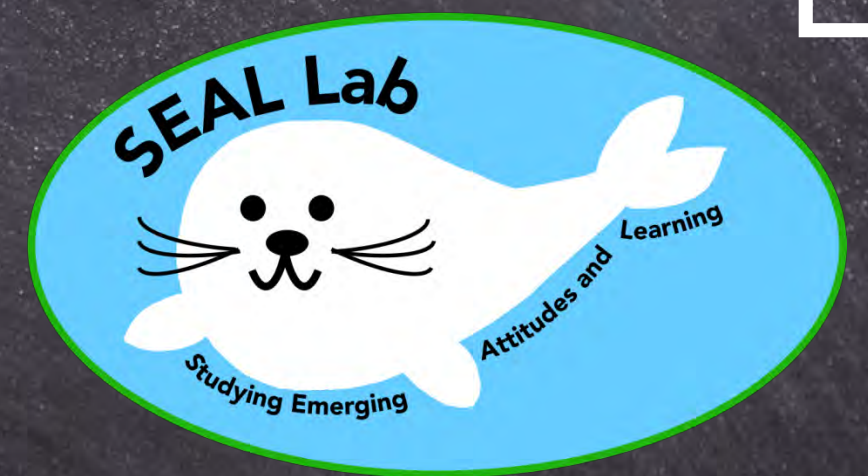


SUPPORTING EARLY STEM

EMILY F. COYLE, Ph.D.



NGCP Webinar: *Choosing Toys to Inspire Young Girls in STEM*

November 14, 2023



ROADMAP



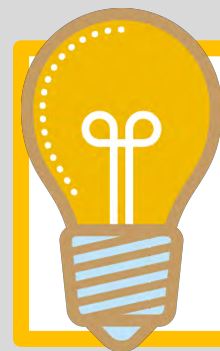
- Early childhood STEM learning (what & how)
- Other skills that support kids' long-term STEM success
- What to look for in STEM materials

EARLY CHILDHOOD STEM LEARNING

1. Numeracy
2. Thinking like a scientist
3. Ideas about social categories (e.g., gender)

1. Numeracy

- Sizes and shapes
- Patterns
- Counting
- Measurement
- Estimation
- Symbolic representation

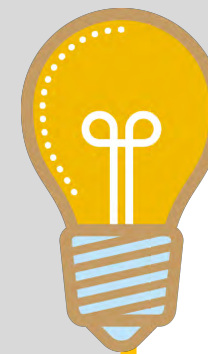


Sesame Street does a LOT of all of these, pretty effectively

2. *Thinking like a scientist*

Rooted in the **scientific method** -

1. Asking **questions**
2. Making **predictions**
3. **Observing**
4. **Recording** observations



Good STEM activities target 1+ of these principles

Opportunities to use STEM principles can be super simple!

- 1. Ask:** How does X work/
What will happen if...?
(overarching research question)
 - *Will the rock sink or float in water?*
- 2. Predict:** What do you think will happen?
(be specific)
 - *It will sink!*
- 3. Observe:** Test the comparison
(try to make single comparison or vary one aspect at a time)
- 4. Record:** Write, draw, or diagram what you see

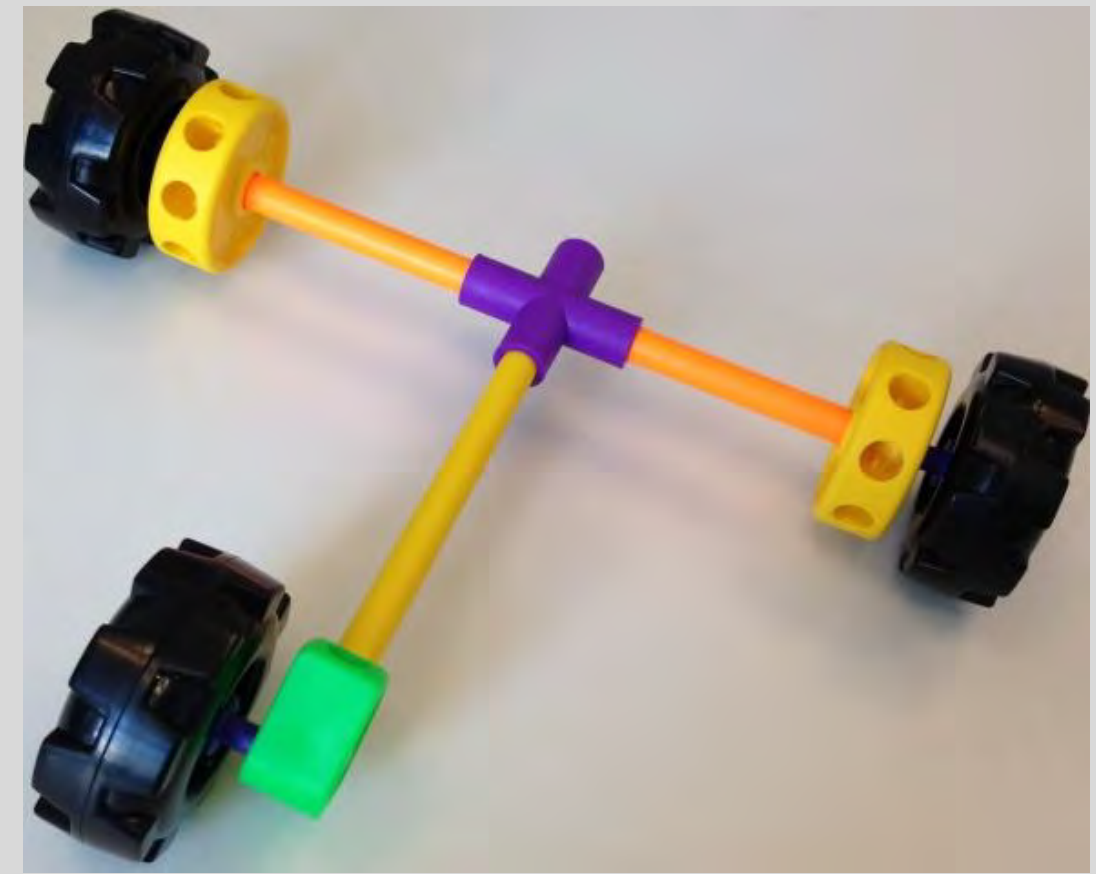


Do anywhere ideas:

