Children's Narrative Reflections Reveal Engineering Learning during Tinkering Activities in a Children's Museum

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INTRODUCTION

- In this study children were invited to tell reflective narratives immediately after their visit to *Tinkering Lab* at Chicago Children's Museum.
- When children tell narratives immediately after an experience it can both reveal what they have learned, and extend that learning (e.g., Haden, Cohen, Uttal, & Marcus, 2016).
- The purpose was to understand what information children can recall based on a previously experienced event and how these narratives reflect children's learning of science, technology, engineering, and mathematics (STEM).

PARTICIPANTS

- 77 children (37 females, 40 males)
- *M* age = 7.02, range 4 to 11 years
- 39% Caucasian/White, 16.9% Hispanic/Latino, 7.8% African American/Black, 3.9% Asian, 1.3% Other, 5.2% More than one race, 26% not reported

METHODS

- Children were presented with an engineering design challenge to make something that flies.
- Immediately after completing the challenge, narratives were elicited with the following questions:
  - What did you do in *Tinkering Lab* today?
  - How did you do it?
  - Did somebody help you? Tell me how you worked together.
  - Did you test your creation? Did it fly?
 - What did you learn today?
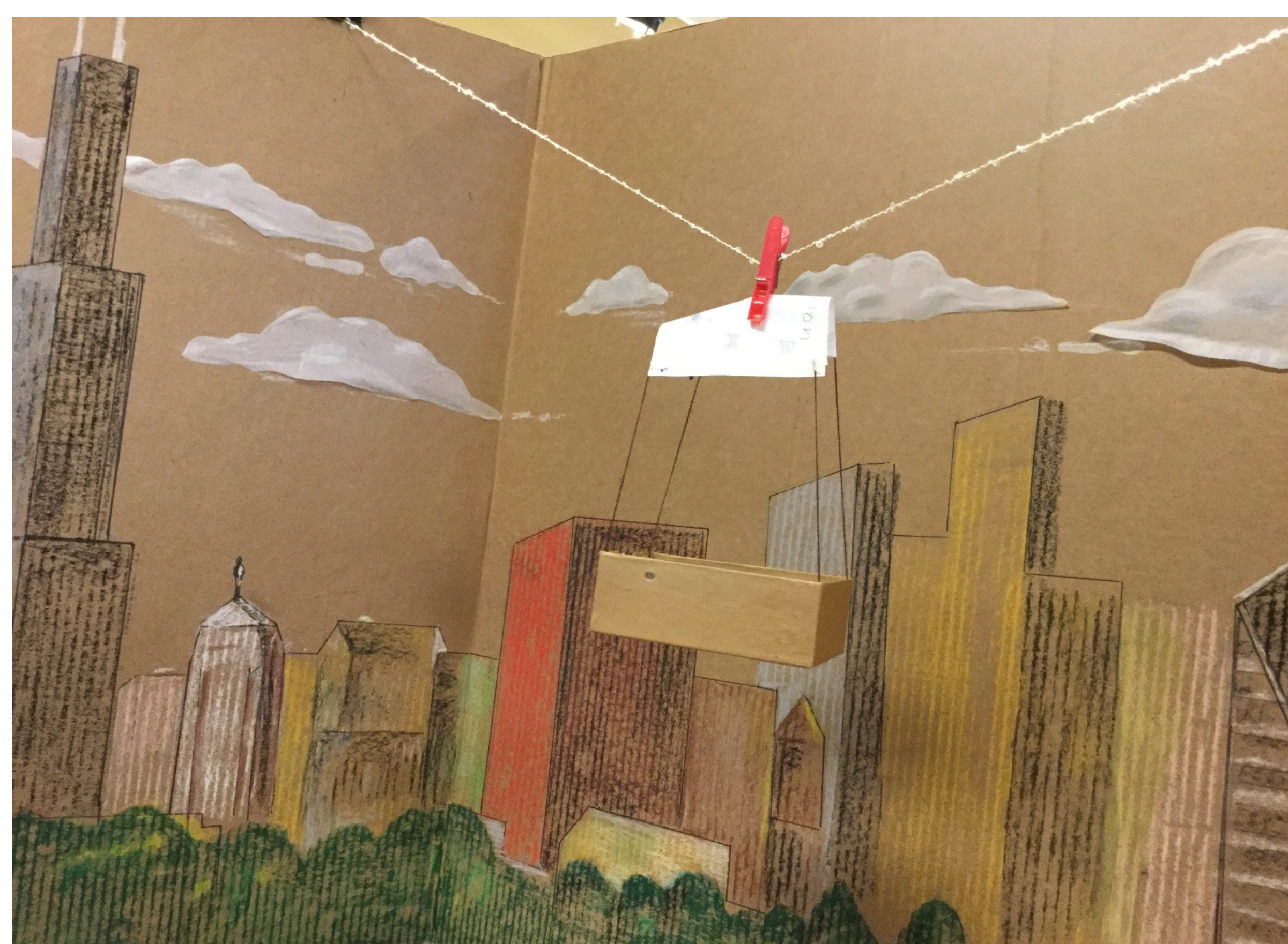
CODING

- Narratives were coded for frequency of talk about **engineering, math**, and **science**.

