LUDDY
SCHOOL OF INFORMATICS,
COMPUTING, AND ENGINEERING
Indianapolis

Family Makers: Promoting Engineering Learning for Children and Caregivers Through Online Making Programs at Rural Libraries

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Makerspaces are “informal sites for creative production in art, science, and engineering where people of all ages blend digital and physical technologies to explore ideas, learn technical skills, and create new products.”

(Sheridan et al., 2014, p. 505)

Online space to expand library makerspace

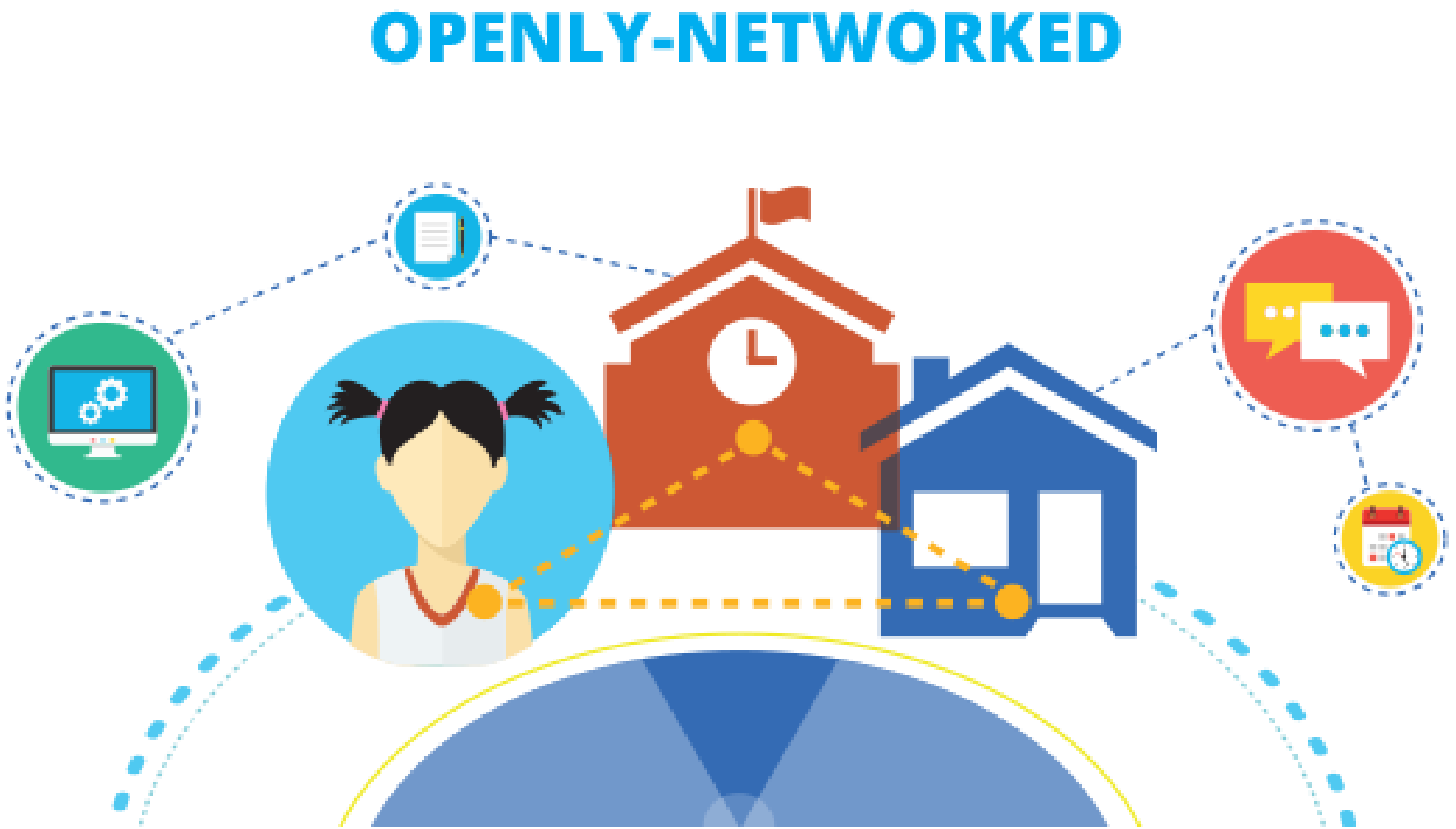