- ✓ Sink or float
- ✓ Objects on ramps
- ✓ Mixing colors



Ex: GoldieBlox



Ex: Using Senses

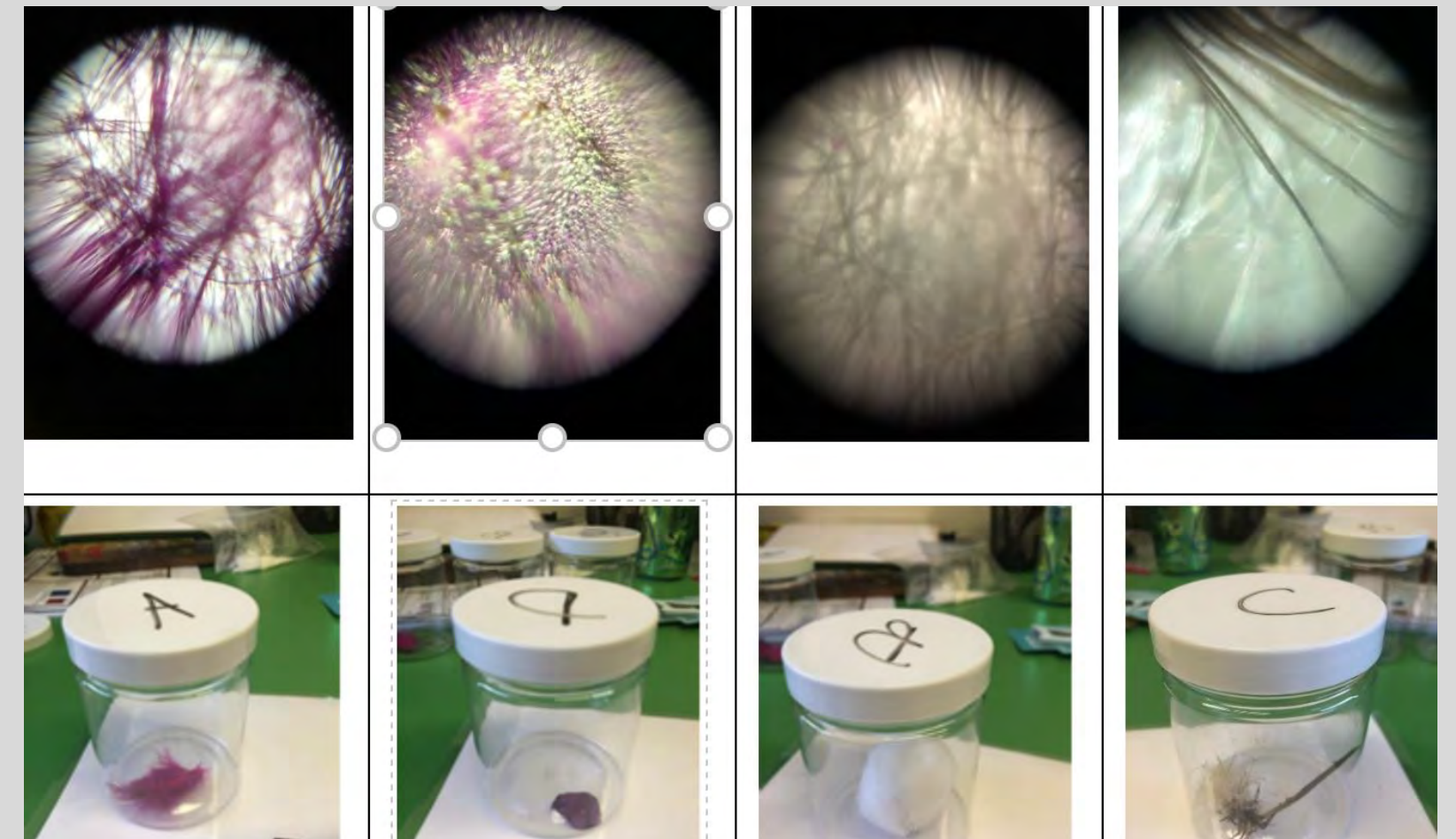
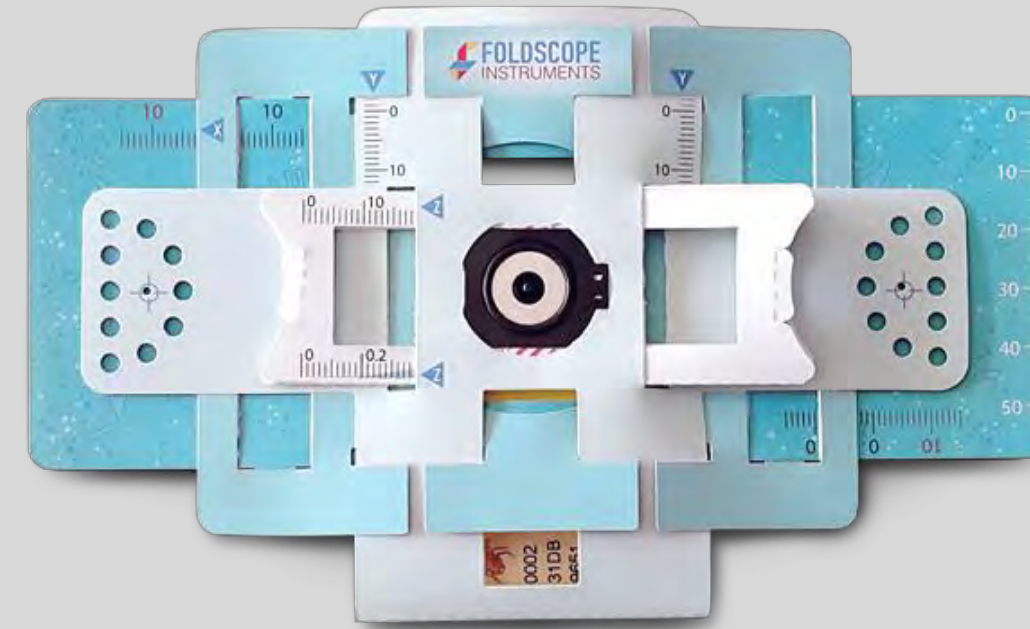
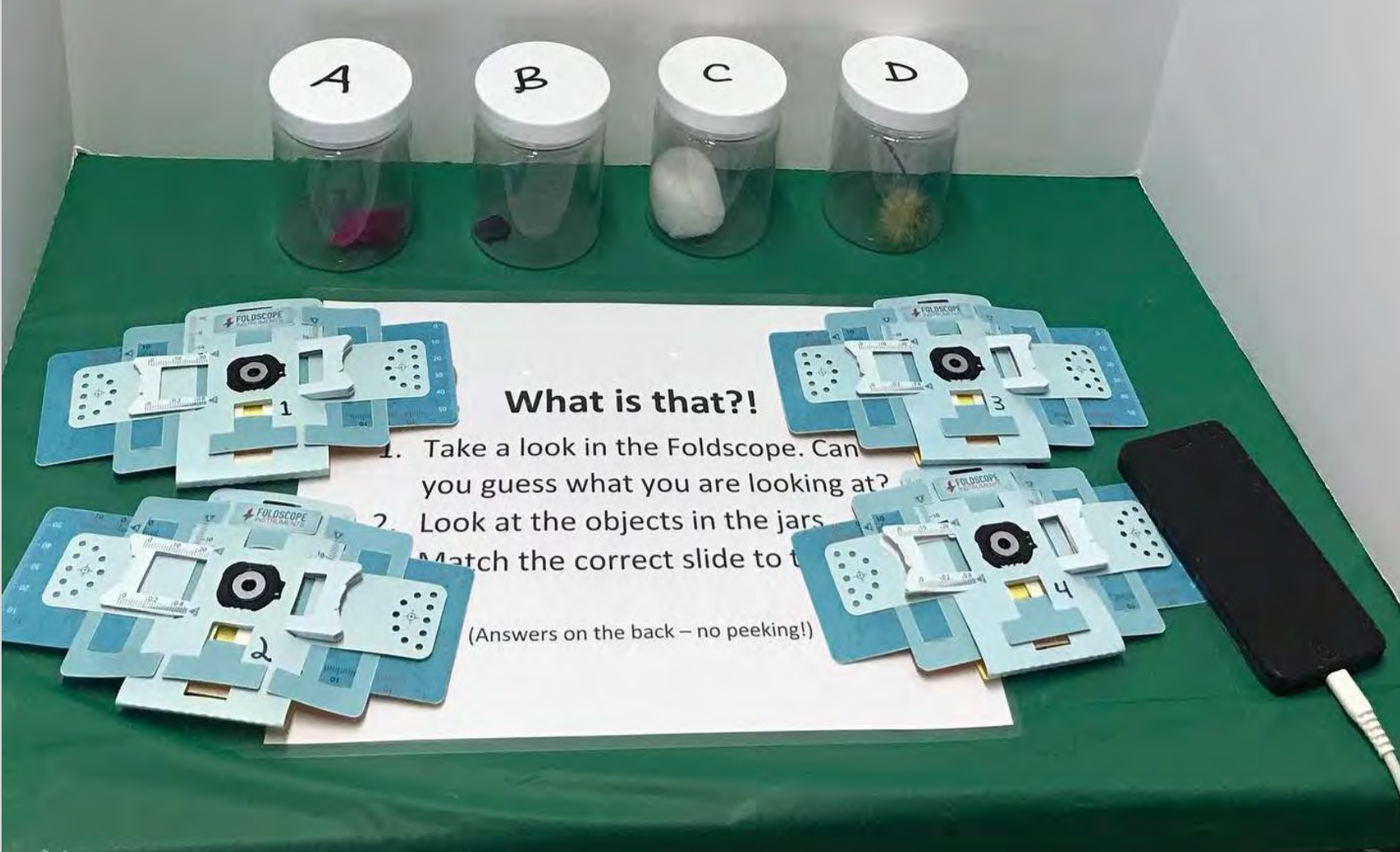


Play a sound...