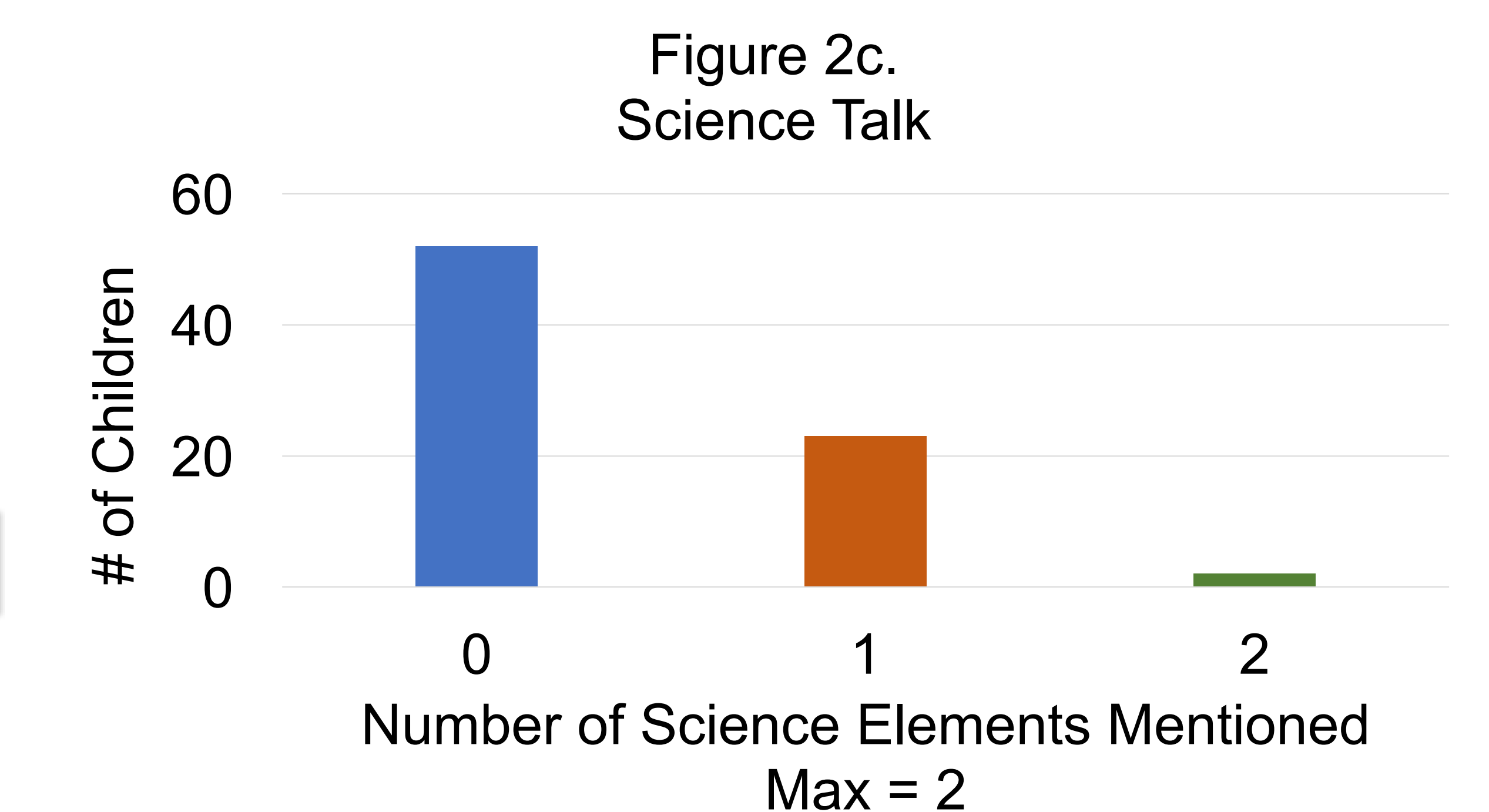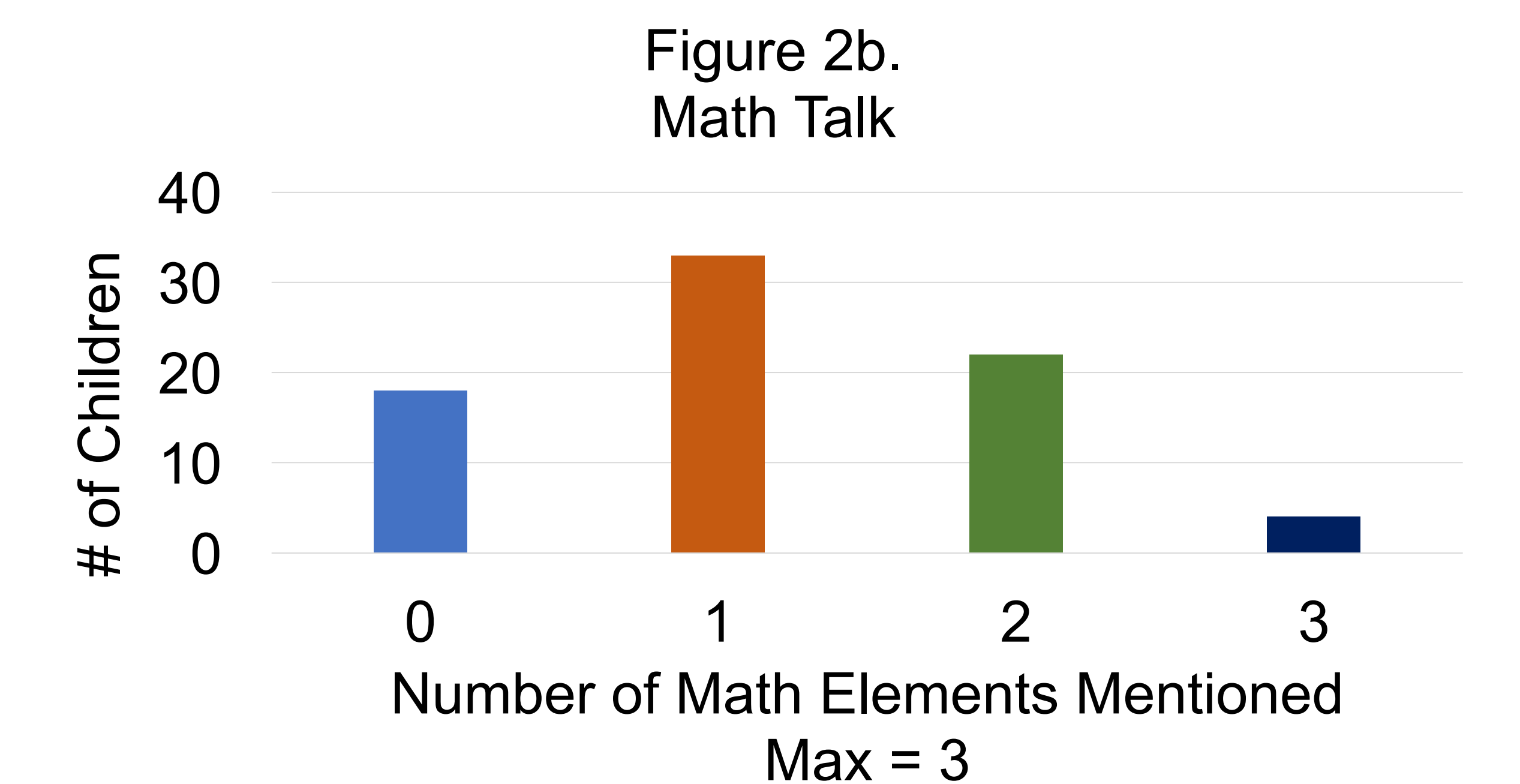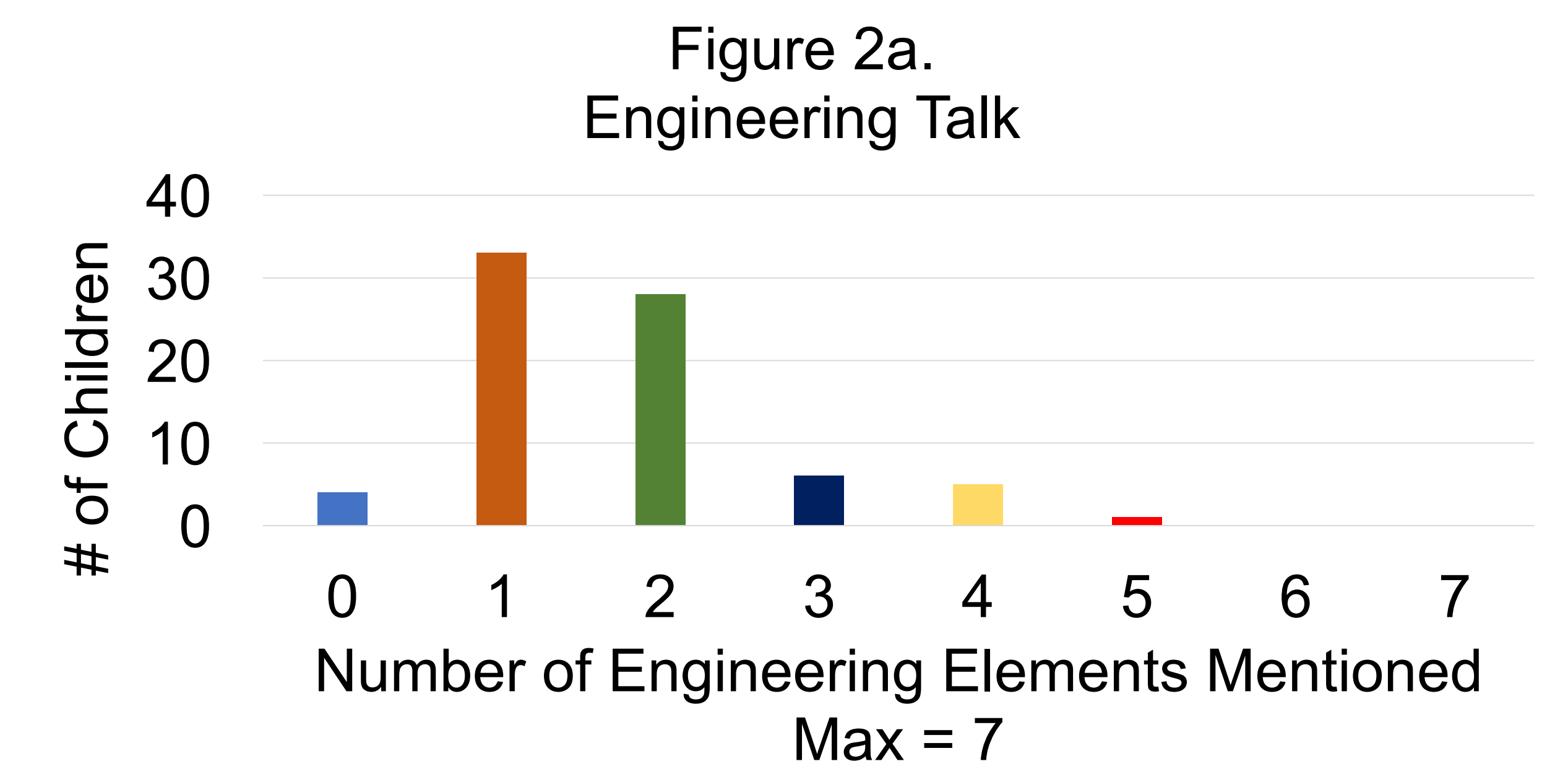| ENGINEERING TALK	
Transforming Materials	"I took three sheets of cupcake whatever and I **flipped it inside out** and some tin foil."
Models	"I was making parachutes for a long time and then I finally used something like a paper bag and **got the idea from somebody else**."
Planning	"We kinda sat over at the work table and got different materials and just kinda worked it out, **made a plan**."
Testing	"So I made wings and I added like foam passengers and then I **put it in it [wind tunnel]** and then it flew around."
Modifying/ Redesigning	"At first, when I tried it, it didn't work because it had too much weight. **So the person I worked with, he cut it in half and said, 'We'll try it a different way'**."
Engineering Principles	"It didn't work the first time so I added a little more point at the end to try to **stabilize** it."
Aerodynamics	"I learned about how airplanes, when they start flying, **air pushes up on them to keep them flying**."
MATH TALK	
Shape	"I used a small sheet of **square** tissue paper."
Size	"I cut some **small** pieces of paper and I cut the bag and I made it like wings."
Quantity	"First, I grabbed **two** foam gingerbread people."
SCIENCE TALK	
Predictions/ Inferences	"If there's two curved bags and they're connected and you put them on a wind tunnel, I think it flies a bit."
Causal Explanations	"Well weight kinda makes a difference cause with the cork on it, it doesn't go up as well, it doesn't go up as fast."

