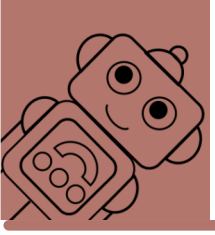


UNIT 2
WE CAN DO STEM

Unit 2 is all about using strategic approaches to solve challenging problems. Children will understand that using the design process helps us solve complex problems in our daily lives. This means **STEM** *is everywhere and for everyone!*

How do we break up a task into iterative steps to solve a problem?
EQ I

What is a robot? What does it do? Where do we see robots in our lives?
EQ II

Who is a computer scientist? How do they solve problems?
EQ III

POWERFUL IDEAS

The design process is a series of steps used to solve complex problems. The steps included help us solve the problem in strategic and organized ways. Solving the problem will mean determining how robots work and how they can be communicated with, addressing **hardware/software**. Regardless of how the problem is solved, issues are almost certain to arise so it is important to use **debugging** to be able to identify and solve those issues.

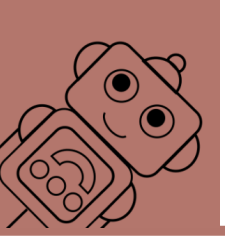
MATERIALS

(see materials list)

1. Design Process Anchor Chart
2. Robot Mouse
3. TaleBot Robot
4. Loose parts for designing robot prototypes
5. Art/writing materials for planning
6. Chart paper
7. Engineering materials (ramps, tubes)
8. Community pictures
9. Computer scientist dramatic play materials

LEARNING OUTCOMES

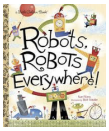
- **PK4.I.C.4** Child increasingly interacts with peers during cooperative play scenarios that share a common plan and goal
- **PK4.IV.B.2** Child interacts and provides suggestions for revisions (add, take out, change order) and edits (conventions) in whole/small group writing activities.
- **PK4.IV.A.2** Child independently draws and writes for many purposes to communicate ideas, using a variety of writing tools
- **PK4.VI.A.1** Child observes, investigates, describes, and discusses characteristics of common objects



UNIT 2
WE CAN DO STEM

TEX:CS
UNIT 2

UNIT 2 OVERVIEW

Unit 2 Focal Experiences	Unit 2 Small Groups	Unit 2 Centers	Unit 2 Focal Texts
Build a Community Robot *Work together to design a robot to solve problems*	Robot vs. Robot Problems We Can Solve (ABC Tree) Designing Your Robot Welcome Home, Robot	• Art *loose parts, design materials* • Blocks *tangram blocks or other puzzle-type blocks; magnatiles* • Books *books featuring robots and STEM figures* • Computer *ABCya Robot Builder (web)* • Dramatic Play *Astronaut costumes/props* • Puzzles/Games *Pattern blocks, shape puzzles* • Writing *Clipboards, graph paper (for design)*	 *Computer Decoder* (Real life STEM users)  *The Astronaut with a Song for the Stars* (Real life STEM users)  *Robots, Robots, Everywhere* (What are robots and what do they do)  *Pete the Cat: Robot Pete* (What are robots and what do they do)

UNIT 2 TIMELINE

Each Tex:CS Unit lasts approximately 6 weeks. Units can and should overlap or be extended or shortened as needed in your classroom. This timelineis a ***suggestion****.*

week 1

Wrap up Unit 1 Focal Exp, Small Groups, and Centers
Transition to Unit 2
Make connections between Units

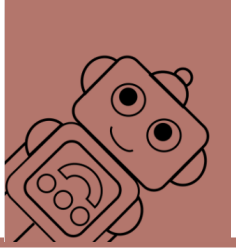
Unit 2
Introduce focal robot
Books about real STEM users
Small group 1-2
Centers as desired

week 3

Unit 2
Continued robot explorations
Books about robots
Small Group 3-4
Centers as desired

week 6

Unit 2
Unit 2 Focal Experience
Small Groups 3-4
Centers as desired



CULTURAL RELEVANCE

STEM is for everyone!

Discuss who can do STEM. Books in Unit 2 focus on real life STEM heroes who defied the odds of their time. Discuss how everyone (including children) can do STEM. Use the design process to support conversations about how STEM works.