*Image from https://lead.nwp.org/knowledgebase/what-is-connected-learning/

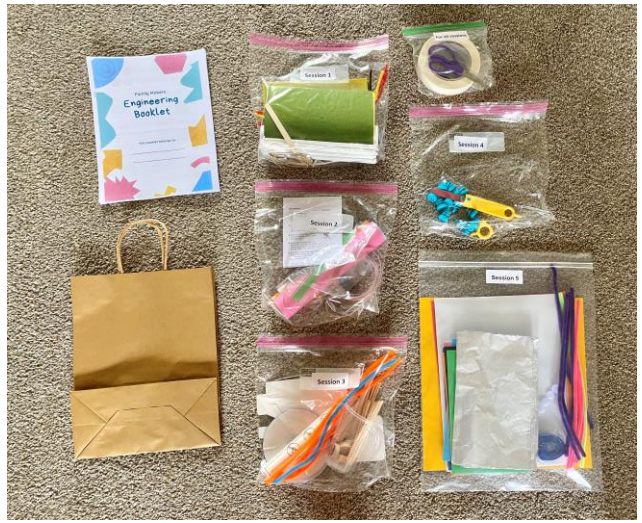
Online making program

Tablets/ hotspots

Video conferencing

ZOOM

Take-home kits



#FAMILY makers

University

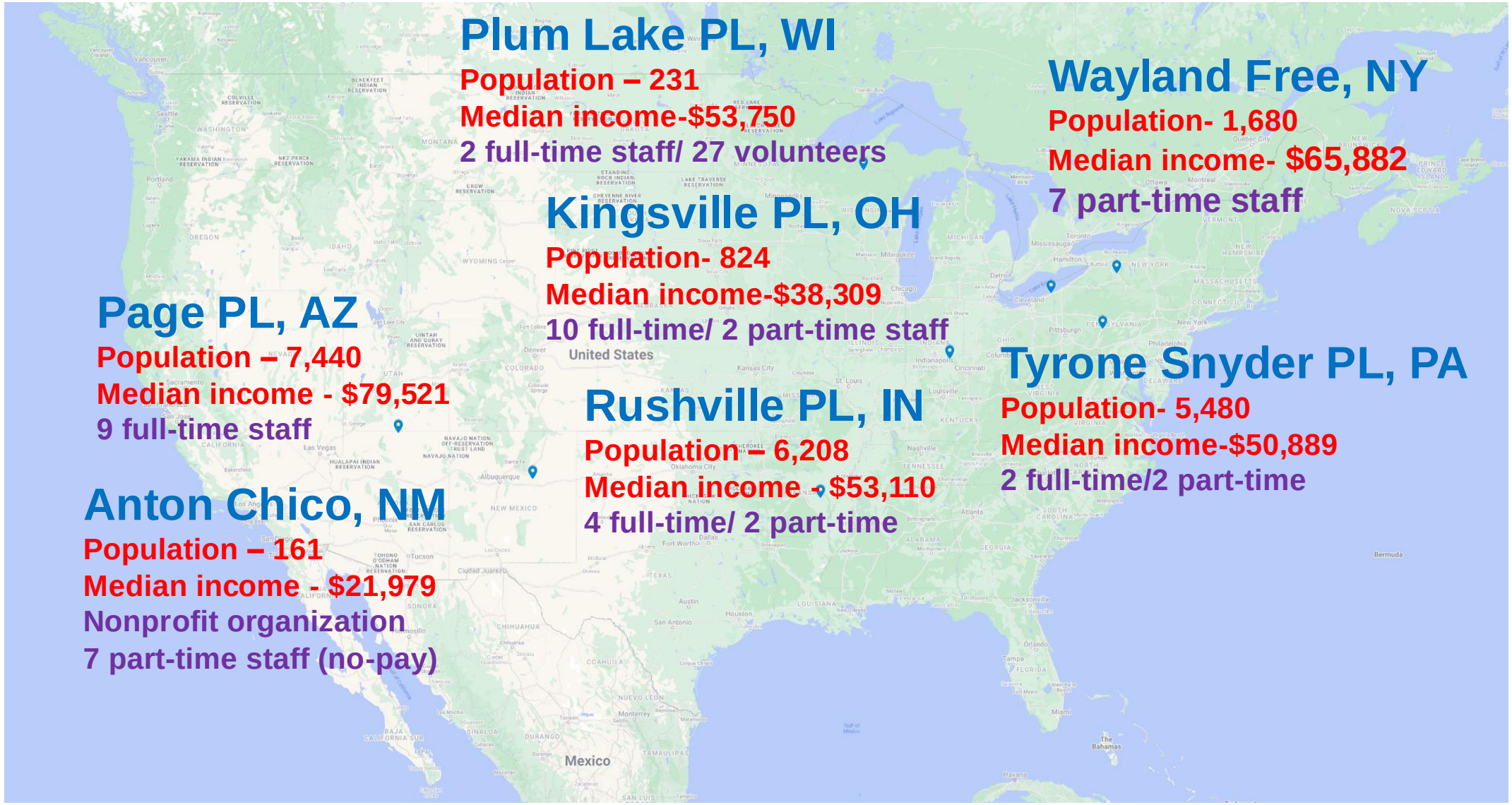
Rural Library

Online engineering program for children (ages 5-10) and parents/caregivers through rural libraries

ARSL/ Engineers

INSTITUTE of Museum and Library SERVICES

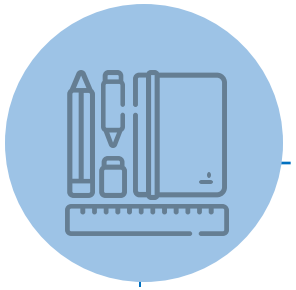
Rural library partners



https://data.census.gov

#FAMILY makers

01



MATERIALS

Tablets, hotspots,
craft materials

02

PARTICIPANTS