RESULTS

- Figure 1 shows the mean frequencies observed for total engineering, math, and science talk across all children in the sample:

Figure 1. Mean Frequency of Talk
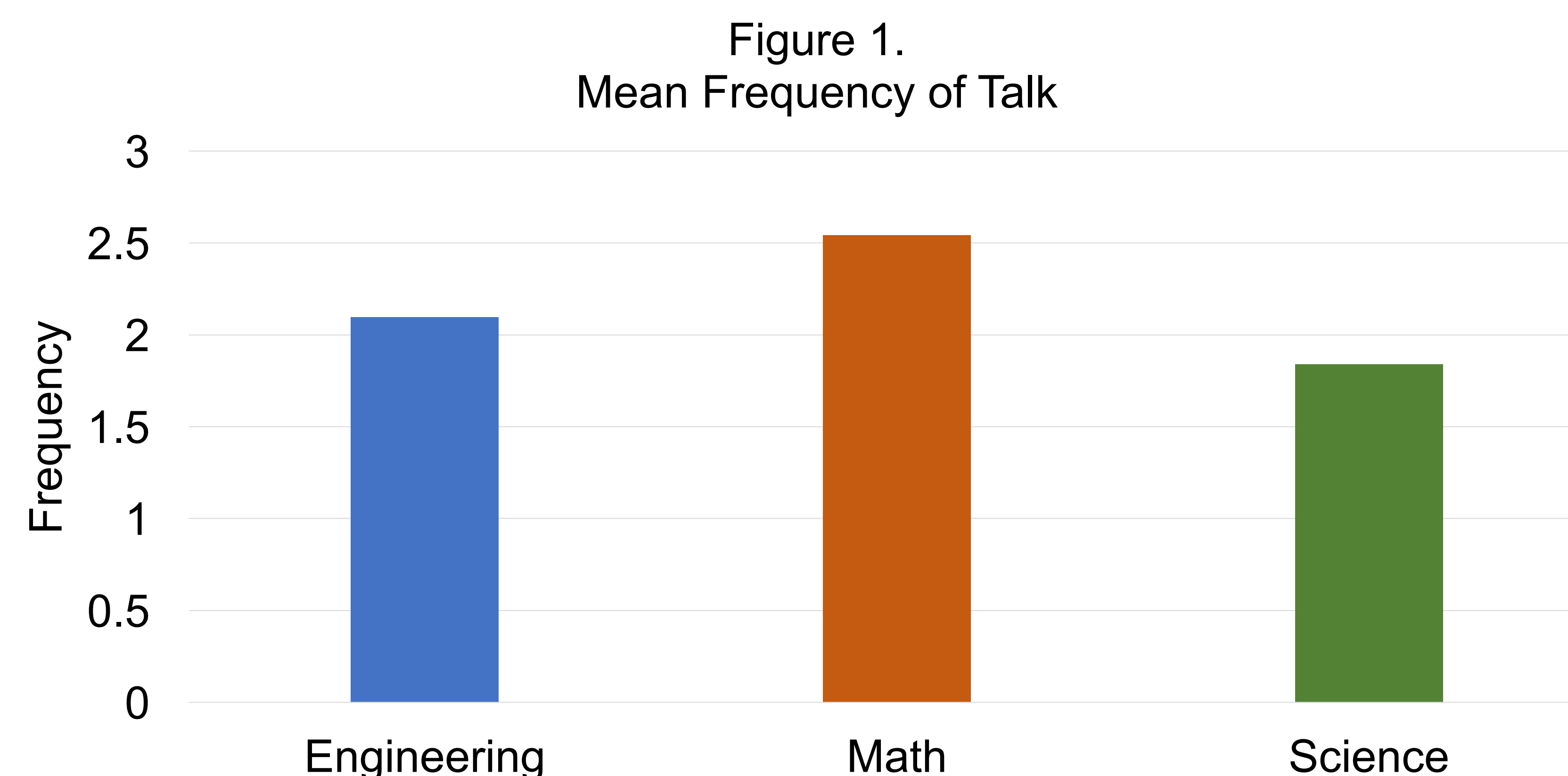
RESULTS

- Figure 2 shows the number of children mentioning different kinds/elements of engineering (2a), math (2b), and science talk (2c).

Figure 2a. Engineering Talk

Figure 2b. Math Talk

Figure 2c. Science Talk

- The frequency of engineering talk was correlated with the frequency of math ($r = .31$, $p < .05$) and science ($r = .53$, $p < .01$) talk, but math and science talk were not ($r = .35$, n.s.). Child age was related to engineering ($r = .29$, $p < .05$), but not science ($r = .30$, n.s.) or math ($r = .14$, n.s.) talk.

FUTURE DIRECTIONS

- Next steps include observing families in the *Tinkering Lab* and examining linkages between family engagement during tinkering and children's narrative reflections immediately afterward.