Honor Communities!

Spend time thinking with children about their community - the assets and the challenges. Consider where and how robots are a part of their everyday lives. Talk about how robots can solve specific community issues.

Solving problems iteratively!

Remember that the design process does not have a specific starting and ending. As some cultures do not tell stories using the Western narrative structure (beginning, middle, ending), problem solving can also support iterative and cyclical ways of thinking. Problems can be worked on, the plans can be revised and re-envisioned, and new problems and questions can emerge.

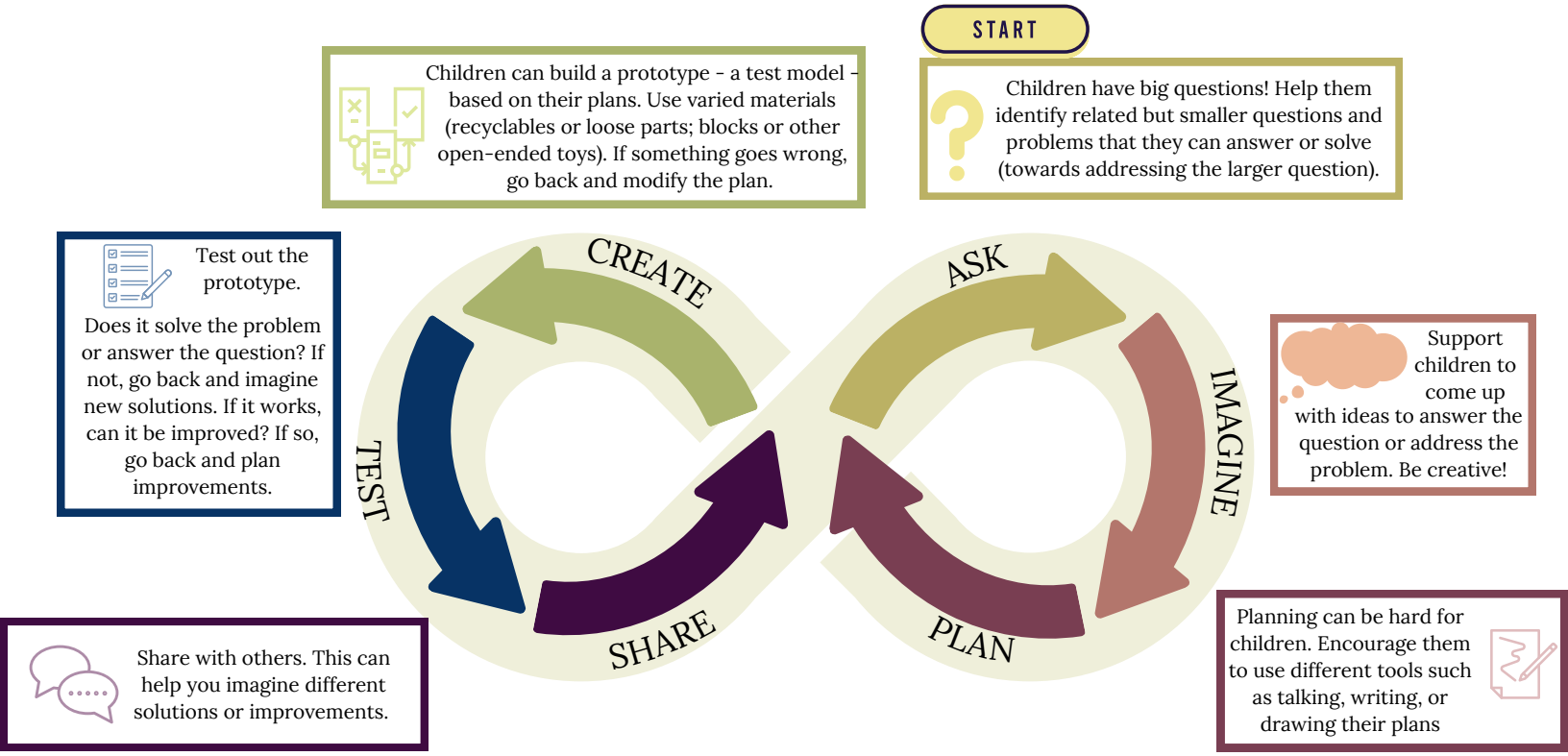
THINGS TO CONSIDER

Note: These are tips and tricks to get the most out of the unit

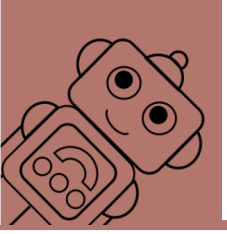
- Use the design process to solve problems and address questions above and beyond specific robotic activities. You can use the design process to support a science experiment or building a block structure.Encourage children to ask questions
- Unit 2 builds onUnit1. Continue implementingUnit1 activities based on children's interests and needs. Suggestions include:
  - Identifying sequences and algorithms in everyday experiences.
  - Continue programming self/teacher/peer using coding cards on velcro strips.
  - Program robots using coding cards, with a particular focus on directionality.

The Design Process

The **design process** is a series of steps. Those steps help us solve complex problems in strategic and creative ways. All the steps are related to each other. Solving hard problems is messy! So the design process helps us stay organized. But we can repeat steps in the design process as many times as needed. It is normal to make mistakes when doing **STEM**. We can learn from those mistakes. We use the **design process** to keep trying.



Design Process anchor chart, from DevTech Research Group's Coding as Another Language Curriculum.
Source: https://sites.tufts.edu/codingasanotherlanguage/curricula/pre-kindergarten-kibo/



UNIT 2 CENTERS

Center	Materials	Powerful Idea
Art	In art, we can be designers and makers • Design materials (rulers, protractors) • "Maker space" craft materials (pompoms, pipe cleaners) • Recycled materials and loose parts for prototype building	Design Process