- | | | | |
|----|---|----|---|
| 1. |  | 4. |  |
| 2. |  | 5. |  |
| 3. |  | 6. |  |

<https://www.stemlittleexplorers.com/en/sensorimotor-activities-children/>

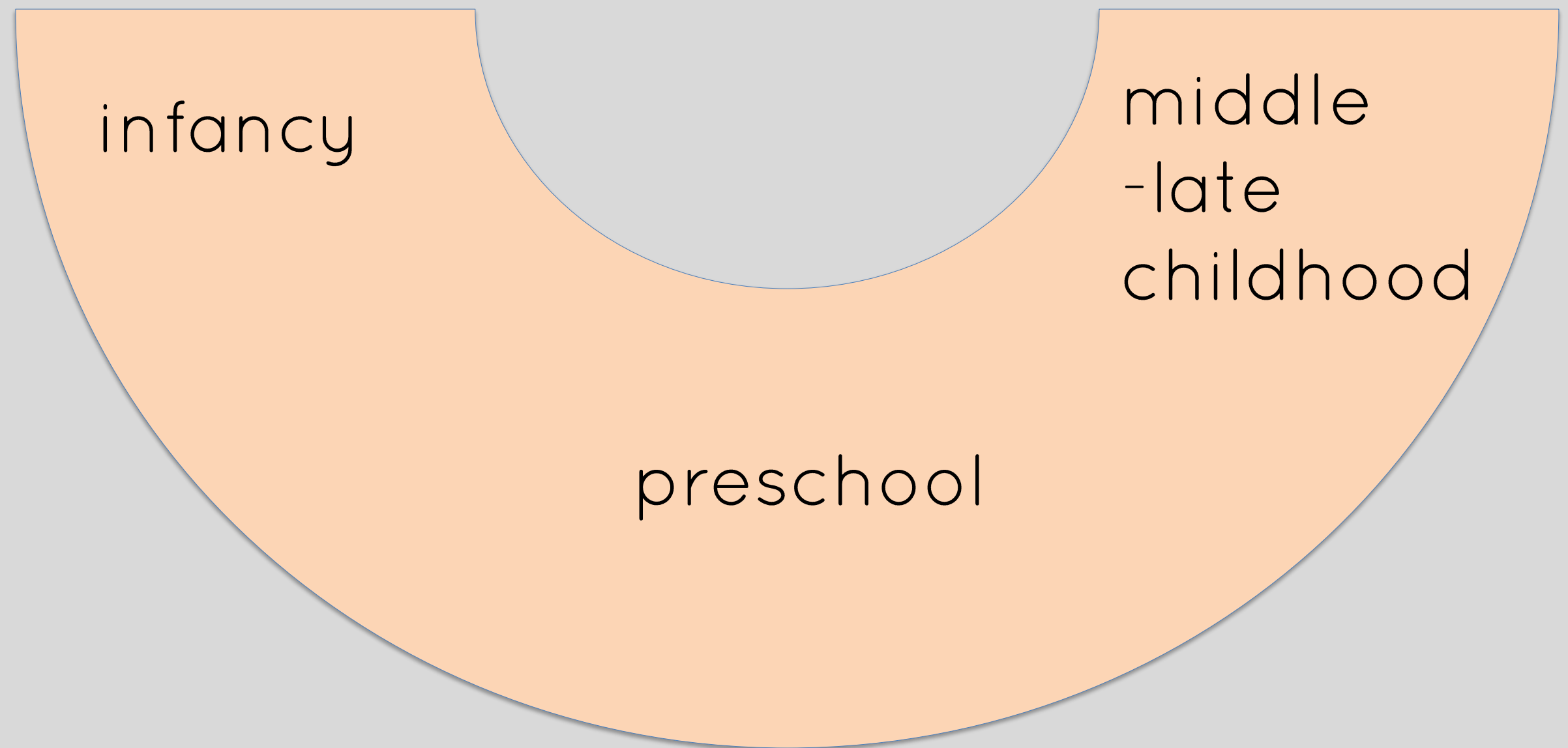
Ex: Foldscope



3. Ideas about social categories

- Part of typical, healthy cognitive development
- Attitude flexibility declines w/ stereotype development
- Flexibility improves as interests specialize

Children's
stereotype endorsement
(/flexibility)



Kids are constantly filtering environment by **social identity cues**:



STEM gap may start when social group membership stereotypes are formed -

- Early play is highly gender-segregated, differentiated
(e.g., Martin et al., 2012)
- Children report stereotyped job interests by preschool
(e.g., Fulcher et al., 2008)

OTHER SKILLS THAT SUPPORT STEM SUCCESS

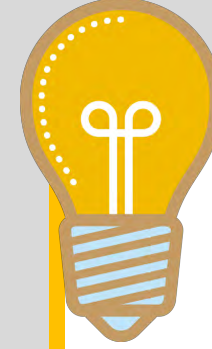
1. Spatial skills
2. Executive function
3. Self-representation

Building skills for LT STEM success

- **Spatial skills**

- Gender gap

- But can be learned:



Support with:

- ✓ **Building & puzzles**

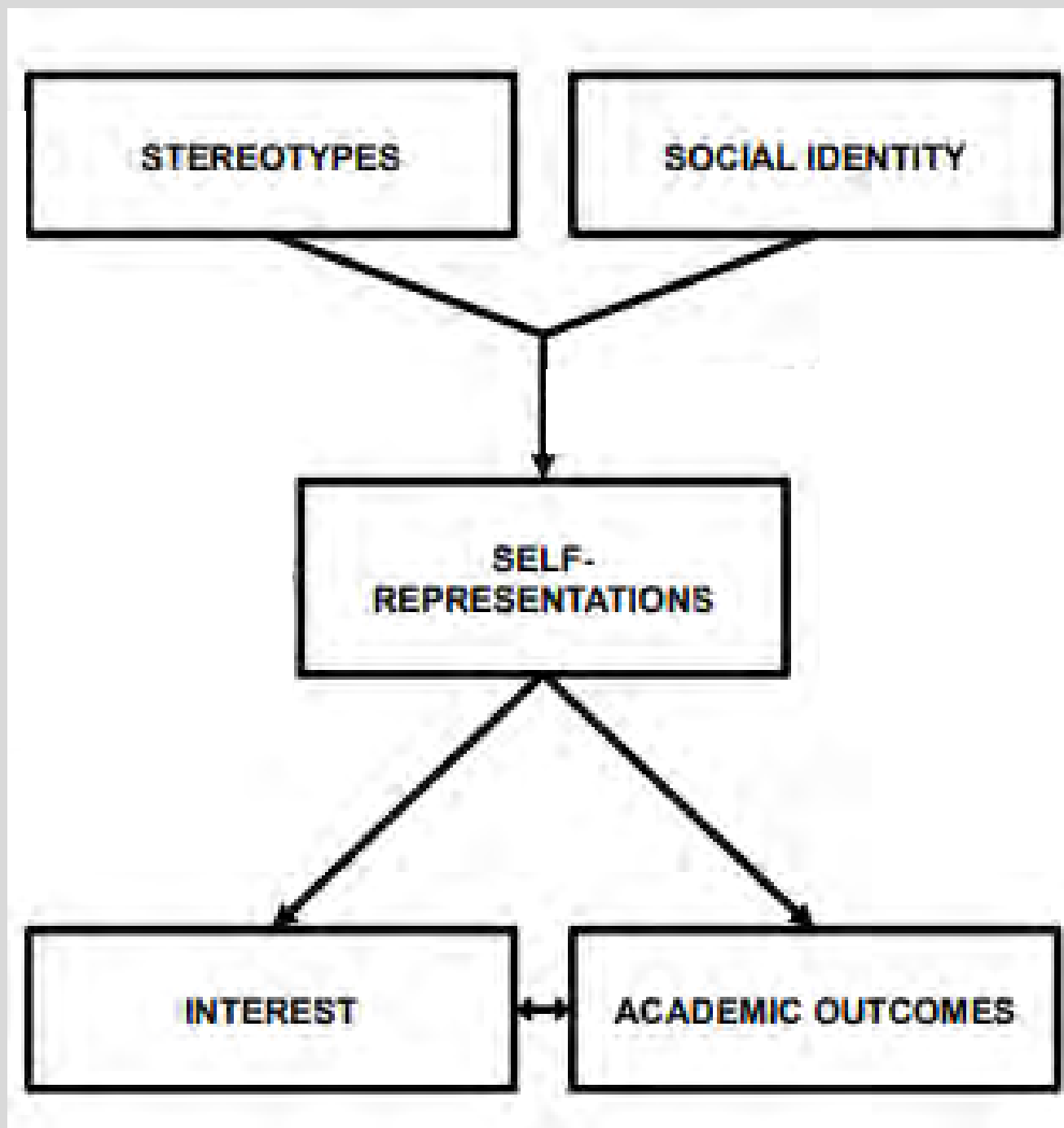
- ✓ **Paper cutting & folding**

- ✓ **Perspective taking/**
spatial visualization –
what do I see vs. what do
you see,
what does it look like
from here vs. from above,
close up vs. far away

- **Executive function**

- Planning, making
systematic comparisons,
thinking flexibly

- But **most** important
 ...**ability to imagine yourself as a scientist**
 –“self representation”
 –Rooted in kids’ **stereotypes**



Master & Meltzoff (2020)



<https://www.nsta.org/draw-scientist>

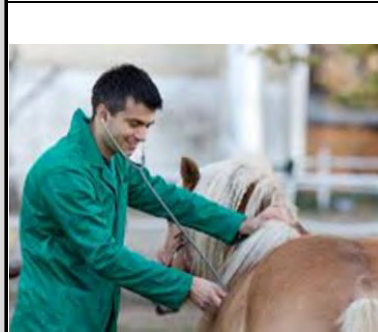
STereotypes, Motivation, & Outcomes (STEMO) model

Language matters

Did you like playing with the microscope?
Maybe you should think about becoming a scientist!
of jobs that use science every day.

“Be a scientist”

Science Jobs in Your Community!



Large Animal Veterinarian:

They are scientists that keep farm animals healthy.



Science Teacher:

They are scientists that teach what they know about science and how to do science too



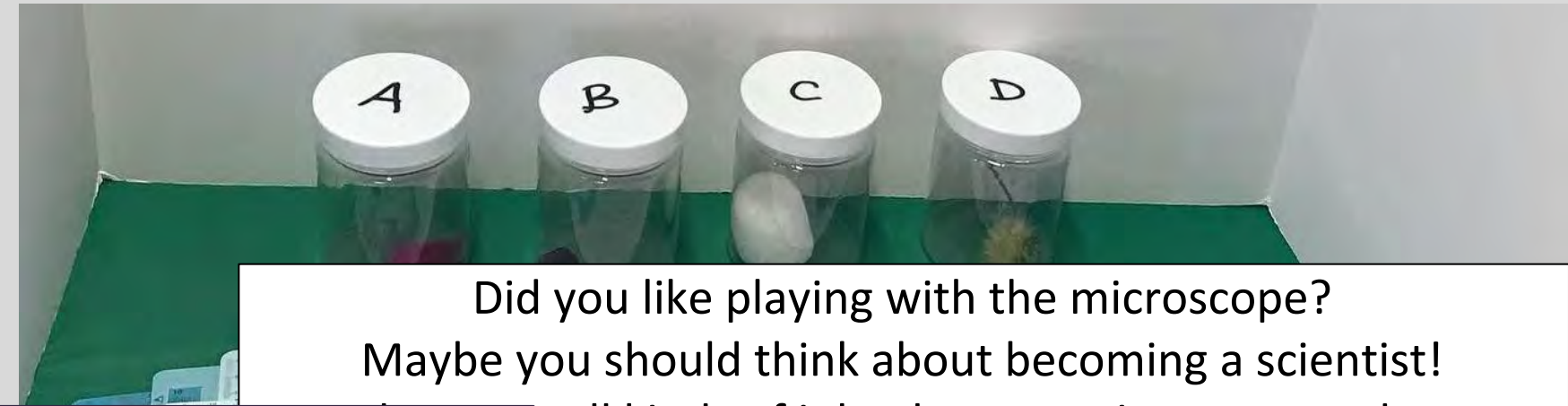
Nurse:

They are scientists that keep people healthy and help sick people feel better.



Park Ranger:

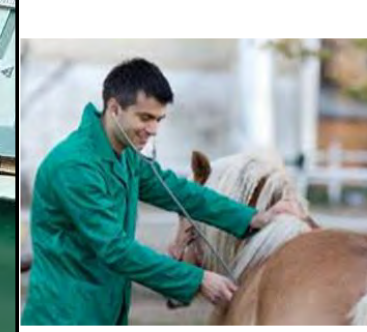
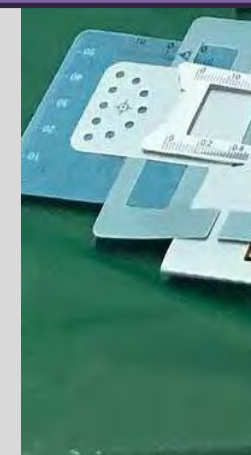
They are scientists that protect wild animals and keep people safe in the woods.



Did you like playing with the microscope?
Maybe you should think about becoming a scientist!
of all kinds of jobs that use science every day.

“Do science”

Science Jobs in Your Community!



Large Animal Veterinarian:

They use science to keep farm animals healthy.



Science Teacher:

They teach children what they know about science and how to do science too.



Nurse:

They use science to keep people healthy and to help sick people feel better.



Park Ranger:

They use science to protect wild animals and keep people safe in the woods.

