

# Cultivating STEM Identity and Belonging Through Children's Literature



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Advancing Skills and Knowledge (A.S.K.) Conference

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FRANK PORTER GRAHAM  
CHILD DEVELOPMENT INSTITUTE



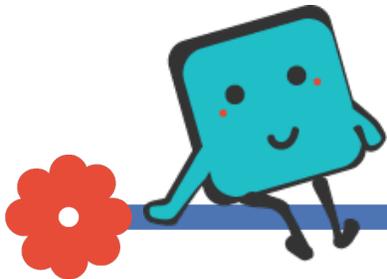
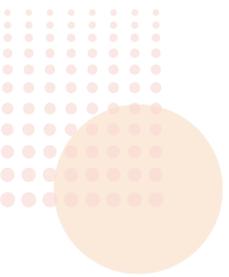
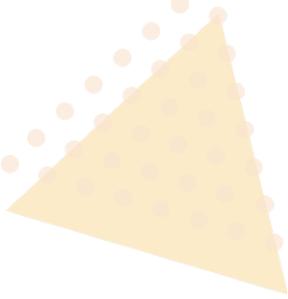
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Office of Special Education Programs  
U.S. Department of Education

# Introduction





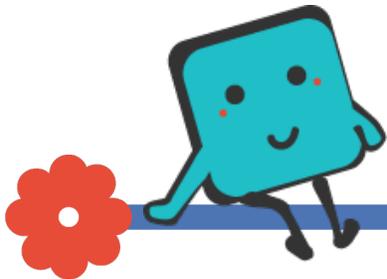
# Who Is Here?

# Housekeeping

- One hour session
- Use Zoom 'raise hand' tool
- Ask questions!
- Unmute!
- Use cell phone camera to scan resource QR codes
- Use chat box



Image from <https://spotme.com/blog/virtual-event-planner/>





**What messages did you hear  
about STEM when you were  
growing up?**



**Do you remember when you  
recognized yourself/your family in  
a book for the first time?**

# Participants Will:

- Describe the importance of using children's literature to support identity, equity and inclusion
- Identify tools and resources for building children's positive STEM identity and belonging through children's literature
- Create a plan for using children's literature to support conversation about diversity and STEM learning.



# Strategies Shared During This Session are Aligned to NC Foundations

- **Emotional and Social Development (ESD): Developing a Sense of Self**

- Goal ESD-1: Children demonstrate a positive sense of self-identity and self-awareness.
- Goal ESD-2: Children express positive feelings about themselves and confidence in what they can do.

- **Language Development and Communication (LDC): Learning to Communicate and Foundations for Reading**

- Goal LDC-2: Children participate in conversations with peers and adults in one-on-one, small, and larger group interactions.
  - Goal LDC-3: Children ask and answer questions in order to seek help, get information, or clarify something that is not understood.
- Goal LDC-8: Children develop interest in books and motivation to read.



# Strategies Shared During This Session are Aligned to NC Foundations (cont'd)

## Cognitive Development (CD): Social Connections

- Goal CD-7: Children recognize that they are members of different groups (e.g. family, preschool class, cultural group).
- Goal CD-8: Children identify and demonstrate acceptance of similarities and differences between themselves and others.
- Goal CD-9: Children explore concepts connected with their daily experiences in their community.



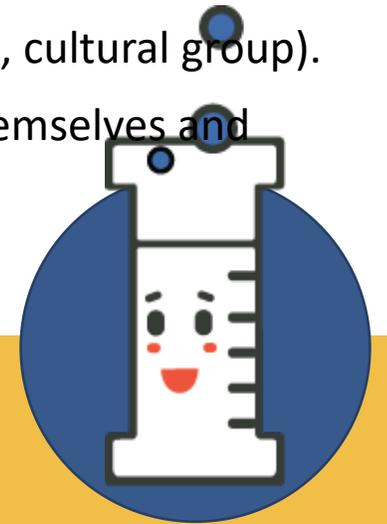
# Strategies Shared During This Session are Aligned to NC Foundations

## • Language Development and Communication (LDC)

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# Why this is important



# Children's books are a vehicle for promoting inclusion

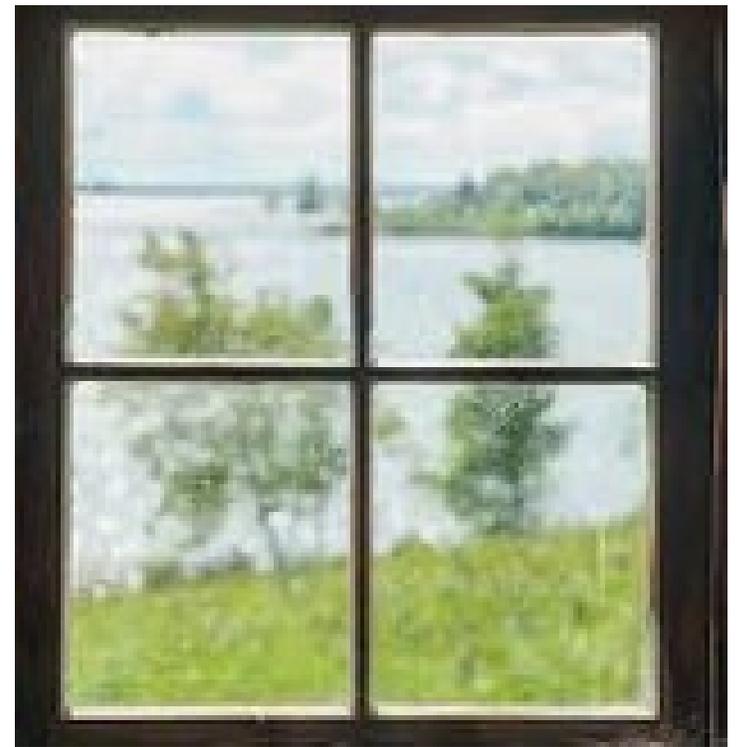


Rudine Sims Bishop

Professor Emerita  
Ohio State University



Mirror



Window



Children's attitudes about STEM and about themselves as STEM learners are formed early  
- Early Childhood STEM Working Group, 2017

