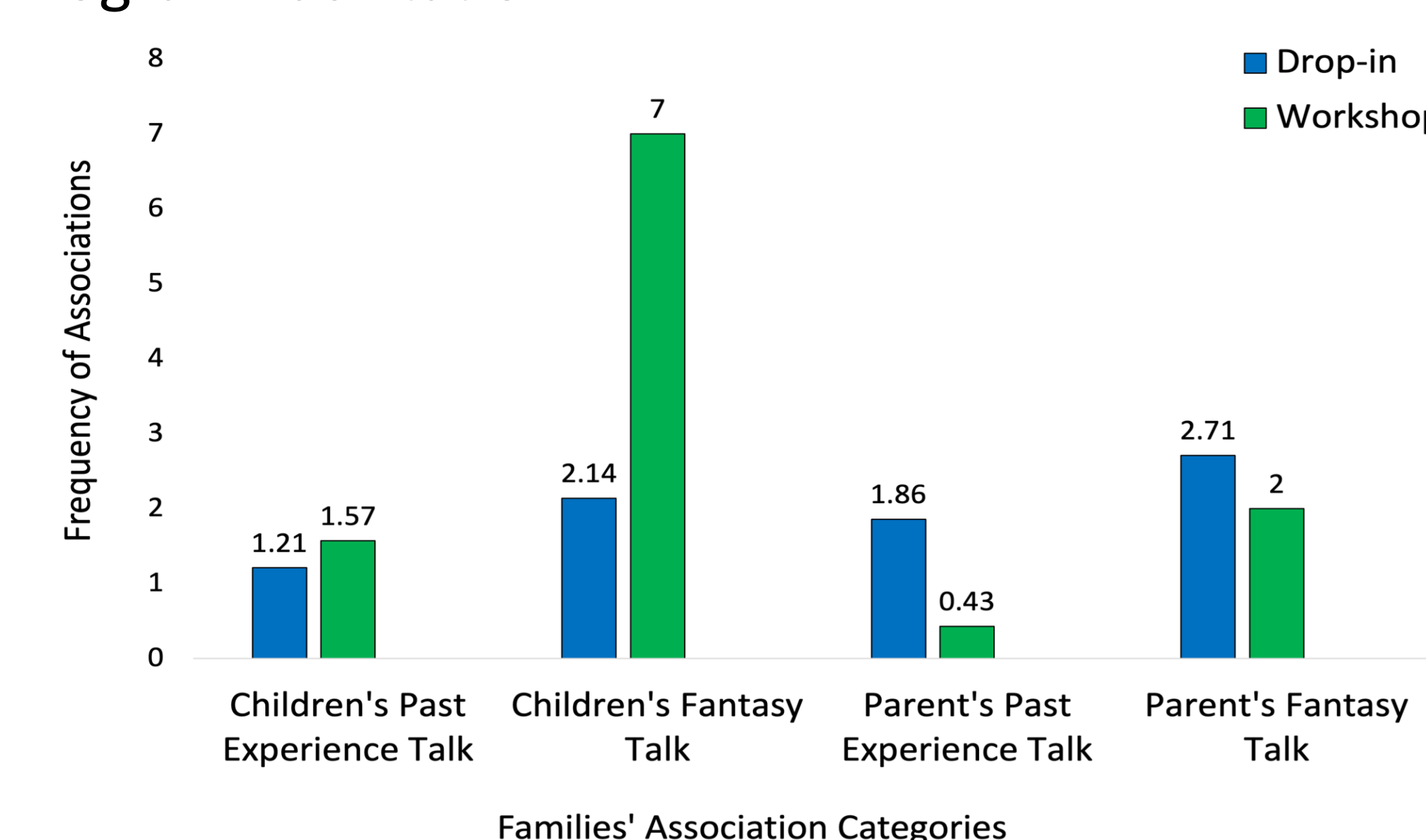
Figure 2. Children's Spatial Talk in Reflections by Use of Story Supports



- As shown in Figure 2, children who used story supports also used more spatial language overall in their reflections, compared to those who didn't, $F(1, 16) = 7.24, p = .02$. Specifically, they talked more about spatial dimensions, $F(1, 16) = 4.69, p = .05$, spatial locations, $F(1, 16) = 5.10, p = .04$, and continuous amounts, $F(1, 16) = 5.90, p = .03$.

- Children who attended workshops talked more about fantasy elements, $F(1, 16) = 6.44, p = .02$, while parents who attended drop-ins talked more about past experiences, $F(1, 16) = 7.30, p = .02$, (see Figure 3).

Figure 3. Families' Associations During Tinkering by Program Facilitation



- Children who attended workshops talked more about spatial dimensions during their reflections, compared to those who "dropped in," $F(1, 16) = 6.56, p = .02$.

Discussion

- Incorporating toy characters may help families to develop meaningful stories about their creations and may even promote spatial thinking by encouraging children to consider the scale of their character in relation to their structure.
- Group activity facilitation may offer example stories that inspire children to imagine fantastical stories about their creations. When families don't receive a group orientation, parents may frame the activity by talking about children's personal experiences.
- Overall, informal tinkering activities that incorporate toy characters can drive storytelling and personal connection, bolstering families' engagement in STEM activities.