



DESIGN MAKE PLAY • New York Hall of Science



Big Data for Little Kids

Data Modeling with Young Children and their Families in a Science Museum

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Promising Math

To know more about how to activate and celebrate math learning in diverse racial, ethnic, cultural and socio-economic family and community contexts

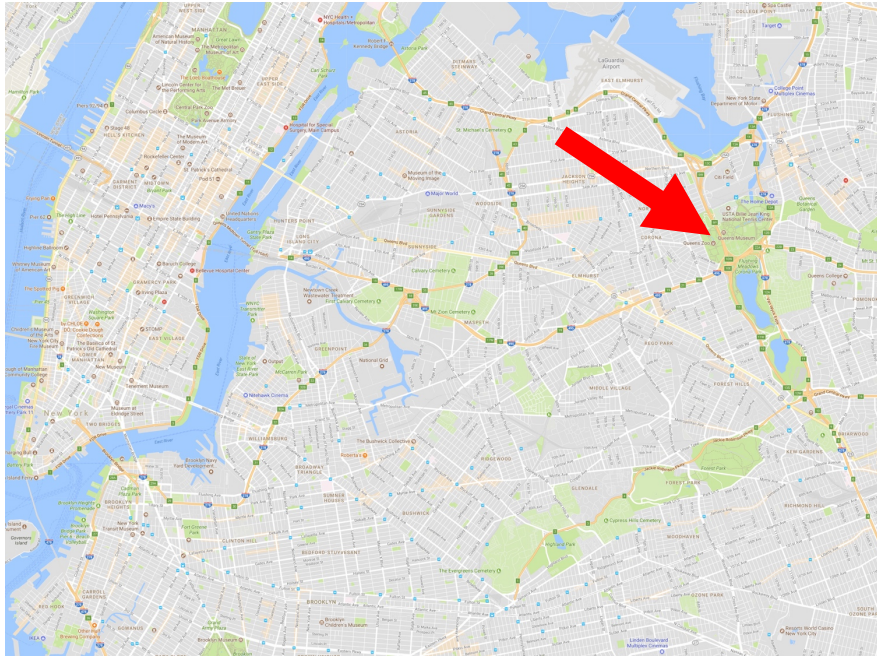
Our motivation in this project

- Children need more and earlier opportunities to use math to answer real questions about the world. *(NAEYC, 2002)*
- Data literacy is an increasingly vital skill for learners of all ages. *(Ben-Zvi & Garfield, 2004)*
- Inquiry-based practices can support early data science learning for elementary school children. *(English & Watson, 2016; Makar & Rubin, 2009)*
- Existing research has provided theoretical frameworks, but mainly conducted in formal educational settings. *(English, 2012; Konold, et al. 2015; Lehrer & Schauble, 2002)*

Development of the program

- Goal:
 - Provide underserved young children and their caregivers an introduction to data science concepts in informal settings
- Research questions:
 - *How do young children (ages 5-8) and their caregivers engage with data science concepts in an informal setting?*
 - *What are the factors impacted these families' learning experience of data science?*
- Project format:
 - Weekly family workshops
- Project status:
 - Ended August 2019

Broaden STEM participation at New York Hall of Science (NYSCI)



- Diverse audience, community-focused
- Design-Make-Play approach to STEM learning

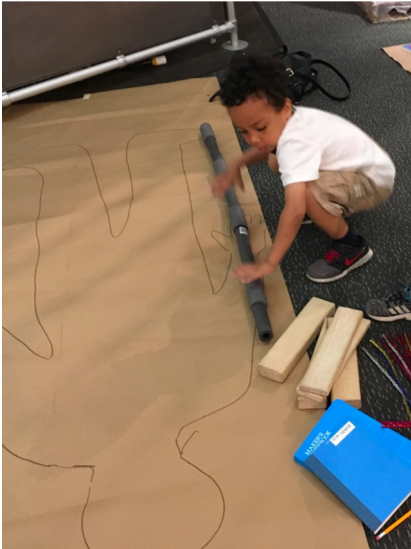
Workshop design

- *Theme:* Use data to help you design a new exhibit for the science museum.
- *Structure:* 7-week workshop, meeting once per week for 2 hours
- *Iteration:* One pilot series and two workshop series (2017-2018)
- *Families:* Each iteration involved 7-10 local families
- *Languages:* Families and facilitators spoke English, Spanish, Mandarin