# What is STEM Identity?

“A social identity bound by early and deliberate exploration of STEM and an explicit recognition of the relevance of STEM-related activity in daily life”

- Harchey, 2020



# Research shows



Children improve their math, early literacy, and reading when they start learning science concepts early.  
(Paprzycki, et al., 2017)



Children can learn STEM through storybook reading (Green et al., 2018).

During shared-book reading, adults can provide adaptations for children with disabilities in various ways.  
(Towson, 2020)



To better support children's math learning at home, a collaboration between teachers and parents is needed (Sonnenschein et al., 2020)



Huyck, David and Sarah Park Dahlen. (2019 June 19). Diversity in Children's Books 2018. [sarahpark.com](http://sarahpark.com) blog. Created in consultation with Edith Campbell, Molly Beth Griffin, K. T. Horning, Debbie Reese, Ebony Elizabeth Thomas, and Madeline Tyner, with statistics compiled by the Cooperative Children's Book Center, School of Education, University of Wisconsin-Madison: [ccbc.education.wisc.edu/books/pcstats.asp](http://ccbc.education.wisc.edu/books/pcstats.asp). Retrieved from [readingspark.wordpress.com/2019/06/19/picture-this-diversity-in-childrens-books-2018-infographic](http://readingspark.wordpress.com/2019/06/19/picture-this-diversity-in-childrens-books-2018-infographic).

# DIVERSITY IN CHILDREN'S BOOKS 2018

Percentage of books depicting characters from diverse backgrounds based on the 2018 publishing statistics compiled by the Cooperative Children's Book Center, School of Education, University of Wisconsin-Madison: [ccbc.education.wisc.edu/books/pcstats.asp](http://ccbc.education.wisc.edu/books/pcstats.asp)



Illustration by David Huyck, in consultation with Sarah Park Dahlen  
Released under a Creative Commons BY-SA license: <https://creativecommons.org/licenses/by-sa/4.0/>

The CCBC inventory includes 3,134 books published in 2018. This graphic would not have been possible without the statistics compiled by the CCBC, and the review and feedback we received from Edith Campbell, Molly Beth Griffin, K. T. Horning, Debbie Reese, Ebony Elizabeth Thomas, and Madeline Tyner. Many thanks.

# How do you select books for shared book reading?



# Selection criteria (see Handout)

## STEM Storybook selection criteria

### Consider Diversity and Inclusion

There are no stereotype and misrepresentation prompted in the story

Diverse characters (e.g., characters with disabilities or characters of color; male/female) are represented in the book

If diverse characters were portrayed in the book, they were identified as a positive and constructive role model or have leadership and action roles.

There are no offensive or harmful words to individuals with disabilities or diverse population (e.g., slow, crazy, idiot, etc.)

### Consider STEM content

Storybook provides an accurate STEM idea/concepts that can be expanded on through conversation; list all possible STEM concepts

The story incorporates different STEM vocabularies; list STEM vocabularies used

The story can make connections with children's own experiences

The story can promote STEM learning and process

Is STEM content developmentally appropriate or align with standards

### Consider Storybook Conversation

The book is appropriate and appealing for young children (content, length, vocabularies)