4-6 families per community
Children (5-10 years)
Caregivers
Library staff
Researchers

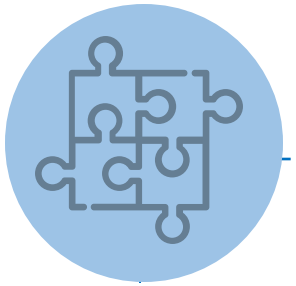
03

STRUCTURE

6 programs
1 hour/ once a week
Meet in Zoom

Goals & expected outcomes

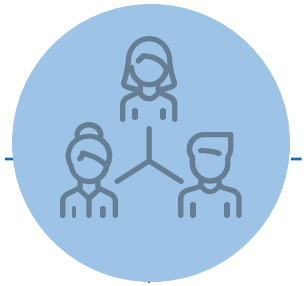
01



FAMILY MAKERS PROGRAM

Six curricula
Facilitation guide
Material list
Webinars

02



CHILDREN & PARENTS

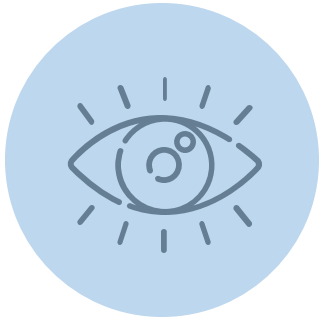
Development of engineering interest and practices

03

LIBRARY STAFF

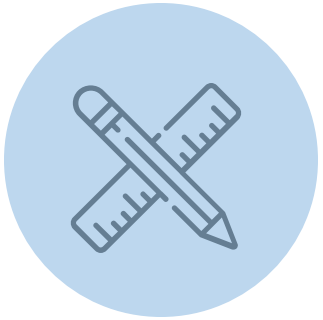
Development of understanding in engineering design thinking and online facilitation skills