Workshop activities

Hands-on introduction



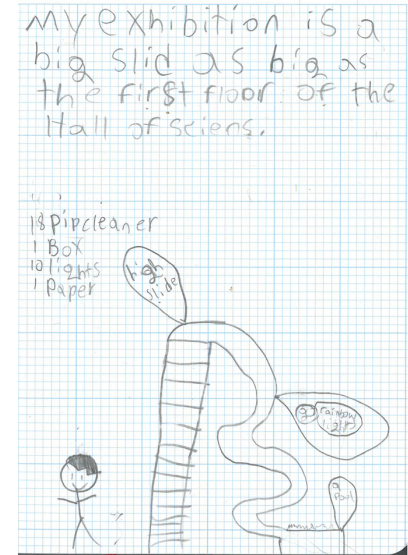
Collecting data in the museum



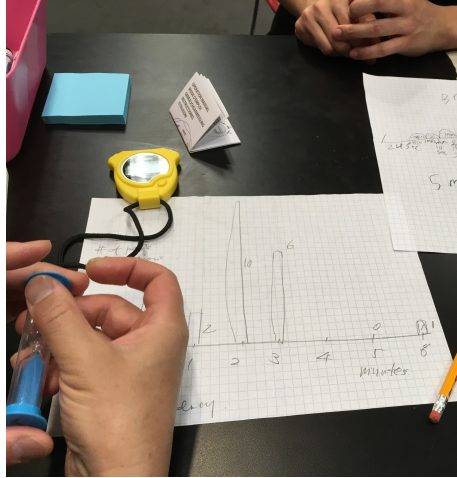
Organizing & interpreting data



Planning your own exhibit

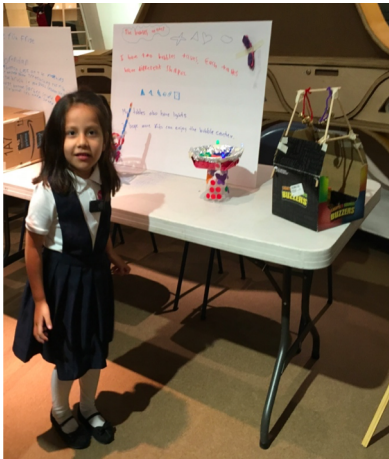
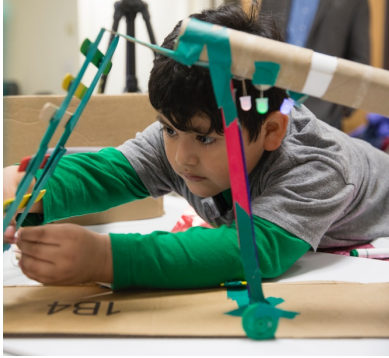


Workshop activities



Week 4: How long do people play at different museum exhibits?

Final Projects



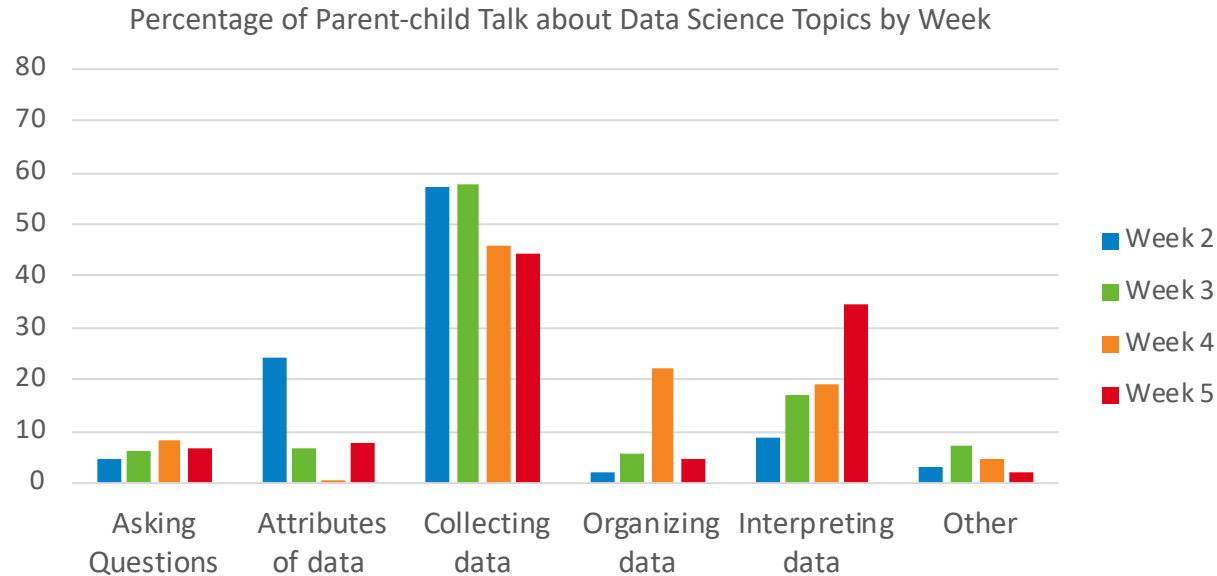


Research Methods

- *Participants (2nd iteration):*
 - 7 families with children ages 5-8 (Mean = 6.85 years)
 - 14 children total: data analyzed for one child per family
 - 5 families were bilingual (4 Spanish-speaking, 1 Mandarin-speaking)
- *Data sources:*
 - Audio & video recordings
 - Transcribed & translated parent-child conversations
 - Artifacts of children's work
 - Pre-post interviews with children and caregivers