Blocks	In blocks, we can continue exploring robots • Robot mice, directional cards, numbered velcro strips for directional cards; TaleBot • Tangram blocks and/or Magna Tiles • Various blocks and loose parts	Design Process Hardware/ Software Debugging
Books/ Library	In books, we can learn about robots and STEM leaders • Books on robots • Books on computer scientists and other STEM figures	Hardware/ Software Debugging
Dramatic Play	In dramatic play, we can act as computer scientists • Astronaut or scientist dress ups/props • Old (not operating) phones, tablets	Representation Hardware/ Software
Puzzles and Games	In puzzles/games, we can represent designs and solve problems • Pattern blocks and sheets	Representation Debugging
iPad/ Computer	In iPad/computer, we can build our own robots • ABCya Robot Builder (web)	Hardware/ Software
Writing	In writing, we can represent our ideas and plans • Clipboards • Graph paper	Representation Design Process

SMALL GROUP #1

Robot vs. Robot

hardware/software | representation

Please collect documentation /artifacts for each small group lesson

Students will discuss the nature and functions of different robots. What are robots and what can they do?

Outcome: **PK4.VI.A.1** *Child observes, investigates, describes, and discusses characteristics of common objects*

Materials Needed

- Chart paper (anchor chart), paper, markers
- Directional cards
- Robot Mouse and TaleBot

Success Criteria

M= Student contributes several (3-4) ideas defining robots' nature and functions; represents functions using drawing, writing, and/or dictation

IP= Student contributes a few (1-2) ideas to define robots' nature and functions; may or may not represent meaningfully

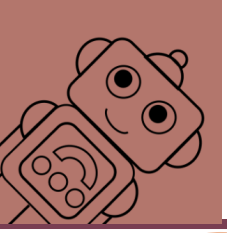
NM=Student follows along, imitates and observes.

Instructional Steps

- ***I DO***: *Introduce the idea of a robot - what it is and what does it do? Introduce new robot and review its functions.*
- **WE DO**: Explore Robot Mouse and record on their paper what it can do, use cards to help. Discuss and compare with new robot.
- **YOU DO:** Collaborate on an anchor chart showing the differences in robots. Students can represent their thoughts on the chart paper.

Key Questions

- How do we know these are robots? What makes them so?
- What are all the things that Robot Mouse can do?
- How can you represent those actions on your paper?
- What can the new robot do? How are they the same or different?



