

Introduction

- Informal learning activities in museums can be designed to support children's spatial thinking which is foundational for children's later STEM abilities (Polinsky et al., 2023).
- One way to bolster children's engagement during STEM activities is to provide opportunities for families to tell stories and make connections to their prior experiences (Callanan et al., 2017; Haden et al., 2023).
- Storytelling may also support families' sense of belonging during STEM activities, which is important for fostering children's interest in STEM (Belanger et al., 2020; Goodenow, 1993).
- **Research Questions:**
 - How do families' use of toy story characters support children's storytelling and spatial talk during tinkering and when reflecting on the activity?
 - What role does children's STEM belonging play in the relation of storytelling and spatial talk?



Participants & Method

- **Participants:** 23 families with children ages 4-10-years-old (M age = 7.22, 65% male; 43% White, 17% Asian, 13% Latine, 13% More than one, 13% Unreported).
- **Cardboard Neighborhood Activity:**
 - Families were invited to make something that they thought was missing from the existing neighborhood (e.g., town square, soccer field, pet store, house).
 - Toy characters were available to be incorporated into the activity. 12 families chose to use the toy characters and 11 did not.
- **Post-Tinkering Reflection:** When families finished building their creation, a researcher elicited the children's reflections about what they made and learned.
- **Coding:** As shown in the tables on the lower left, the tinkering observations and reflection interviews were coded for the frequency of (1) spatial talk, (2) use of story elements, and (3) expressions of STEM belonging.

Spatial Talk (Cannon et al., 2007)

Spatial dimensions
 Shapes
 Locations/Directions
 Orientations/Transformations
 Continuous Amounts
 Deictics
 Spatial Features
 Patterns

Spatial Talk Codes

Storytelling

Code	Description
Fantasy/Fiction	Framing the task through fantasy/fiction stories (e.g., characters, locations)
Past Experiences	Framing the task through real-life past experiences or activities (e.g., personal interests, own neighborhoods)

Fantasy/Fiction

Past Experiences

STEM Belonging Codes

STEM Belonging Supports	STEM Belonging Indicators
Helpful to Others	Interest
Persistence	Enjoyment
Confidence	Comfortability
Encouragement	Connection
Motivation	STEM Identity

