

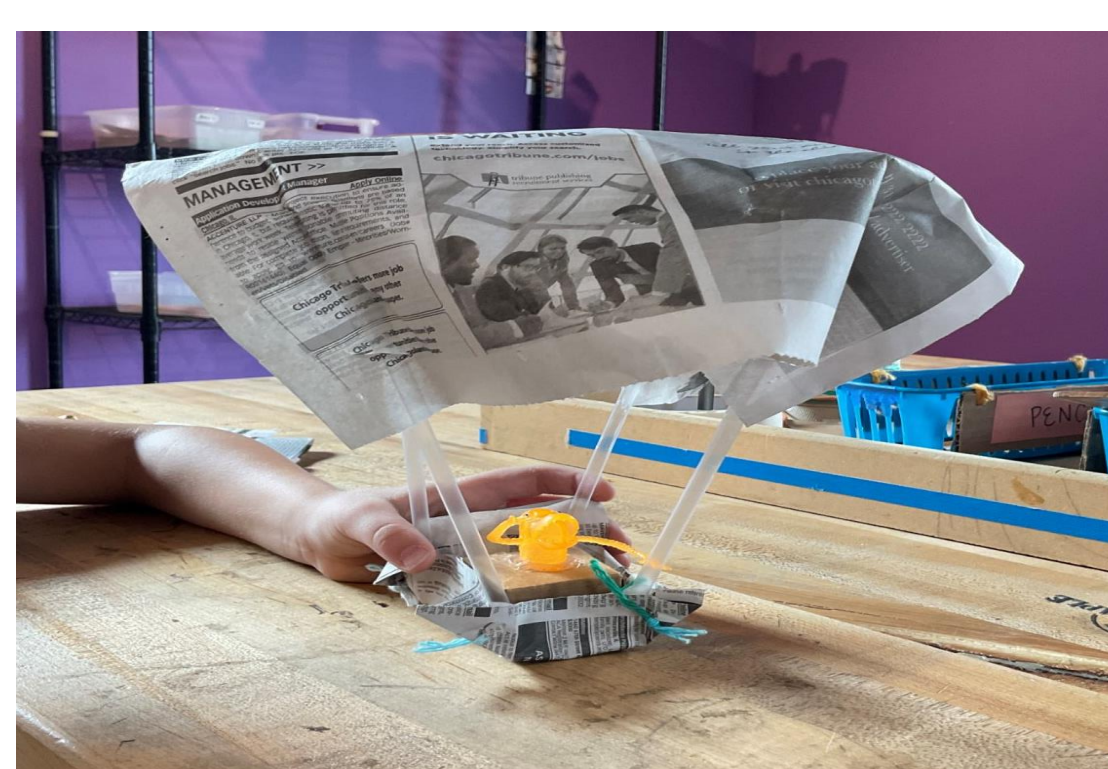
"Get in, monster!": Children's storytelling and STEM talk during iterative museum tinkering programs

Riley E. George, Milla A. Metlicka, Bianca M. Aldrich, Catherine A. Haden

This material is based upon work supported by the National Science Foundation under Grant No. 1906839/1906940/1906808
 Thank you to our collaborators at Chicago Children's Museum: Tsivia Cohen, Kim Koin, and Natalie Bortoli.

Introduction

- Informal educational settings can support children's STEM learning by providing them with opportunities to engage in playful activities with their families, such as tinkering (Marcus et al., 2021).
- Recent work shows that storytelling is an everyday practice children engage in that can be incorporated into STEM activities to increase both their sense-making and the accessibility of the content (Acosta & Haden, 2023; Haden et al., 2023).
- Across two iterations of a tinkering program that varied in their emphasis on story, we asked:
 - How might program design and museum staff facilitation strategies inspire family storytelling during tinkering?
 - How does children's storytelling support STEM talk during tinkering?



Participants & Method

- Participants:** 116 children, ages 4-10-years-old ($M = 7.10$, 62 girls, 47 boys), 51% White, 15% Mixed, 12% Latine, 10% Asian, 9% Black, 2% Native American, and their families.
- Tinkering Programs:** Children were tasked to make a flying creation for a toy monster in each of two programs that varied design and facilitation strategies focused on story.
 - Story Program 1 ($n = 56$)**
Story Prompt: Help the toy pilots fly to deliver their package to the destination! Create a story about what your toy pilot is delivering and why.
 - Story+ Program 2 ($n = 60$)**
Story Prompt: As the aircraft engineer, your job is to help the tiny monster pilot deliver their package safely by building an aircraft for them! What is your pilot delivering and where is it going?
Exhibit Features: For Story+ the exhibit space was had a more immersive, package delivery service design, with clouds and flying contraptions hanging from the ceiling, a map of potential destinations, "Employee of the Month" signage, and company logos.