The book has potential for STEM conversations/discussions

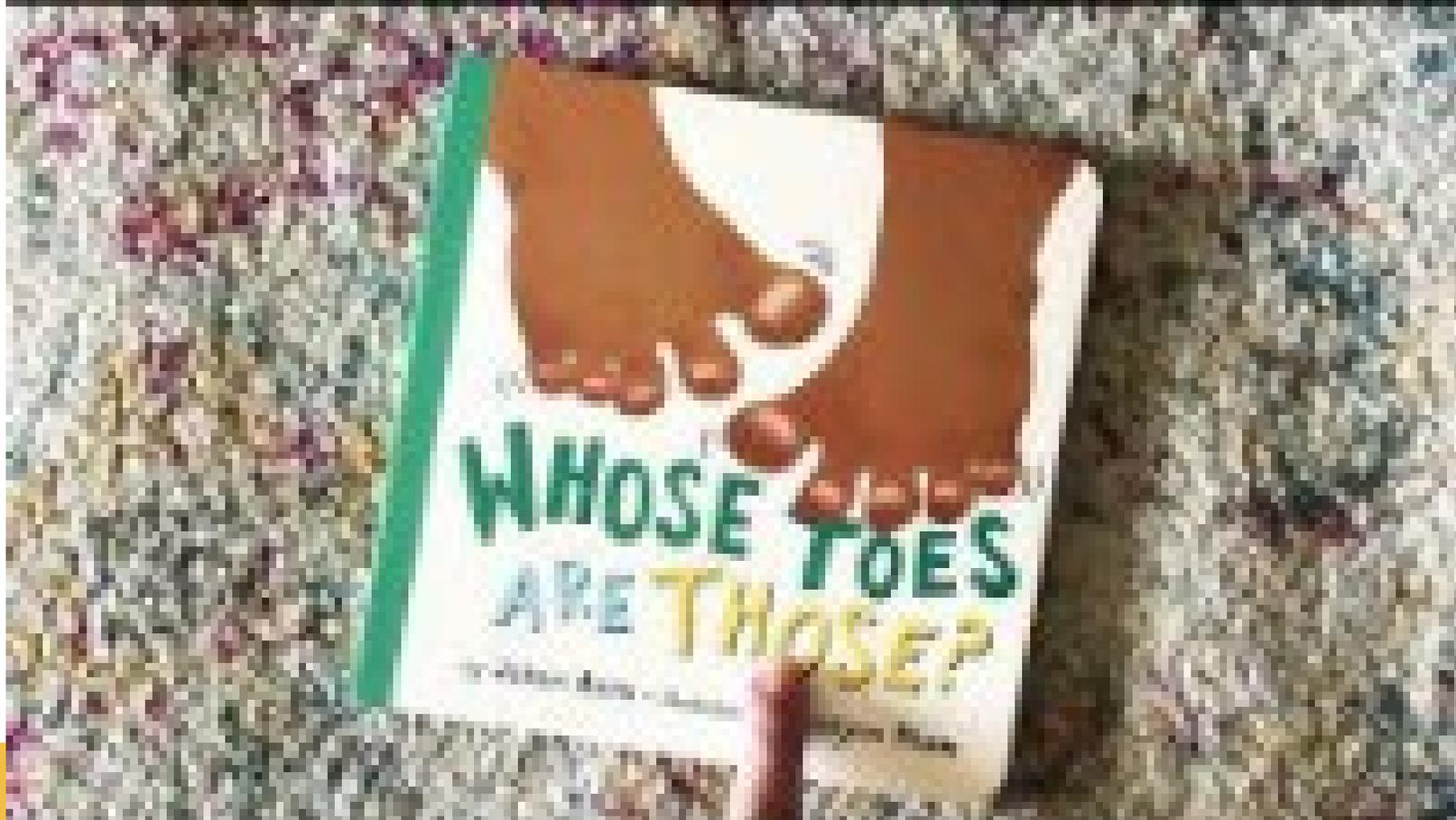
This check list was adapted by Hsiu-Wen Yang from Connect Module 6.2; Cavanaugh, C. L. (2010); Nasatir and Horn (2003); STEM literacy, 2017; Van den Heuvel- Panhuizen, M. & Elia, I. (2012)



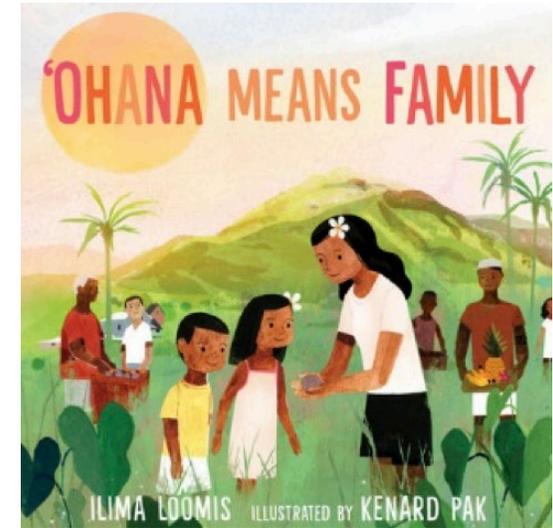
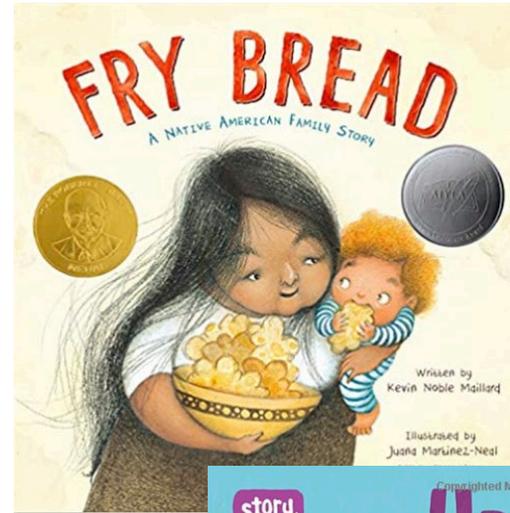
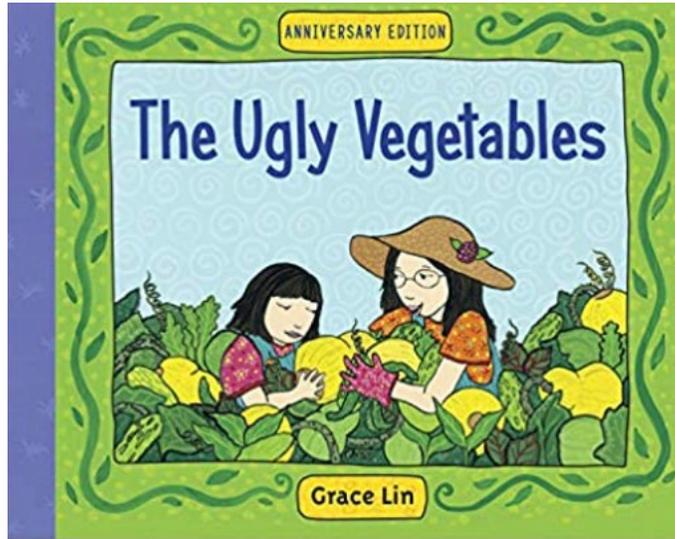
**Would you recommend this book?  
Why or why not?**