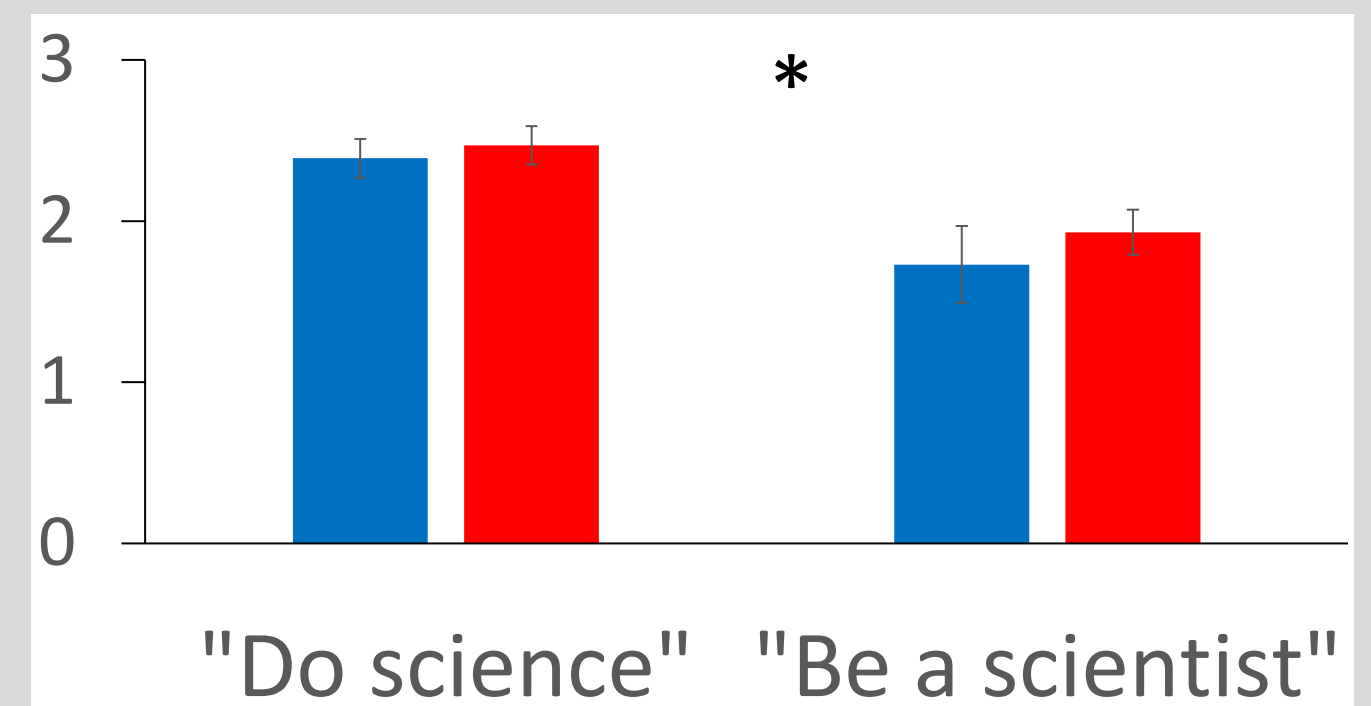
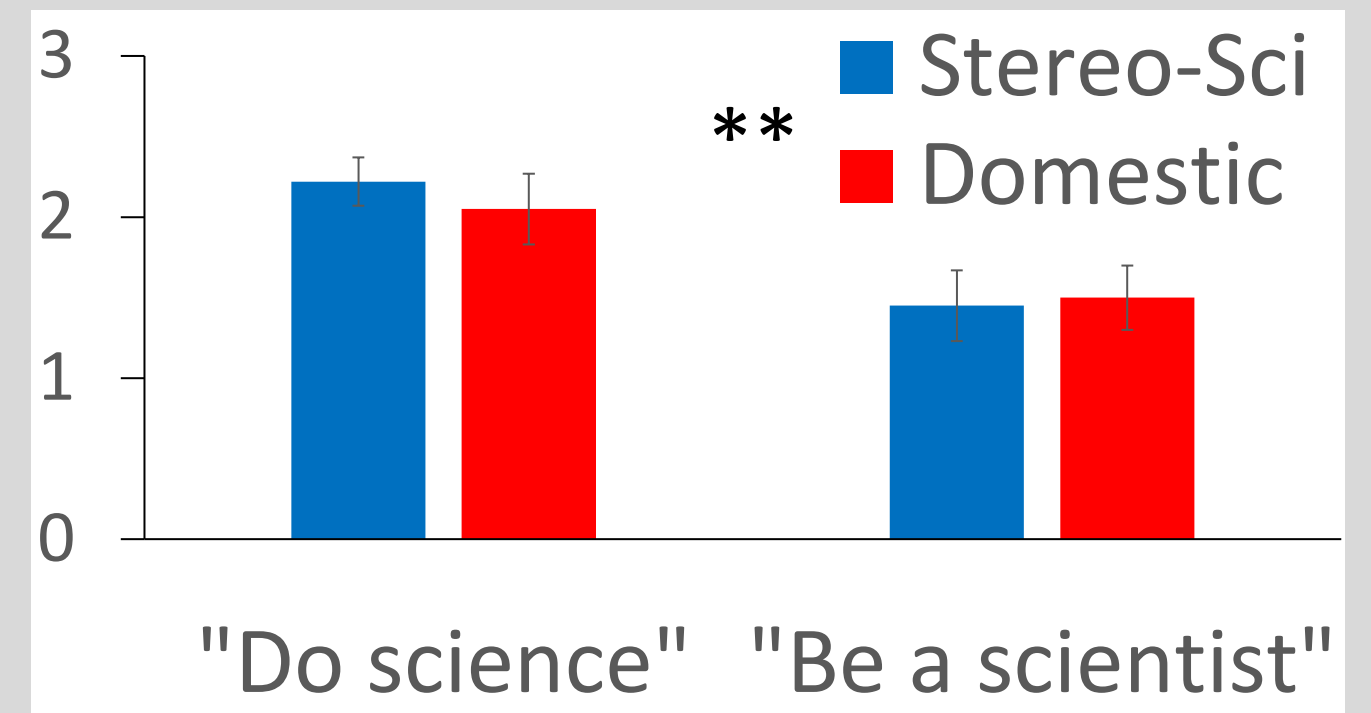




Children who heard about jobs w/ “do science” language...

- more likely to want to be scientists/do sci. as adults,
 $\chi^2(1, N=88)=18.01, p<.001$
- more interested in science,
 $F(1, 84) = 6.45, p = .005$
- had greater science self-efficacy
 $F(1, 84) = 3.16, p = .013$

than “be a scientist,”
regardless of age or gender

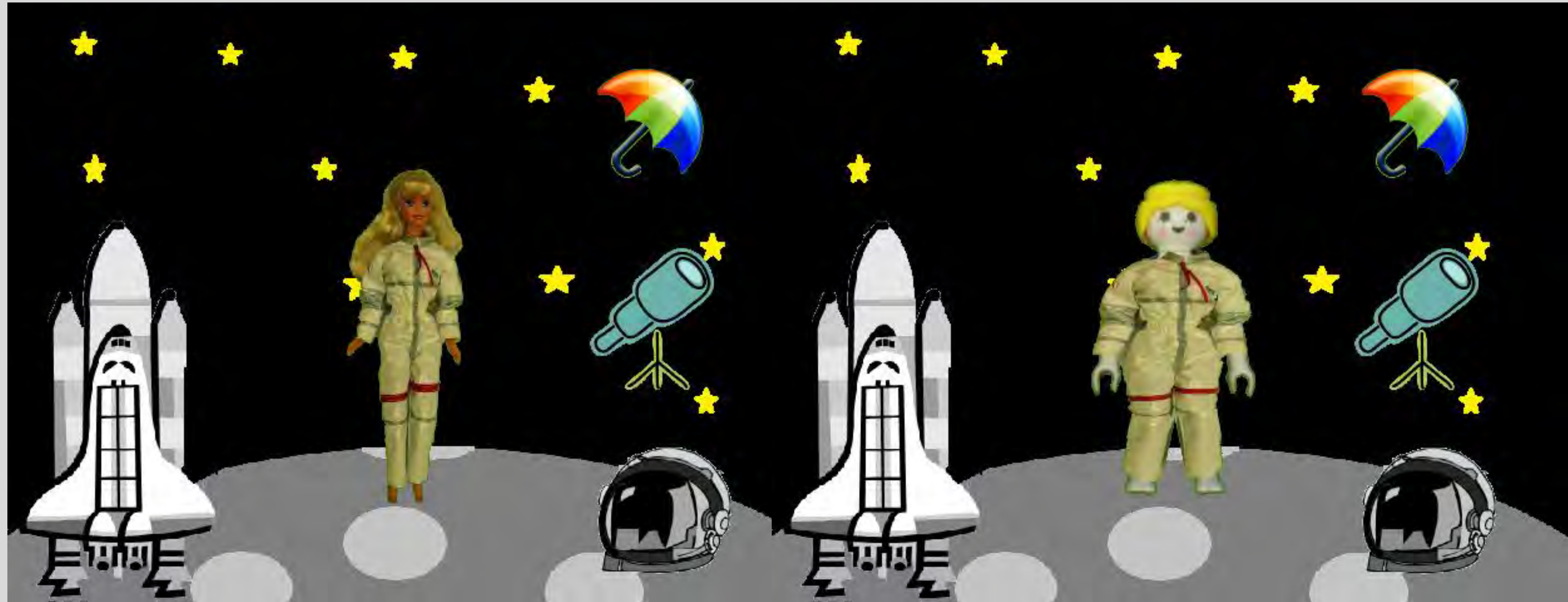




WHAT TO LOOK FOR

1. Supports something about STEM –
actual skill OR self-representation
2. Limited use of social categories
(or intentional diversity)