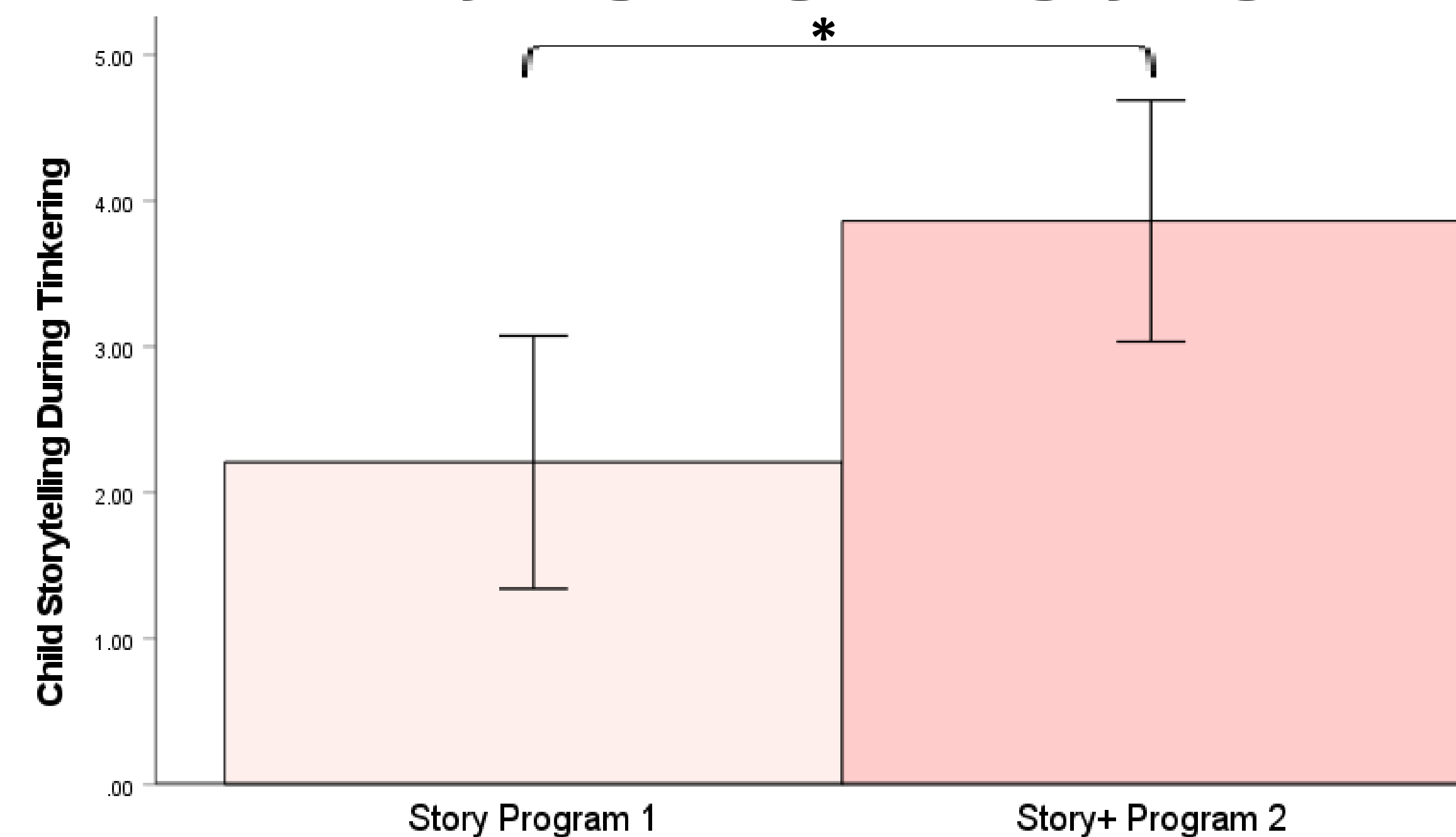
Tinkering & Reflection Coding Schemes

STEM Talk

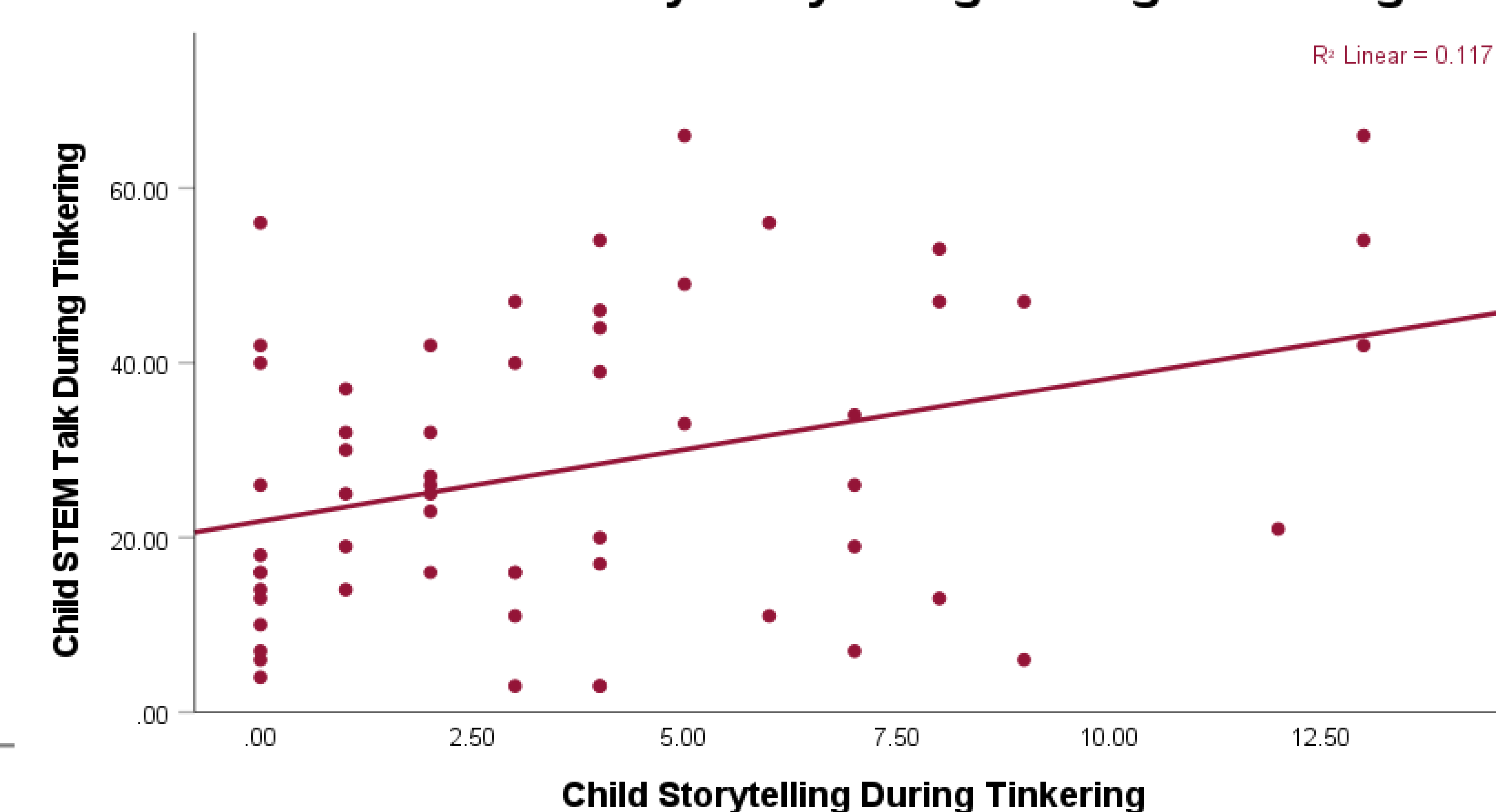
Code	Example
Project Name	"I made an airplane."
Naming Tools and Materials	"We used cardboard, ribbons, beads."
Making	"I punched holes then put wheels on."
Function of Tools and Materials	"We used wires like to hold it together."
Metacognition	"I thought of how divers use parachutes." "Mom said: how about we just make one big one."
Engineering	"At first it didn't really work. And then after [the] second [test] it kinda worked. And after the third [test] it worked!"
Mathematics	"On the last two times it flew like onto the top."
Past and Future Associations	"I wish we could use actual motors, like a tiny rocket motor." "You know the wings from [Zelda] Tears of the Kingdom? We're gonna try to make something like that."

Results

Child Storytelling During Tinkering by Program



Child's STEM Talk by Storytelling During Tinkering



- Children engaged in more storytelling during tinkering in **Story+ Program 2** compared to Story Program 1, $F(1, 110) = 7.42, p = .01$.
- Children's storytelling was not associated with children's STEM talk during tinkering for the Story Program 1.
- In contrast, children's storytelling was positively associated with their STEM talk during tinkering for the **Story+ Program 2**, $B = 1.04, t = 2.22, p = .03$.

Storytelling

Code	Example
Character	"Here comes Frosty."
Location	"It's going to outer space."
Dialogue	"Hey buddy, nothing big is gonna happen just you're gonna die."
Temporal Ordering	External Time "It's Lunar New Year."
	Internal Time "He's flying up into space! And then he lands back."
Internal Reactions	"He loves to create, build, and explore."
Motivation	"He's taking markers to kids that need to draw something."
Past Experiences	"He works for FedEx and he has one of their planes."

Discussion



- This design-based research project supports our theoretical understanding of how storytelling can be a powerful tool in supporting children's learning during their STEM experiences.
- Further, this project has important practical applications, by offering information about effective museum practices that can support children's engagement with their families in storytelling and STEM learning.