Theoretical perspectives



Culturally relevant pedagogy

(Ladson-Billing, 1995; 2014)



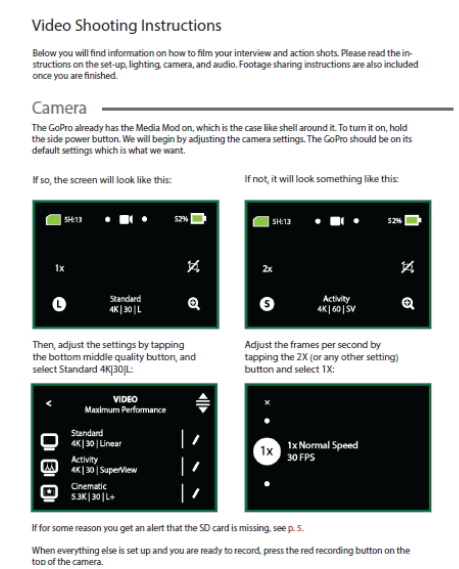
Constructionism

(Papert & Harel, 1991)

Making connections with rural engineers

10 Engineers

Family Makers
Filming Guide



Video Shooting Instructions

Below you will find information on how to film your interview and action shots. Please read the instructions on the set-up, lighting, camera, and audio. Footage sharing instructions are also included once you are finished.

Camera

The GoPro already has the Media Mod on, which is the case like shell around it. To turn it on, hold the side power button. We will begin by adjusting the camera settings. The GoPro should be on its default settings which is what we want.

If so, the screen will look like this:

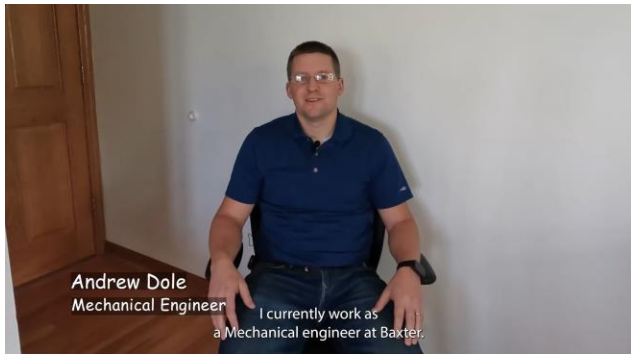
If not, it will look something like this:

Then, adjust the settings by tapping the bottom middle quality button, and select Standard 4K|30|L:

Adjust the frames per second by tapping the 2X (or any other setting) button and select 1X:

If for some reason you get an alert that the SD card is missing, see p. 5.

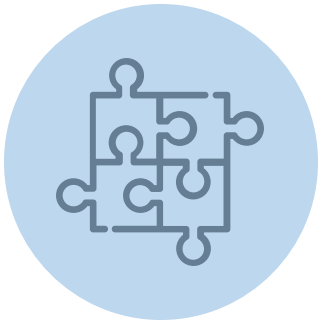
When everything else is set up and you are ready to record, press the red recording button on the top of the camera.



Three phases

Phase 1

Understand challenges rural library staff and underserved families experience and identify engineering-related funds of knowledge for engaging them in online engineering programs,



Funds of Knowledge (González et al., 2005; Hogg, 2011)

Challenges

Lack of confidence in engineering
Lack of resources
Insufficient internet and technology
Nurturing effective online engagement
Cultural and perceptional challenges

Funds of knowledge related to engineering

DIY
Fixing
Repurposing
Upcycling
Farming
Gardening
Cooking
“Re-engineering”

Three phases

Phase 1

Understand challenges rural library staff and underserved families experience and identify engineering-related funds of knowledge for engaging them in online engineering programs,

Phase 2

Co-design *Family Makers* culturally relevant online engineering program with rural library staff that can be easily adopted and facilitated by rural library staff, and

Phase 3

Disseminate a research-based online engineering program by generating training materials for a pre-conference workshop and host online webinars.