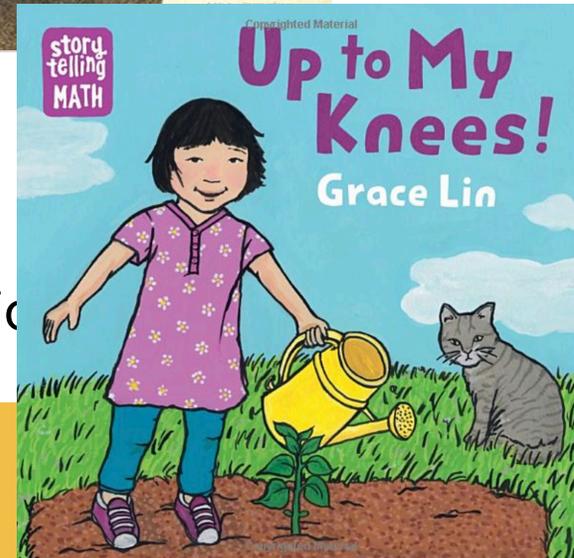
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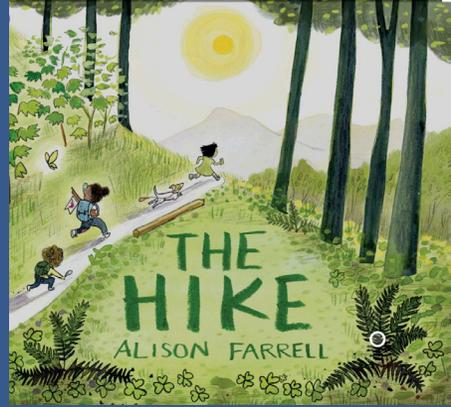
# Foods and cooking; planting; daily routines



- Connect to many aspects of culture and beliefs
- Reflect children's diverse home foods and food practices
- Instill cultural and ethnic pride
- Offer windows or sliding doors to the diverse food practices of others



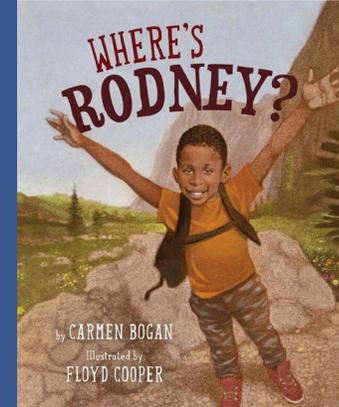
# Click to e



What's a hike?

Have you been on a hike?  
What was it like?

What are things to see and  
do on a hike?



