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**
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


Coyle & Altman (2016)
What is that?!

1. Take a look in the Foldscope. Can you guess what you are looking at?
2. Look at the objects in the jars.
3. Match the correct slide to it.

(Answers on the back – no peeking!)

Ex: Foldscope

Coyle et al. (2021; 2023)
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)

Bem (1981); Martin & Halverson (1981)
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:

• Executive function
  – Planning, making systematic comparisons, thinking flexibly

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

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**STereotypes, Motivation, & Outcomes (STEMO) model**

Master & Meltzoff (2020)

[https://www.nsta.org/draw-scientist](https://www.nsta.org/draw-scientist)
**Language matters**

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

### Science Jobs in Your Community!

<table>
<thead>
<tr>
<th>Job</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Animal Veterinarian:</td>
<td>They are scientists that keep farm animals healthy.</td>
</tr>
<tr>
<td>Science Teacher:</td>
<td>They are scientists that teach what they know about science and how to do science too</td>
</tr>
<tr>
<td>Nurse:</td>
<td>They are scientists that keep people healthy and help sick people feel better.</td>
</tr>
<tr>
<td>Park Ranger:</td>
<td>They are scientists that protect wild animals and keep people safe in the woods.</td>
</tr>
</tbody>
</table>

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

**Coyle et al, 2023**
Children who heard about jobs with “do science” language...

• more likely to want to be scientists/do sci. as adults,
  \[X^2(1, N=88) = 18.01, p < .001\]

• 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

Coyle et al, 2023
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!

Interest in masculine jobs

Change in feminine activity interest

Gender Salience

$R^2 = .01$

$R^2 = .65$

Coyle & Liben (2016)
Marketing to girls
Children played differently with Goldie vs. Bobby

![Graph showing relative frequency of children's play behaviors with Goldie and Bobby, differentiated by gender and building choice. The graph includes error bars and statistical significance markers.]

Coyle & Liben (2020)

\[ F(1.78, 98.12) = 3.39, \ p = .048, \ \eta^2_p = .05 \]
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

Coyle & Liben (2020)

\[ F(1,53) = 5.27, \ p = .025, \ \eta^2_p = .09 \]
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!
ACKNOWLEDGEMENTS

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