How did children, parents, and rural library staff's perception and understanding of engineering change as a result of participating in Family Makers program?

15

Participants/ Data sources

- 7 librarians
- 14 caregivers/ 17 children

2023

Initial interview

Pre-survey

Spring 2024

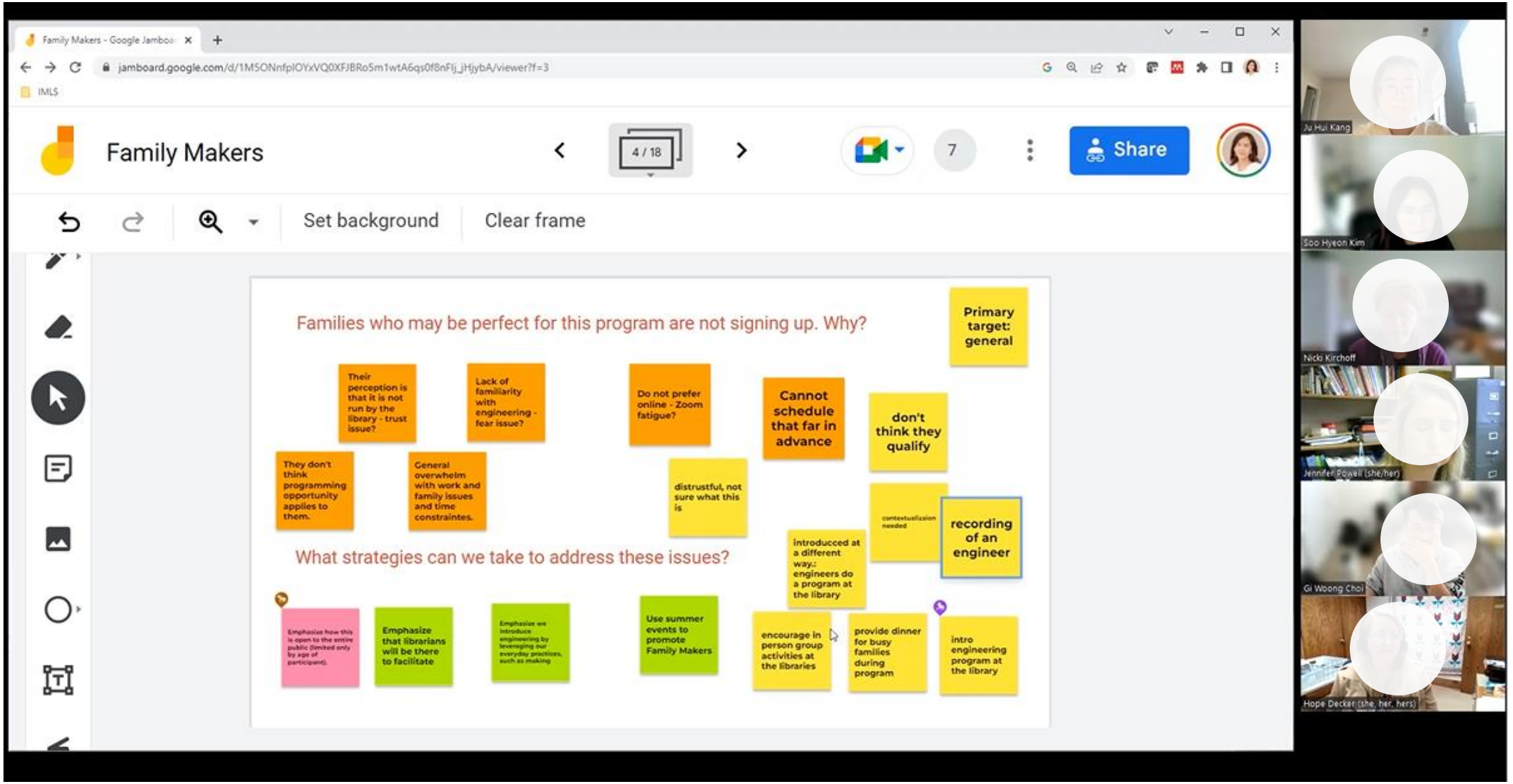
Participation in six Family Makers programs