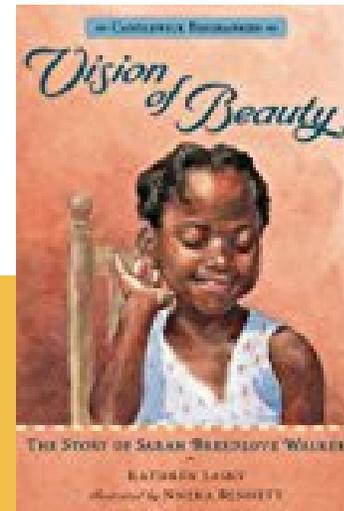
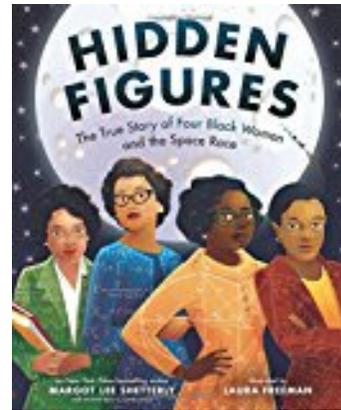
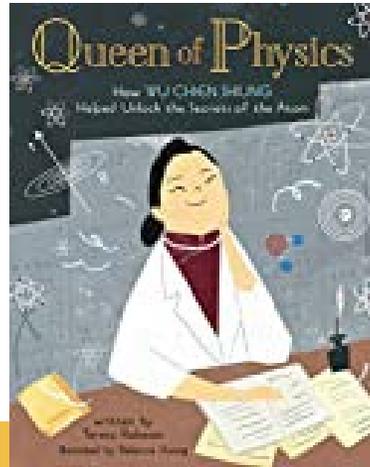
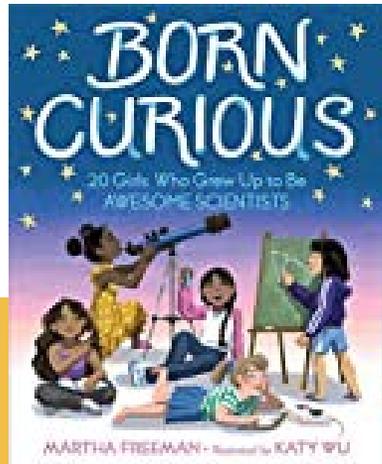
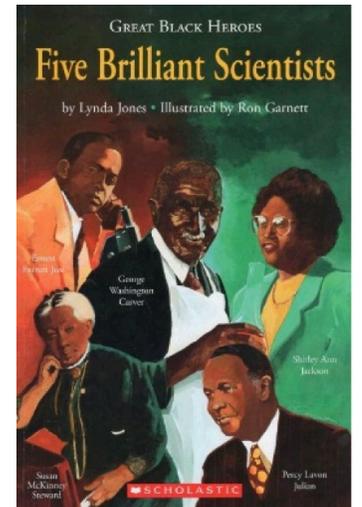
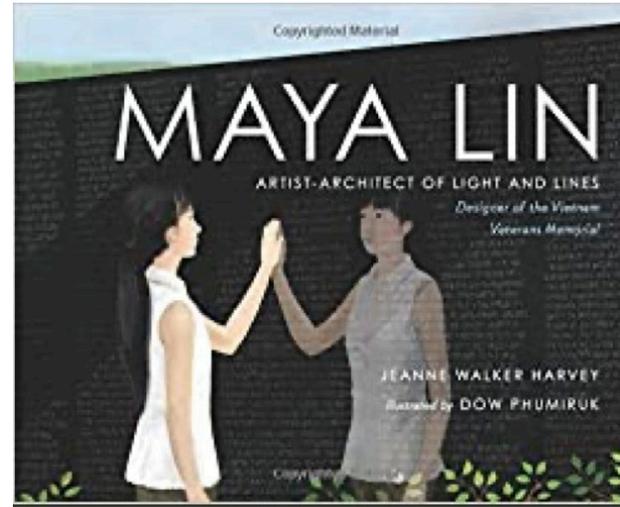
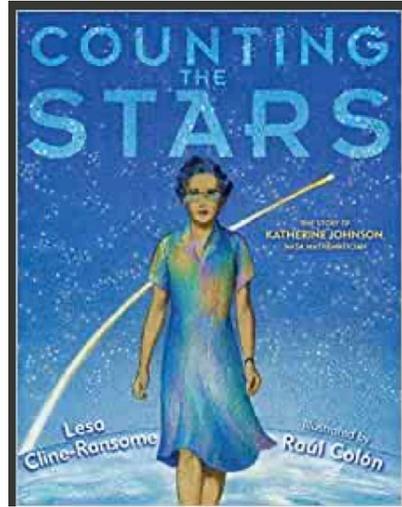
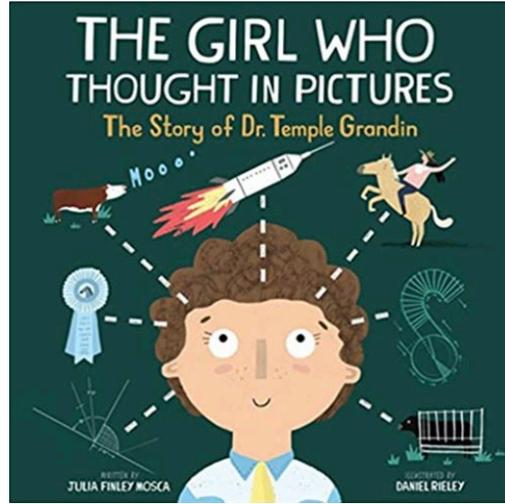
What's a park?

What can you do in a park?

What do you think you'll see  
in a park?

# **Children's books about real-life STEM professionals**

- Important for children to develop strong STEM identity
- Hearing real life stories of individual's success in STEM careers can model
- Use books to facilitate discussion around how ALL children can and should pursue STEM learning opportunities and careers

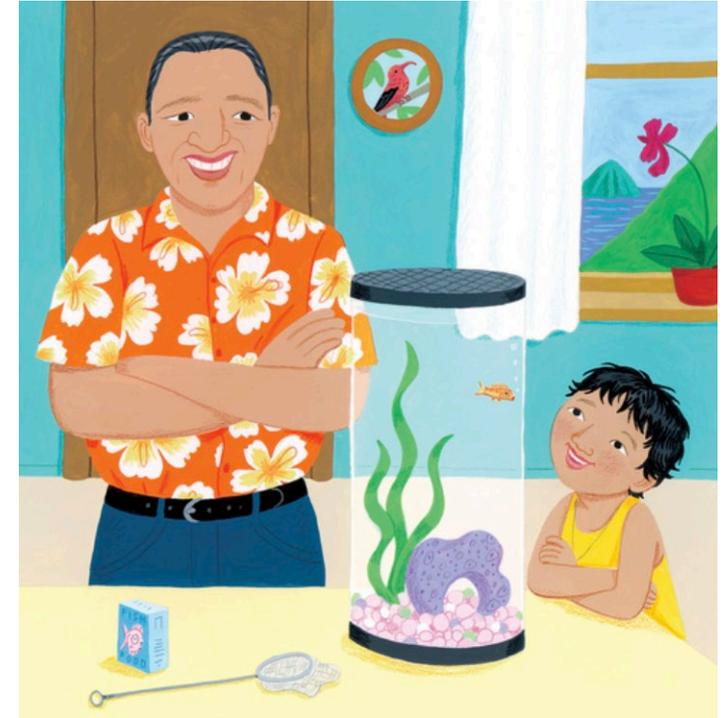


# Chat Box

Are you familiar with dialogic reading?

# The fundamental reading technique in dialogic reading is the PEER sequence

- **Prompts** the child to say/respond to something about the book,
- **Evaluates** the child's response,
- **Expands** the child's response by rephrasing and adding information to it, and
- **Repeats** the prompt to make sure the child has learned from the expansion.