Astronaut Barbie effect



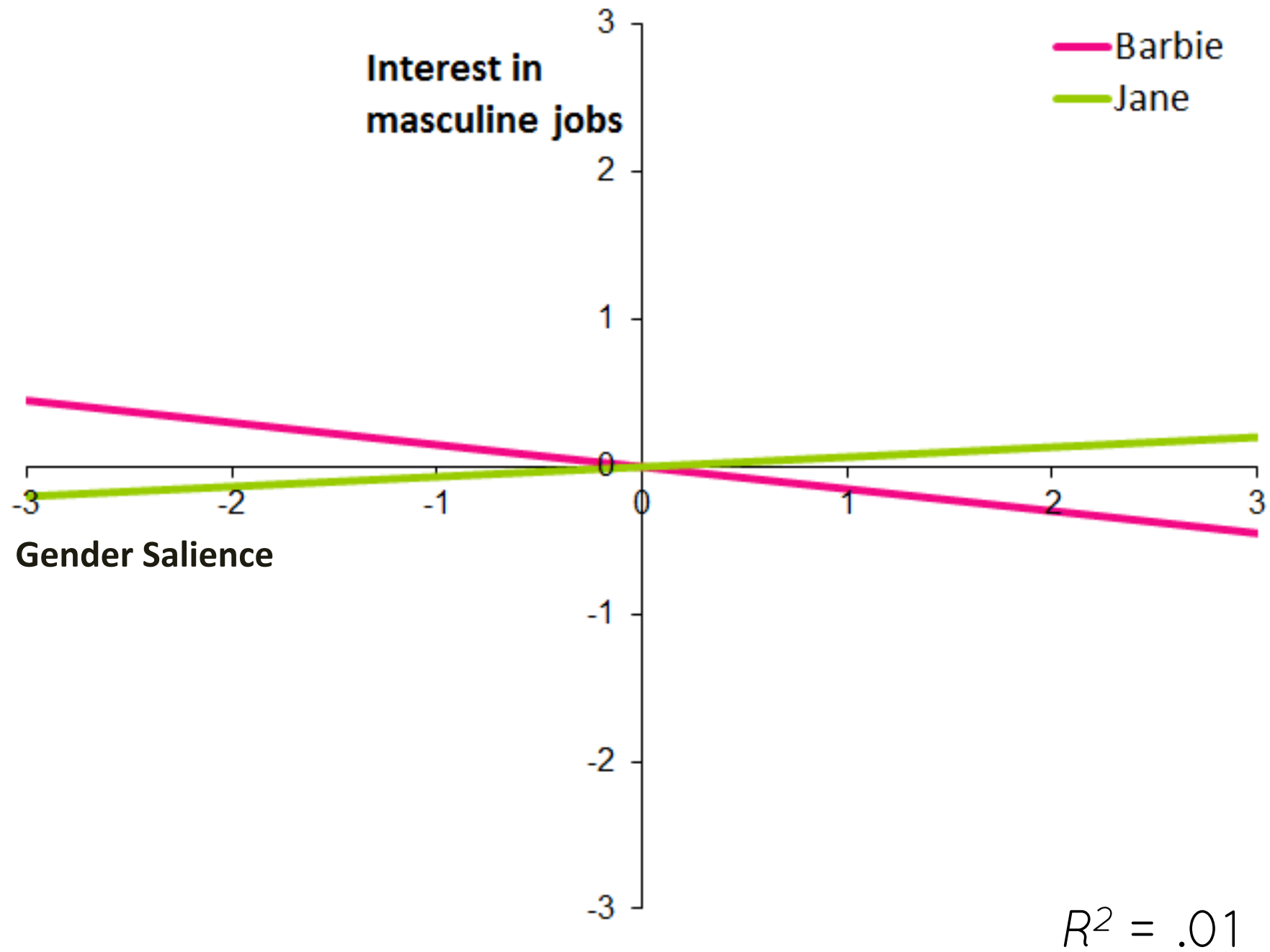
Barbie

(highly feminized)

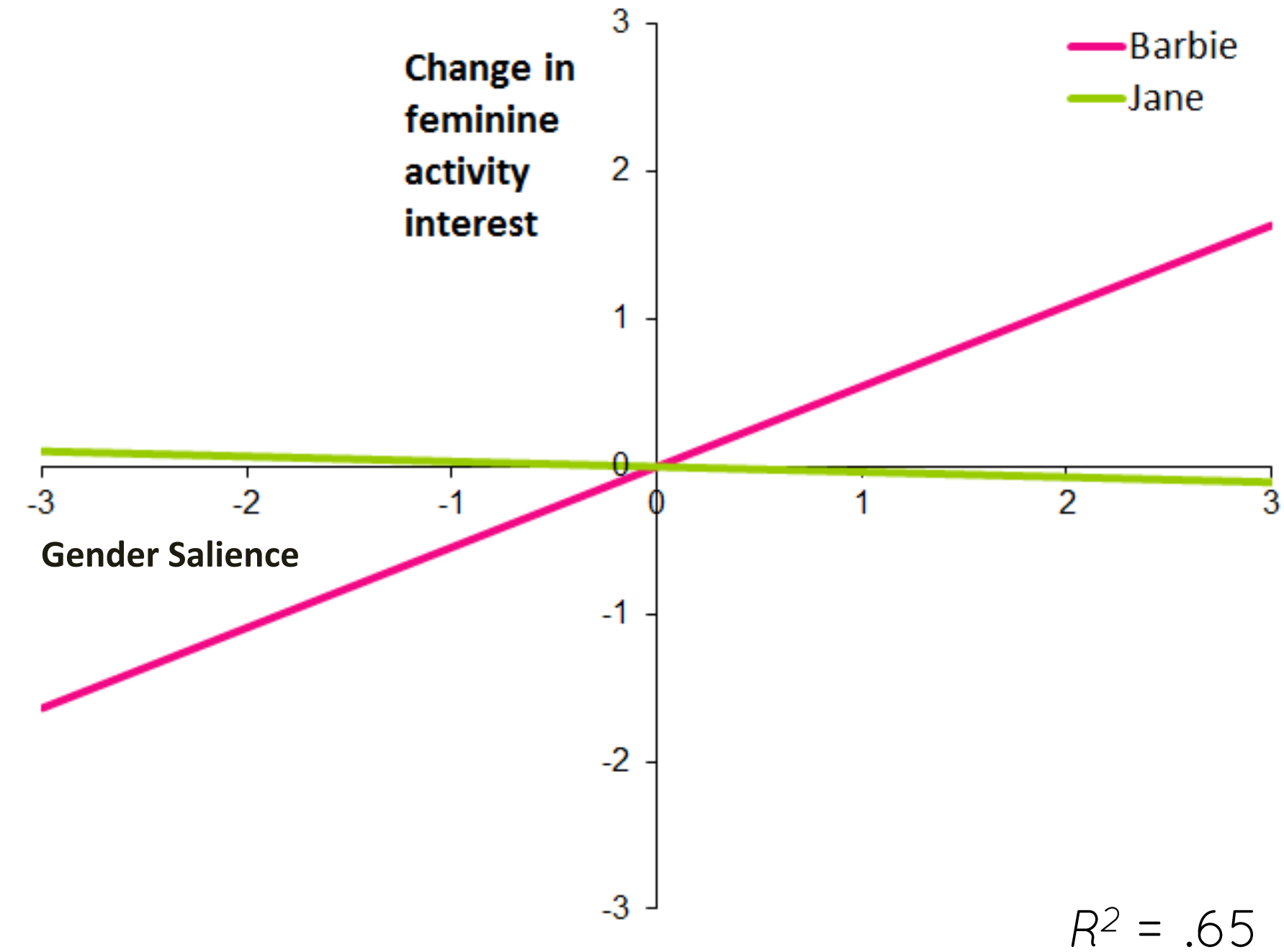
“Jane”