Belonging Codes

Results

Figure 1. Child Spatial Talk by Character Use

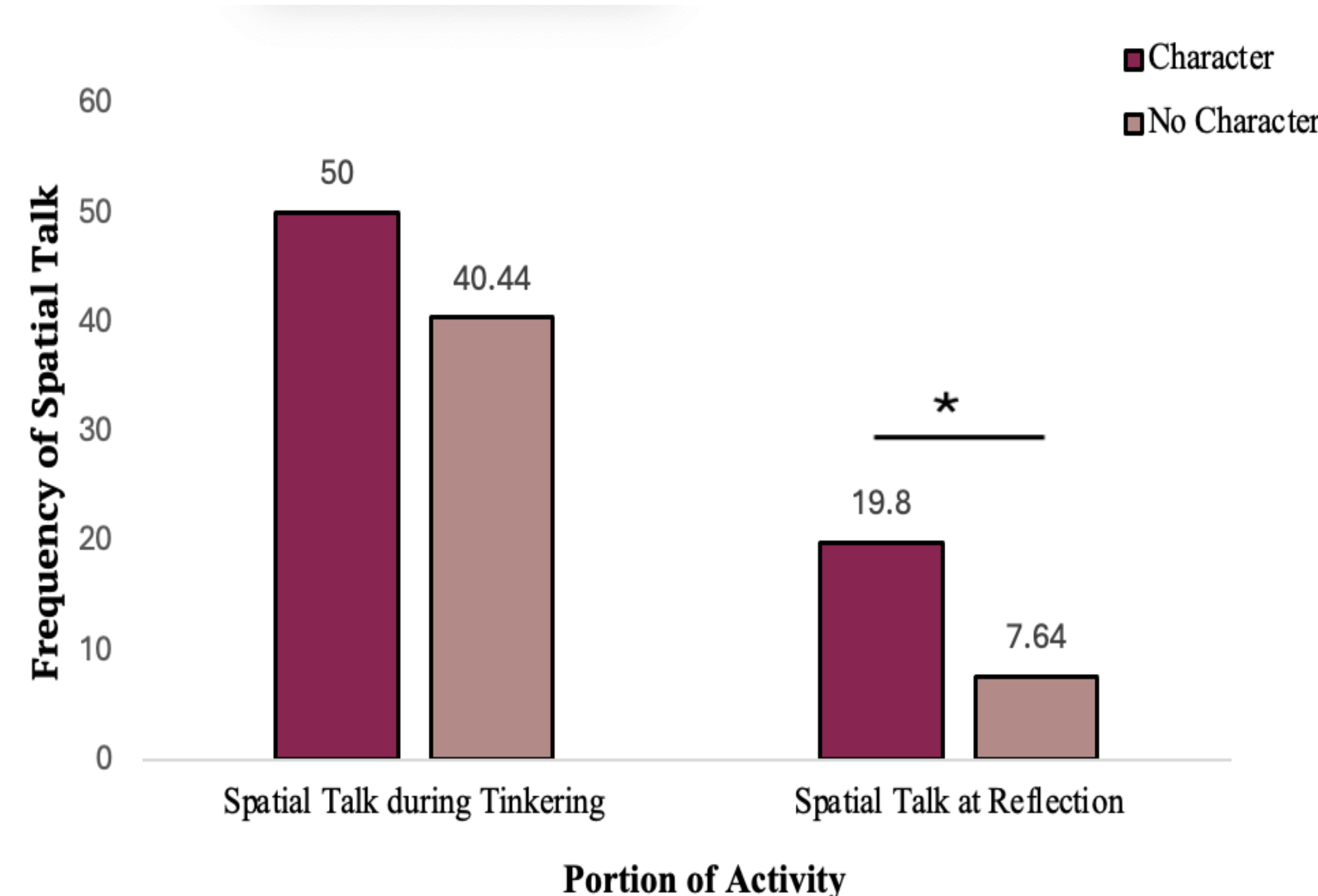
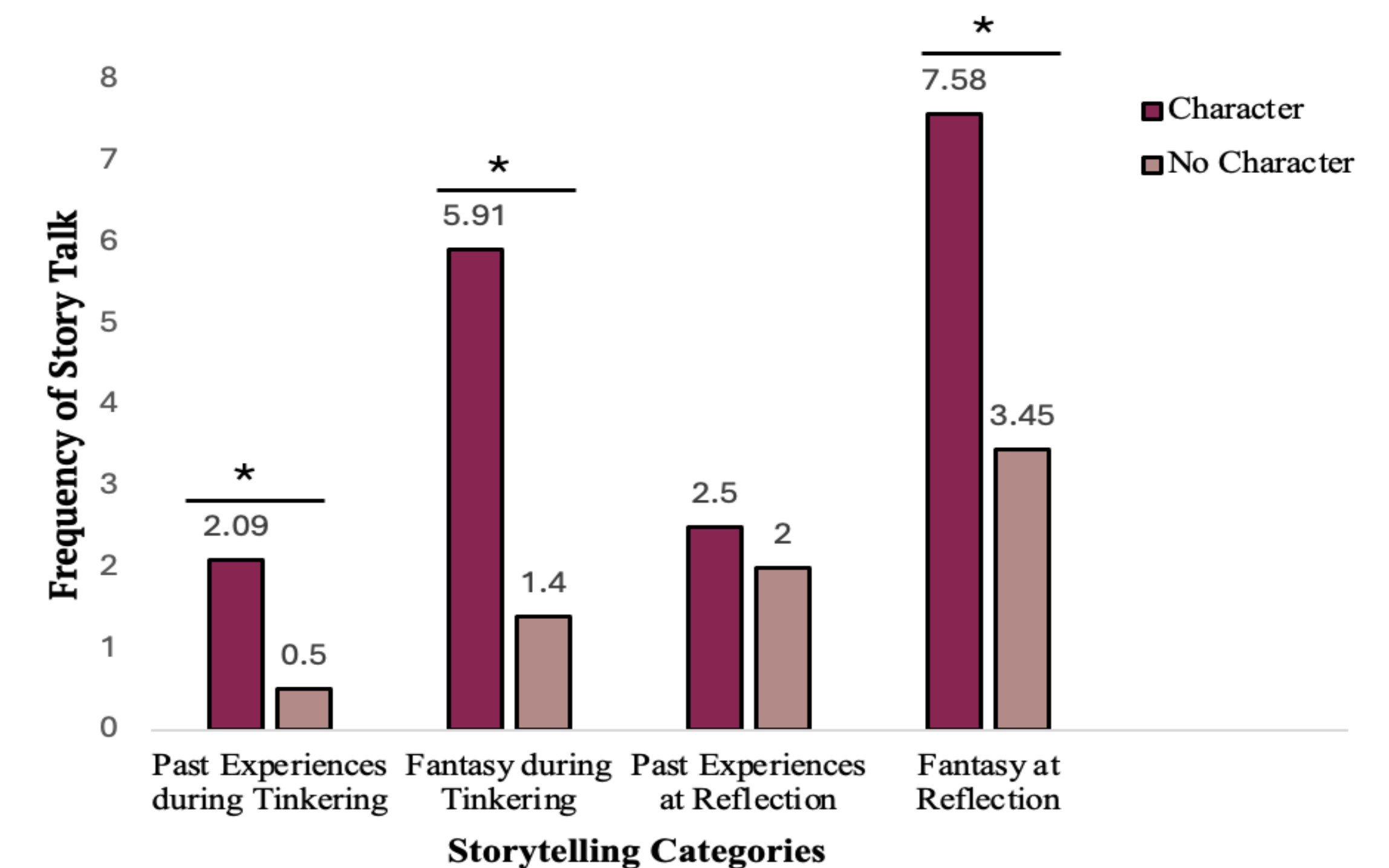


Figure 2. Child Storytelling by Character Use



- As seen in **Figure 1**, children who used characters engaged in more spatial talk at reflection compared with those who did not use characters, $F(1, 18) = 8.27, p = 0.01$.
- As seen in **Figure 2**, children who used characters engaged in more storytelling during tinkering and at reflection compared to those who did not, $F_s = 5.01-7.14, p_s < .04$.
- Storytelling and belonging expressed during tinkering were not associated with spatial talk during *tinkering*.
- However, storytelling and belonging during tinkering did predict children's spatial talk at *reflection*, $R^2 = .66, F(3, 18) = 9.59, p < .001$.
 - Belonging on spatial talk at reflection: $B = .37, t = 2.98, p = .01$.
 - Storytelling on spatial talk at reflection: $B = .85, t = 3.20, p = .01$.

Discussion

- This project expands our understanding of how encouraging storytelling, such as through incorporating story characters, can support children's spatial thinking during tinkering activities.
- This work also suggests that cultivating a sense of belonging during STEM activities can also expand storytelling-spatial thinking relations for children.