- <https://www.readingrockets.org/article/dialogic-reading-effective-way-read-aloud-young-children>

# Examples

**Ages 4-8** **Math**

**Ten Black Dots**  
By Donald Crews

**C** Complete a sentence  
"Four dots can make seeds from which \_\_\_\_\_ (flowers) grow?" (4 dots page)

**R** Recall  
"How many dots can make the eyes of a fox?" (two dots page)

**O** Open-ended questions  
"What do you think will happen if we shake the branch?" (10 dots page)

**W** WH questions  
"What is the shape of the dot?"

**D** Distancing questions  
"What else could you make from four black dots?"

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**Ages 3-8** **Science**

**The Snowy Day**  
By Ezra Jack Keats

**C** Complete a sentence  
"The snow was piled up very \_\_\_\_\_ (high)."

**R** Recall  
"What was Peter thinking about when he was taking bath?"

**O** Open-ended questions  
"Why wasn't the snowball there when he looked in his pocket before bed?"

**W** WH questions  
"What did Peter do next after he climbed up a great big mountain of snow?"

**D** Distancing questions  
"What do you like to do in the snow?"

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# Dialogic reading at home



# Center-based examples



## INSTRUCTION

The teacher continues to connect the story to the children's experiences.

## Bookmark with Prompts



Every child is different, and these are only suggested age ranges and activities. Do what works best for your child.

Print this page and cut around the edges.



**The Hike** is a book written and illustrated by Alison Farrell.



The Hike is a book about three curious and intrepid young explorers enjoying a hike in the woods. They take notes on what they see, look for tracks, collect leaves and twigs, and even get a little bit lost. How will they find their way back?

Do not forget to **PEER!** Use additional Prompts if needed, Evaluate and Expand your child's answers, and Repeat the prompts.

If you do not have a paper copy of this book, go to <https://www.youtube.com/watch?v=eyrsjFAc1pU> to watch a YouTube video of someone reading the book. If you prefer to read it to your child yourself, just mute the audio.

Check your local library to see if it allows you to borrow a digital version of this book to read on a laptop, tablet, or phone. Or find it in a library near you:

<https://www.worldcat.org/title/hike/oclc/1158903128>

Look at STEMIE's tips for making adaptations to the storybook reading process

[https://stemie.fpg.unc.edu/sites/stemie.fpg.unc.edu/files/Dialogic%20Reading\\_General%20Adaptations.pdf](https://stemie.fpg.unc.edu/sites/stemie.fpg.unc.edu/files/Dialogic%20Reading_General%20Adaptations.pdf)



If you print this page, you can download or view online by scanning the QR code.

**Ages 4+ years Science**

### The Hike

By Alison Farrell

**C** Complete a sentence  
Wren, El, and Hattie go on a \_\_\_\_\_ (hike).

**R** Recall  
How many friends went on the hike? (3)

**O** Open-ended questions  
How are the creek, river, and waterfall different? The same?

**W** WH questions  
What does the steller jay say? (shook shook)

**D** Distancing questions  
What do you like to bring along on a hike? What do you like to collect?

#### STEM Words & Ideas to Explore

- Earth Science-Properties (Liquid, Solid)
- Nature Science (Animals, Plants, and the Environment)
- Classify, Sort, Observe, Record

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# STEM Building Activities



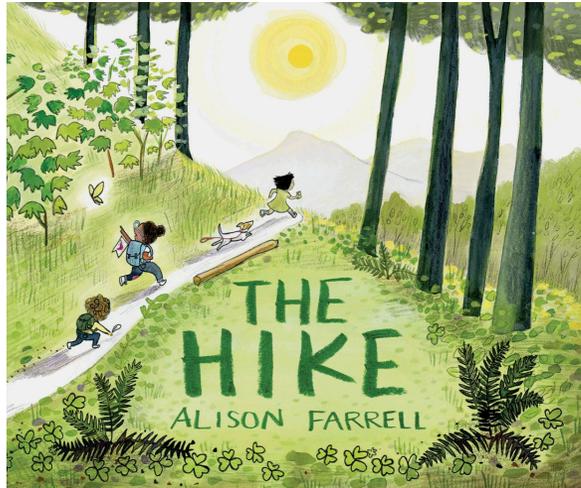
## Earth science: Properties

Take a hike of your own and complete a nature scavenger hunt!

Ask:

<https://stemie.fpg.unc.edu/sites/stemie.fpg.unc.edu/files/Outdoors%20-%20Preschoolers.pdf>

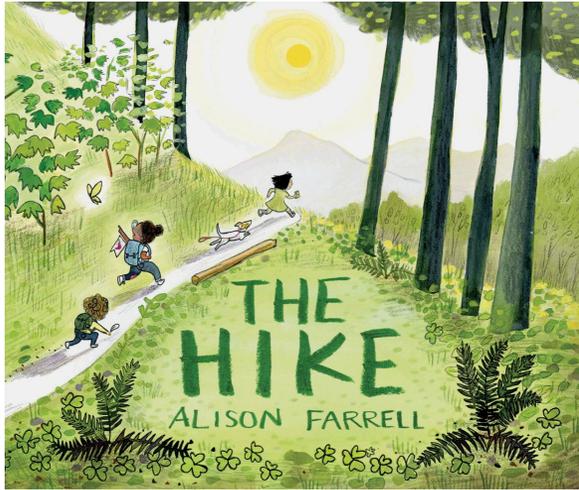
- “What happens if we add water to the soil/dirt?”
- “How can we place a big rock on top of a small rock without it tipping over?”
- “How are rocks and mud different? Similar? What about leaves and pine needles? Puddles and creeks?”



A cairn is a mode of pathfinding that hikers use when above the tree line, using stacks of rocks for hikers to follow trails.