(less feminized)

*No effect on
M job interest*



*Actually, intensified
F play interest!*



Marketing to girls

Goldie Blox™

Goldie Blox and the Spinning Machine

READ ALONG BOOK & BUILD ALONG ENGINEERING TOY

SKILL LEVEL 1
Belt drive
Force
Friction
Wheel & Axle

AGES 6+
Includes: BOOK & 33 PIECES

WARNING:
CHOKING HAZARD - Small Parts
Not for children under 3 years

Bobby Blox™

Bobby Blox and the Spinning Machine

READ ALONG BOOK & BUILD ALONG ENGINEERING TOY

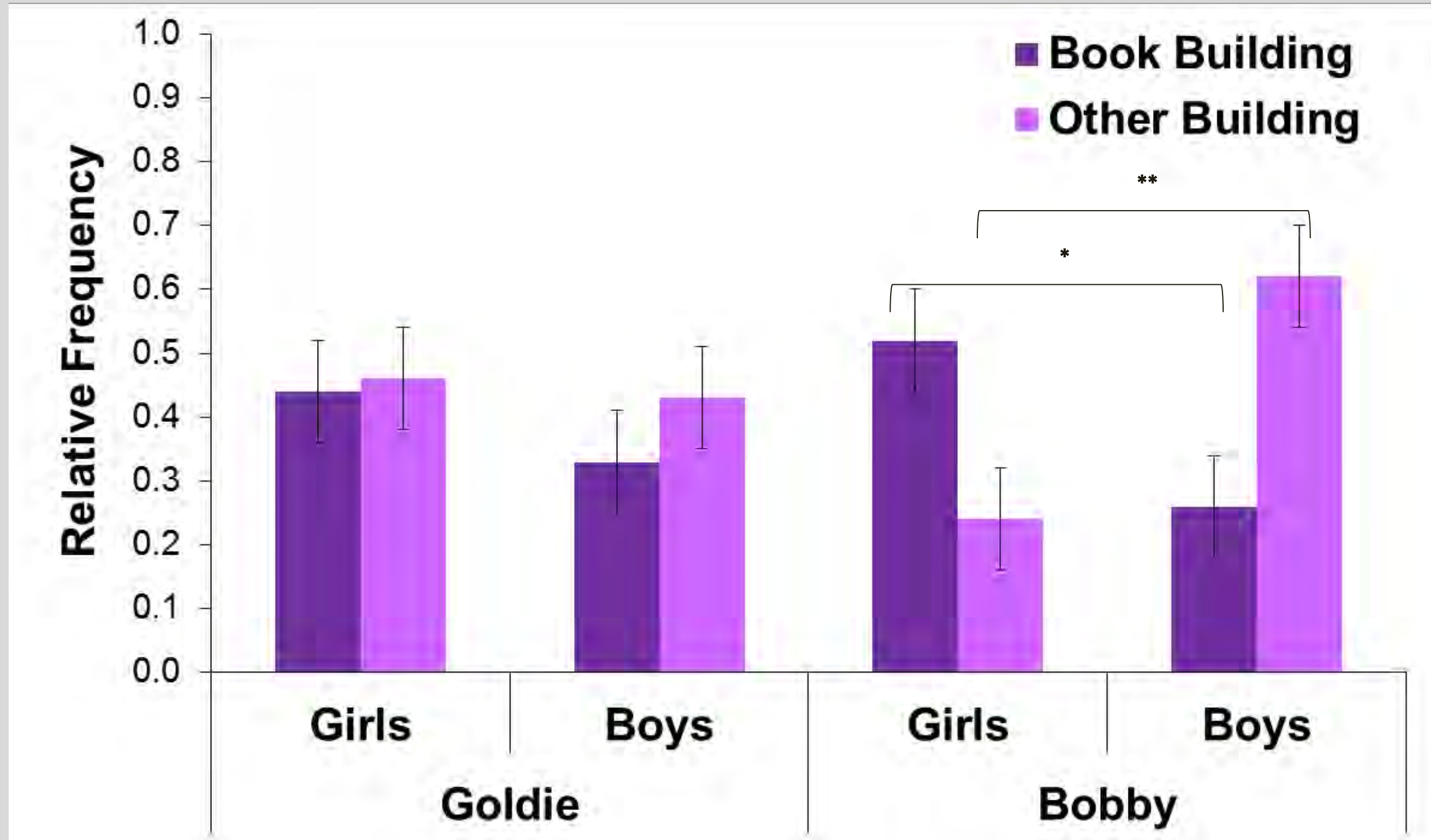
SKILL LEVEL 1
Belt drive
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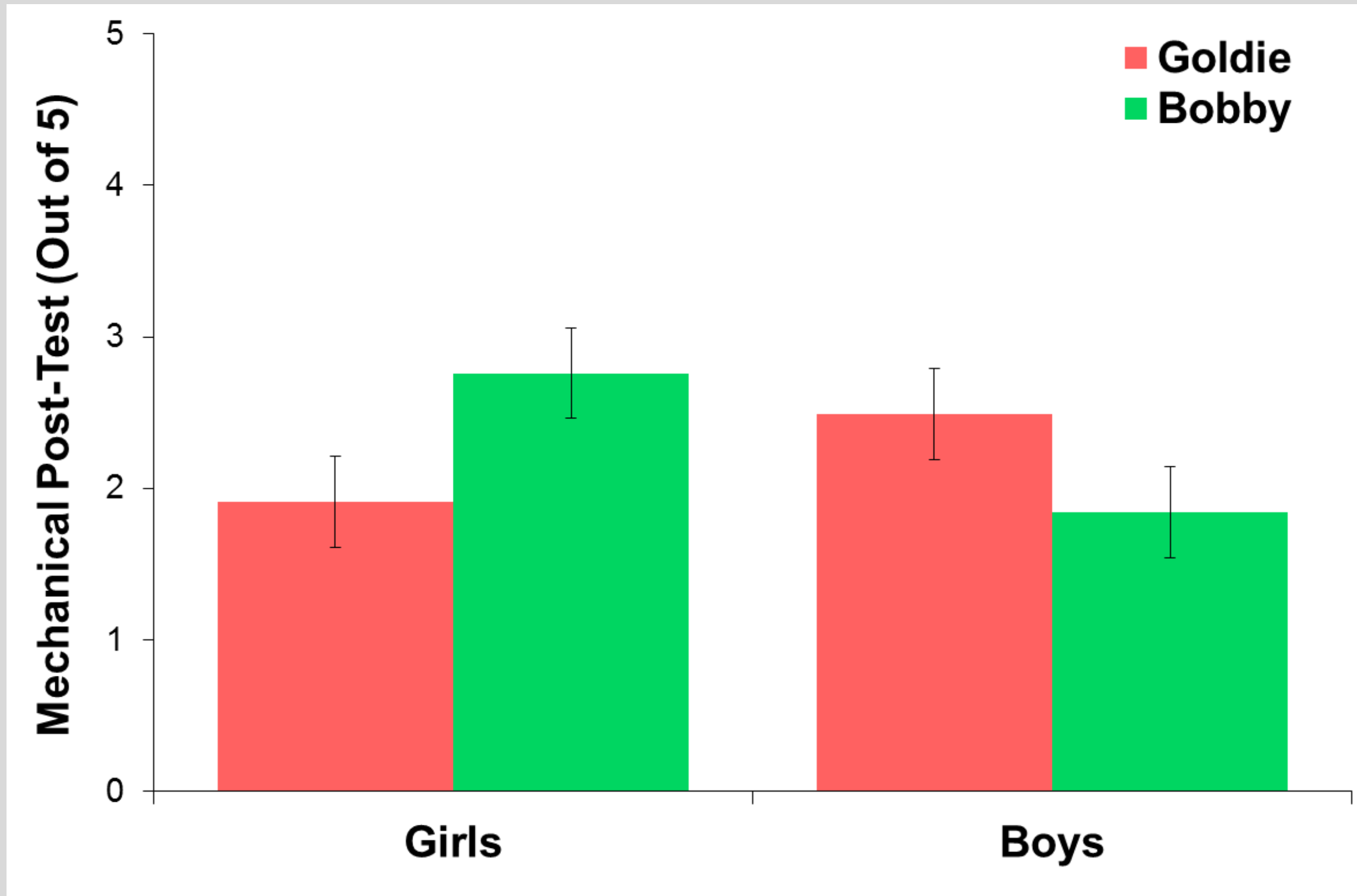
Children played differently with Goldie vs. Bobby