Spring - Summer 2024

Exit interview

Post-survey

Data sources



Children's efficacy and attitudes toward STEM

(n=17)

	Pre-Program		Post-Program	
	M	SD	M	SD
Math	3.58	0.43	3.66	0.25
Science	3.66	0.70	3.98	0.48
Engineering/Technology	4.14	0.50	4.33	0.49
21st Century Skills	4.15	0.61	4.26	0.48

S-STEM survey: Unfried, A., Faber, M., Stanhope, D. S., & Wiebe, E. (2015). The development and validation of a measure of student attitudes toward science, technology, engineering, and math (S-STEM). *Journal of Psychoeducational Assessment*, *33*(7), 622-639.

Parents' knowledge, attitude, and behavior in engineering

(n=14)

	Pre-Program		Post-Program	
	M	SD	M	SD
Knowledge	3.68	0.42	4.45	0.42
Attitude	3.87	0.28	4.14	0.28
Behavior	3.28	0.56	3.63	0.56

Survey adopted from: Yun, J., Cardella, M., Purzer, S., Hsu, M., & Chae, Y. (2010). Development of the Parents' Engineering Awareness Survey (PEAS) according to the knowledge, attitudes, and behavior framework. Paper presented at the 2010 ASEE (American Society for Engineering Education) Annual Conference. Louisville, KY.

Library staff's knowledge, attitude, and behavior in engineering

(n=7)

	Pre-Program		Post-Program	
	M	SD	M	SD
Knowledge	3.856	0.549	4.634	0.271
Attitude	4.057	0.305	4.271	0.411
Behavior	2.631	0.808	2.981	0.871

Survey adopted from: Yun, J., Cardella, M., Purzer, S., Hsu, M., & Chae, Y. (2010). Development of the Parents' Engineering Awareness Survey (PEAS) according to the knowledge, attitudes, and behavior framework. Paper presented at the 2010 ASEE (American Society for Engineering Education) Annual Conference. Louisville, KY.

Children initially lacked knowledge and experience in engineering

Pre-program

Lacking knowledge and experience in engineering

- **Nadeem**: "I didn't really know anything... I never actually did one."
- **Evelyn**: "Before, I didn't know that much."

Initial thoughts had mechanical focus

- **Aurora**: "I thought engineering was like mechanical."
- **Larry**: "I just thought it was for machines."
- **Stella**: "I just thought people that build stuff."

*Names are all pseudonyms.

Children's expanded understanding of engineering

Post-program

Engineering is about problem-solving

- **Nancy**: "I learned the whole process of engineering... finding problems and creating solutions."
- **Lisa**: "Engineering is... facing a problem... finding a way to solve it."

Different engineering disciplines

- **Norma**: "I didn't know there were several different types of engineering."
- **Aurora**: "There are different types of engineering."

Engineers make our lives better

- **Lisa**: "I thought it was just people that built stuff wearing protective hats... now I realize they help our community."
- **Xavier**: "Engineering is about making stuff... for people."

*Names are all pseudonyms.