Try the following investigations with rocks:

- Look for a variety of smooth, rough, round, pointy, large, and small rocks to balance with and make a cairn (tower of rocks used to help hikers find the trail above the tree line)
- Explore the purpose and history of rock cairns while hiking with the following link: <https://www.nps.gov/articles/rockcairns.htm>
- Look out for others' cairns as a wayfinding tool the next time you are on a hike!



## Adaptation tips

### STORYBOOK CONVERSATIONS WITH YOUR YOUNG CHILD

## Adaptations:

### The Hike

by Alison Farrell



Every child is different, and these are only suggested adaptations. Do what works best for your child. Your child's therapist can give you other ideas.

## SUPPORT CHILDREN WITH VISUAL IMPAIRMENT/DEAF-BLINDNESS/MULTIPLE DISABILITIES:

### STORY BOX

- Selecting corresponding items from the story and put them in a box. Items might include leaves, pine boughs, snail shells, pinecones, small rocks, etc.



Image credit: Pxfuel

### This adaptation can also...

- Increase children's attention and engagement
- Support children with sensory challenges

### STORYBOOK CONVERSATIONS WITH YOUR YOUNG CHILD

## Visual Cues:

### The Hike

by Alison Farrell

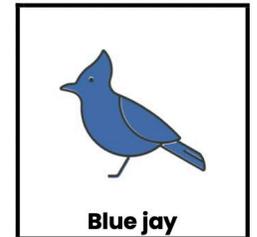
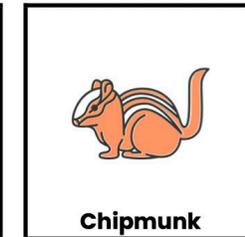
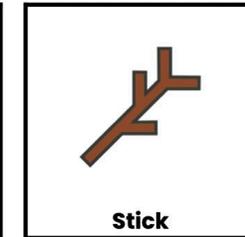


Every child is different, and these are only suggested adaptations. Do what works best for your child. Your child's therapist can give you other ideas.

## HOW TO:

**Step 1:** Print and cut out the images. You can also create your own visual cues (empty squares included).

**Step 2:** As you read, use tape or Velcro to attach the pictures to the corresponding pages in the book.



# Support children's various learning needs

Adapted from Cara's Kit

Environment, activities, and routines



STEP  
01

For example, room set-up, equipment, how an activity is done, length of time)



STEP  
02

Materials

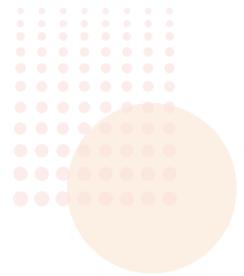
For example, modifications to toys, materials, AT devices)



STEP  
03

Instruction

For example, adding information, reducing steps



# Materials

STORYBOOK CONVERSATIONS WITH YOUR YOUNG CHILD

## General Adaptations



SUPPORT CHILDREN WHO ARE LEARNING TO MANIPULATE:

### PAGE TURNERS



Image credit: Tots-n-Tech

Use things around your house, such as small pieces of felt, popsicle sticks, empty daily contact lens cups, or big paper clips to place on sides of book pages.

Learn more:

[Easy Picture Adaptations](#)

#### This adaptation can also...

- ✓ Increase children's attention and engagement
- ✓ Support alternative ways of communication
- ✓ Support children's learning

STORYBOOK CONVERSATIONS WITH YOUR YOUNG CHILD

## General Adaptations



SUPPORT ALTERNATIVE WAYS OF COMMUNICATION (1 OF 4):

### PICTURES, SYMBOLS, SIGNS, or ICONS



Image credit: Infopeople



Image credit: CONNECT Module 1

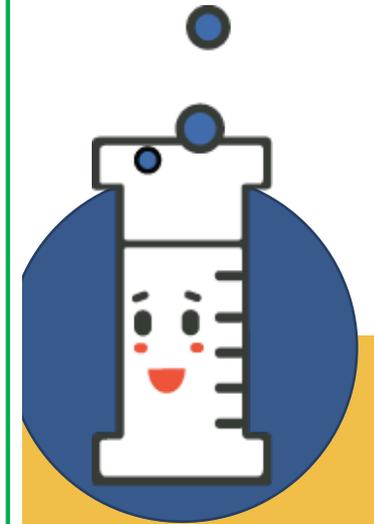
- Use corresponding picture cards of the characters or objects in book
- Add signs and icons to the story

Learn more:

[Make Your Own Adapted Books](#)

#### This adaptation can also...

- ✓ Increase children's attention and engagement
- ✓ Support children' learning
- ✓ Support children who are deaf/with hearing impairment



# Learn more about Storybook Conversations @ stem4ec Blog

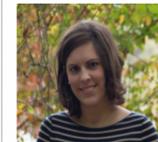


In previous blog posts, we have talked about how storybooks can be used to support children's STEM learning. In this blog post, we will share how to adapt storybooks to support STEM access for young children with disabilities.