Children learned more from other-gender toy



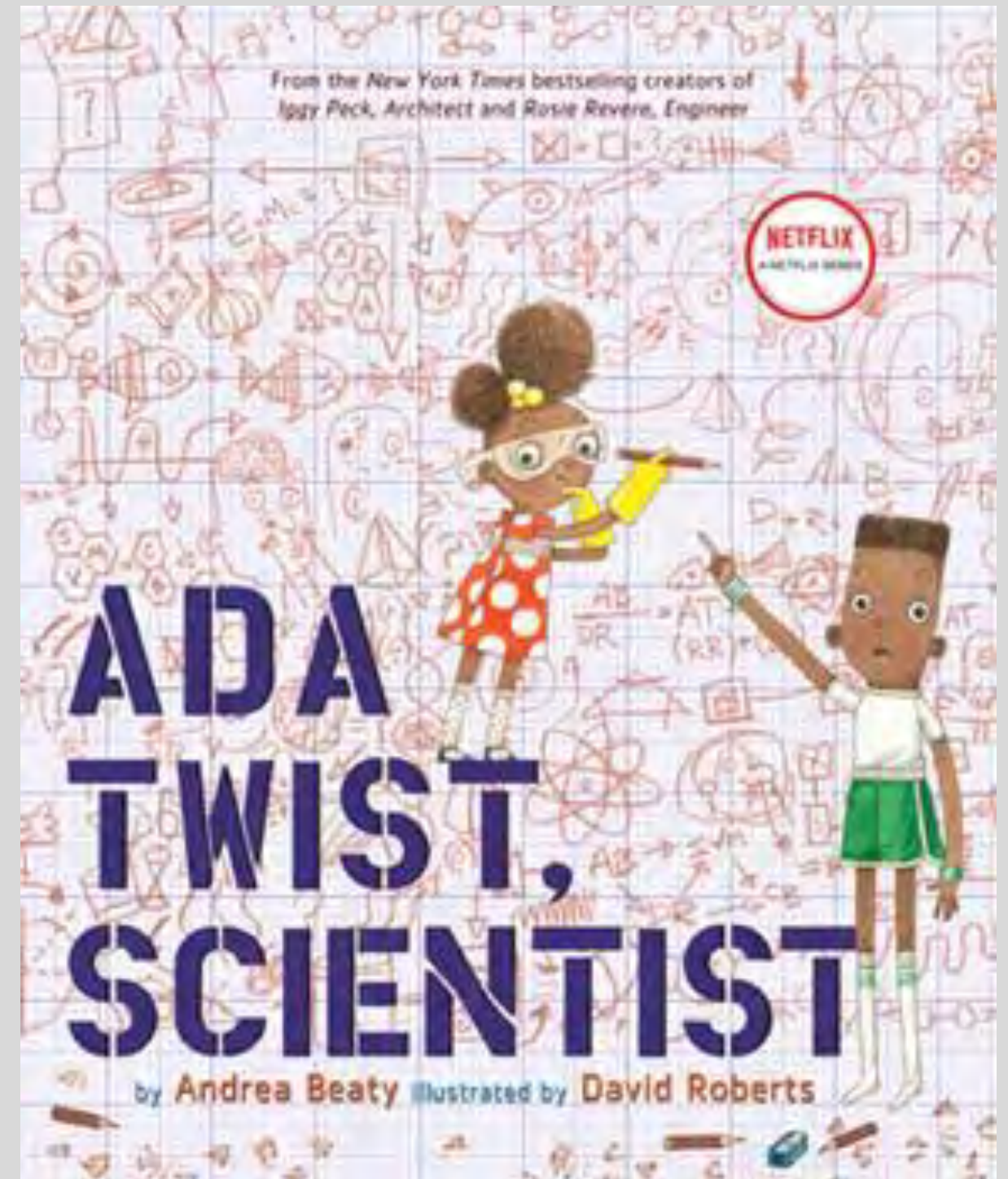
- ✓ Show kids what is different about a new toy if they don't discover it;
- ✓ Avoid strongly gendered marketing





Countering children's stereotypes

- Work hard not to reproduce stereotypes, even subtly
- Keep language gender-neutral
- Offer diverse examples
- Counter the stereotypes kids say, every time (it is exhausting)



THANK YOU!

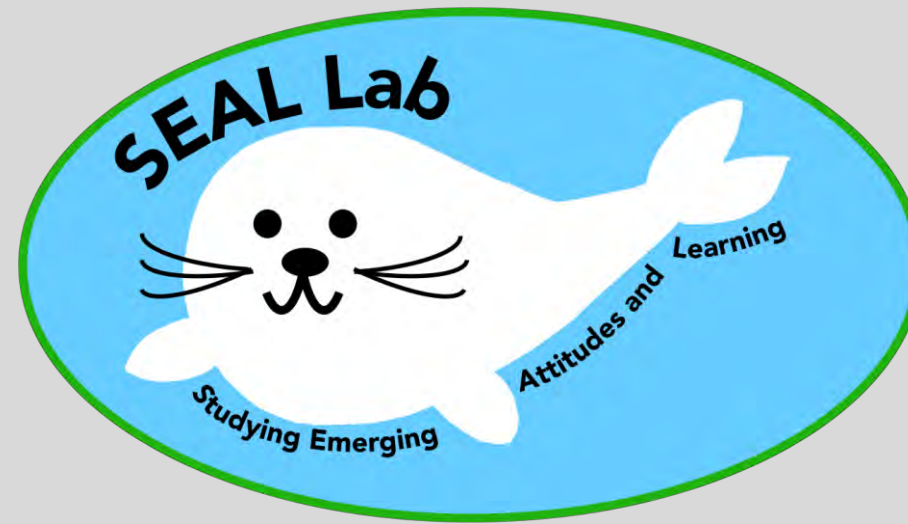


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**Saint Martin's
UNIVERSITY**

- And of course, all the parents, children, teachers, and schools that make this work possible!