Shifts in parental attitudes and perception

Shift towards fostering exploration and creativity

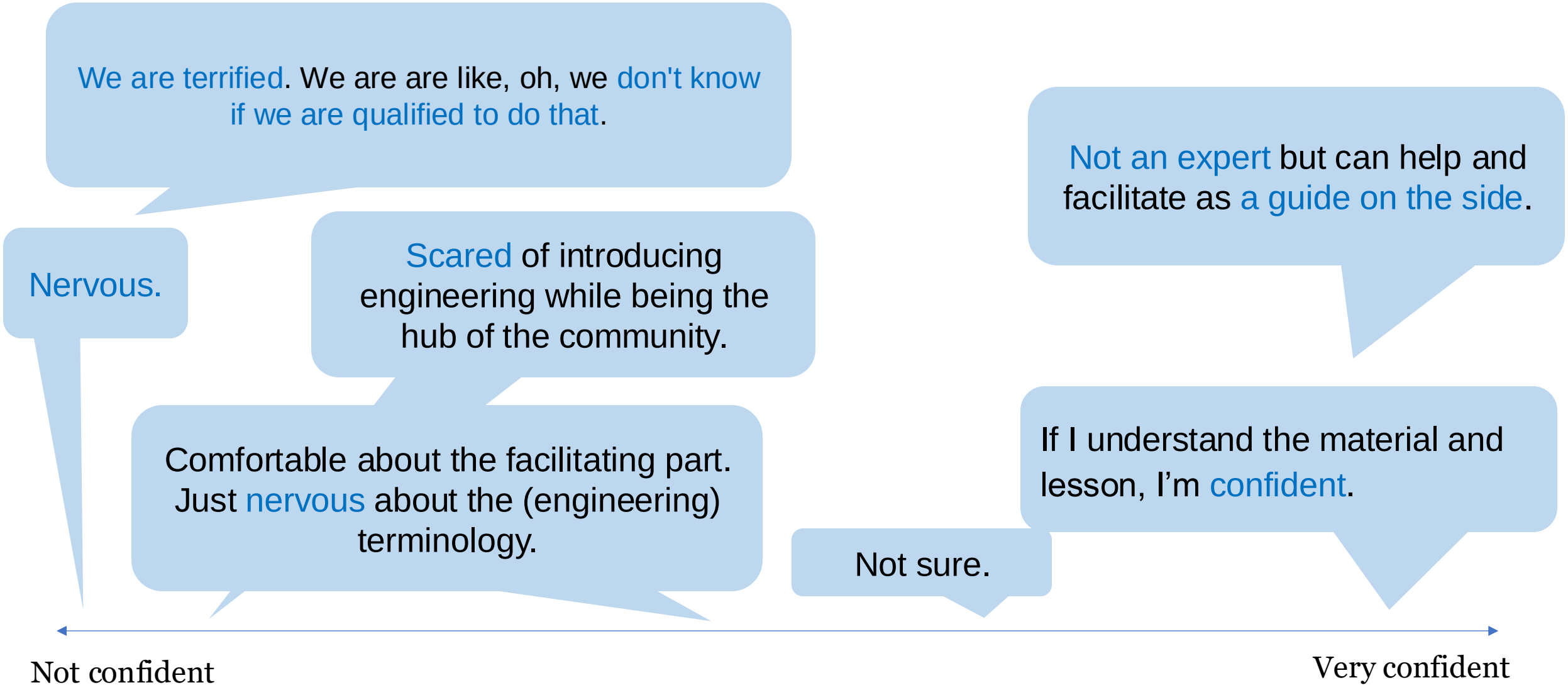
- **Betty**: "I recognized my frustration in creative tasks... now I need to engage more positively."
- **Amber**: "I realized I can be more supportive of his ideas even if they seem messy at first…I'm more open to his messy ideas... it's about exploring together rather than shutting him down."

Perception of STEM

- **Raven**: "Now I feel less intimidated by STEM projects... I'm excited to try this stuff at home…Now I feel like I would seek out more engineering opportunities for my kids."
- **Perry**: "I learned it is beneficial to have more STEM projects... we're incorporating them into our home school curriculum."

*Names are all pseudonyms.

Pre-program: Rural library staff's fear towards engineering



Post-program: Shifts in library staff's perspectives towards engineering

One of the lies, I tell myself, is, I'm not good at math, and I'm not a science person. But, doing these co-design activities and just seeing that it's so wider than this narrow view of it…Which made me go, okay, I could do this! And I'm not bad at math, that's what I tell myself. And **I am an engineering person because I engineer stuff all the time. I just don't call it that.**

(Krystal, pseudonym)

Development of knowledge, attitude, and understanding of engineering
among children, parents, and library staff

Practical Implications

QUESTIONS?

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Scan QR code to access our website

Thank you!

Library Partners

Breezy Gutierrez
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INSTITUTE of Museum and Library SERVICES