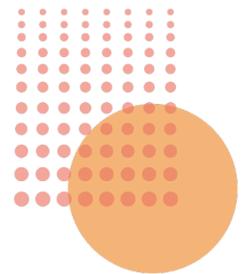
*About the author: Sarah Pedonti, M.Ed., is a Ph.D. candidate in Applied Developmental Psychology and Special Education at the University of North Carolina at Chapel Hill's School of Education. Her research focuses on early reading and language interventions for young children with or at risk for developmental language disorders. She has worked in varied settings serving young children with disabilities, including Early Head Start, Head Start, North Carolina Pre-K (co-located within a Title I Engineering Magnet Elementary School), NC State's Engineering Place Summer Programs, and the Office of Head Start's National Center on Early Childhood, Development, Teaching, & Learning (NCECDTL)*

Adapted storybooks are an easy and inexpensive way to help children with sensory, visual, motor, and linguistic differences to access STEM learning through reading. While dialogic (DR) and shared interactive book reading (SIBR) strategies have been shown to support children with and without disabilities in engaging with books (Lonigan et al., 2008; Mendez et al., 2015; Fleury & Schwartz, 2017; Towson et al., 2017), many children may also benefit from tangible adaptations and modifications to the book itself.

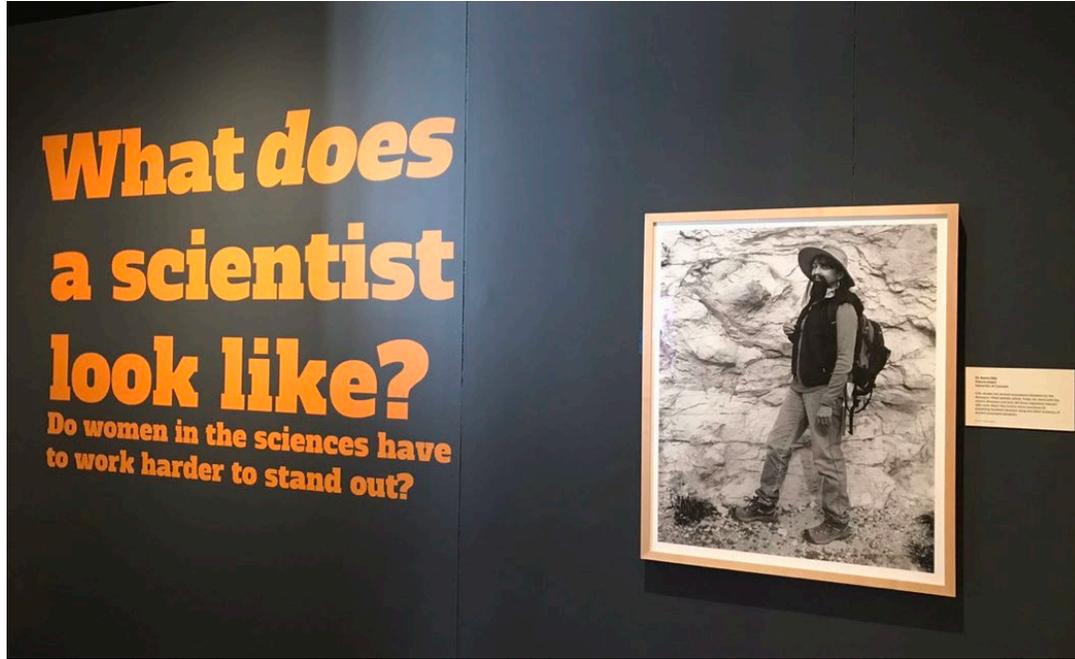
Adapted books can be categorized as a form of augmentative and alternative communication (AAC). Some readers may be familiar with adapted books from seeing their efficacy with children with visual



By Sarah Pedonti  
**Ph.D. candidate in Applied**



# Representation Matters



Source: The Bearded Lady Project@ the Smithsonian Natural History Museum



Source: AstroAccess





**What is one thing you'll like to try or one resource you will check out?**



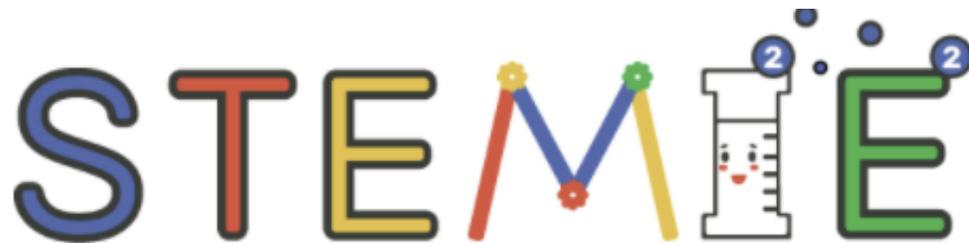
# Questions



Free monthly newsletter.

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<https://stemie.fpg.unc.edu/stay-connected>



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## Inclusion for all in STEM learning!

Cultivating STEM learning opportunities for all young children throughout their daily routines and activities in any environment.

### Winter Wonderland!



Whether you are snowed in or are bundling up to go outside, STEMIE has activities and ideas that can tap into children's natural sense of wonder and help support you in cultivating STEM learning opportunities.

Cozying up indoors? Check out suggested prompts, extension activities, and adaptations for Ezra Keats' book, *The Snowy Day*.

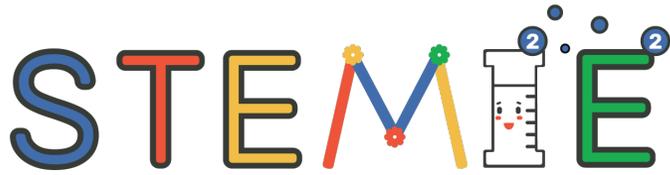
Braving the cold? Consider some tips and adaptation ideas for a nature scavenger hunt.

Find more storybook conversation ideas and STEM learning within daily routines and activities.

The Snowy Day

Scavenger Hunt

Family Resources



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