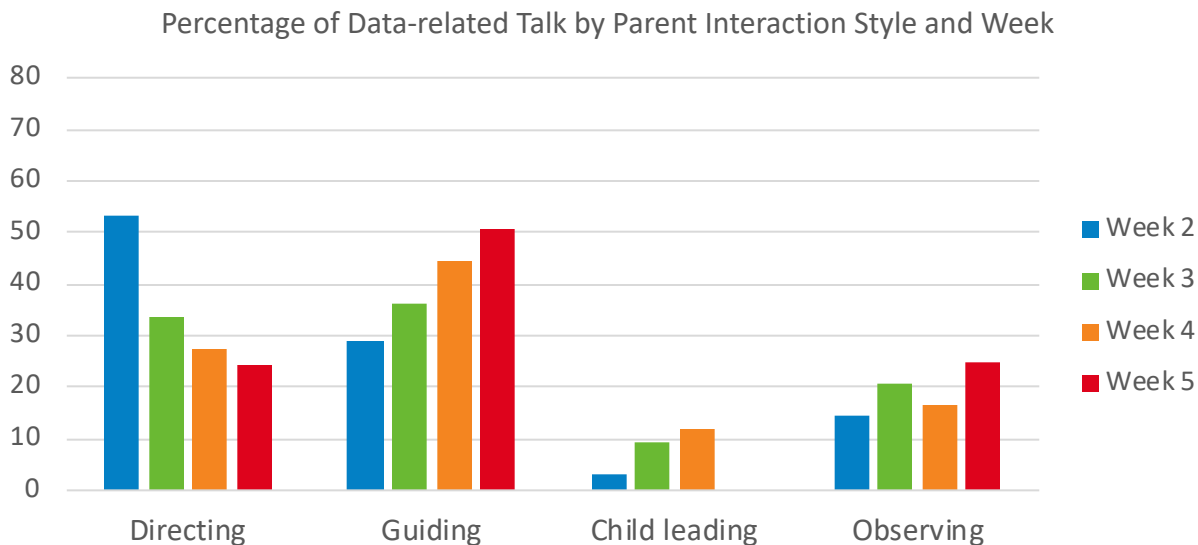
Results: Data science talk

- Over the course of the workshop:
 - Conversations about interpreting data increased ($B = .35$, $SE = .04$, 95% CI [.28, .42], $p < .01$)



Results: Parent-child interactions

- Talk about analyzing/interpreting data related to level of parent direction (in particular, more frequent when parents were guiding than directing) ($B = .33$, $SE = .05$, 95% CI [.24, .42], $p < .01$)
- Parent guiding increased over the workshop, while directing decreased
- Matched feedback from pre-post interviews



Parent engagement

- Building trust with parents and the community
 - Parents felt that they are welcome in the museum
 - Museums are safe places for learning
- Provide space for families to work on problems together
 - Families bring in their own knowledge, culture, and interest
 - Both parents and children take leads in the program
- Supporting parents in teaching
 - Parents may need more knowledge in data science to help their children

Conclusions

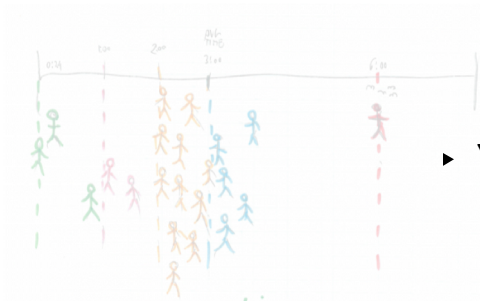
- Parents contribute greatly on the range and depth of children's talk about data science concepts
- The direction and topics of data conversations shifted over the length of the workshop
- Qualitative data also shows that parents need additional support to feel confident in helping their children in learning data.



Acknowledgments

Project Team:

- ▶ C. James Liu
- ▶ Katherine Culp
- ▶ Susan Letourneau
- ▶ Kate Donnelly
- ▶ Delia Meza
- ▶ Laycca Umer
- ▶ Steve Uzzo
- ▶ Yessenia Argudo
- ▶ Catherine Cramer
- ▶ Peggy Monahan
- ▶ Janella Watson
- ▶ NYSCI Explainers



Project materials:

▶ Curriculum:

- <https://nysci.org/wp-content/uploads/Big-Data-for-little-Kids-sm.pdf>



▶ YouTube:

- https://www.youtube.com/watch?v=_cgoOODwL5g



This material is based upon work supported by the National Science Foundation under Grant No. DRL1614663. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.