Collect small group assessment data for all children

SMALL GROUP #2

Robot Prototype

design process | representation

Students will discuss robots - what they are and what they can do = and plan/design and build their own robot.

Outcomes: ***PK4.VIII.A.1*** *Child uses a variety of art materials for sensory experiences and exploration.*
PK4.I.A.4 *Child shows initiative in trying new activities and demonstrates perseverance when attempting to overcome obstacles or challenges*

Materials Needed

- Robot books or anchor chart (from SG #1)
- Design Process poster
- Loose parts and recycled materials (to consider *how* to build robot)

Success Criteria

M= Student designs and plans own robot; can define its functions and how those will be enacted and can describe the robot.
IP= Student may design robot and provide some detail and description of its appearance and functions.
NM=Student follows along, imitates and observes.

Instructional Steps

- ***I DO***: *Review what a robot is and what it does (and how). Connect to books or previous small group anchor chart.*
- **WE DO**: Discuss robot functions, characteristics, and designs; discuss how the design process might be used to build a robot.
- **YOU DO:** Generate ideas to build individual robots - what they will look like, how they will function - represent plan (draw/write).

Key Questions

- What can robots do?
- If you were going to design your own robot, what would you want it to do?
- How would you communicate to the robot? How would it function?
- How does your robot compare to Mouse or TaleBot?

SMALL GROUP #3

Problems We Can Solve

(ABC TREE)

design process | debugging

Please collect documentation /artifacts for each small group lesson

Students will collaborate on solving a problem and designing/constructing an ABC Tree (inspired by Chicka Chicka Boom Boom).

Outcomes: PK4.III.D.1 *Child retells or reenacts a story with a clear beginning, middle, and end.*
PK4.I.C.4 *Child increasingly interacts with peers during cooperative play scenarios that share a common plan and goal.*

Materials Needed

- Chicka Chicka Boom Boom book or recording
- Paper and writing utensils
- Several types of building materials (e.g., wooden cubes and foam blocks)
- magnet letters

Success Criteria

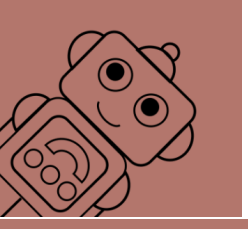
M= Student plans design, represents planning using drawing/writing/dictation, enacts plan, identifies problems and attempts to solve them. .
IP= Student does some of the following - plans, represents plan, enacts plan, problem solves.
NM= Student follows along, imitates and observes.

Instructional Steps

- **I DO**: *Read part or watch segment of Chicka Chicka Boom Boom. Discuss the tree in the book and the issues (not enough room).*
- **WE DO**: *Using the design process, work together to develop a plan for constructing a tree. Represent plan in writing/drawing.*
- **YOU DO:** *Build tree and balance letters on tree top. Collaborate on ways to improve structure. Problem solve as needed.*

Key Questions

- What is the challenge or problem in the book?
- How can we represent our plan for building?
- What do you think is the issue with your design?
- What steps can we take to fix it?



SMALL GROUP #4

Welcome Home, Robot

design process | hardware/software

Please collect documentation /artifacts for each small group lesson

Students will design and draw homes for various robots (prototypes they created or class robots like Robot Mouse).

***Outcomes*: PK4.II.B.3** *Child provides appropriate information in various settings.* **PK4.IV.B.2** *Child interacts and provides suggestions for revisions (add, take out, change order) and edits (conventions) in whole/small group writing activities.*

Materials Needed

- Design materials
- Classroom robots (Robot Mouse)
- Robot prototypes (from SG #3)

Success Criteria

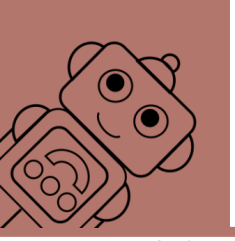
M= Student designs a home for the robot including the materials that will be used and share their design with a friend or friends.
IP= Student designs a home for the robot.
NM= Student make a random drawing.

Instructional Steps

- **I DO**: *Walk through the design process steps. Model drawing a design for a robot house. Think out loud about what is needed.*
- **WE DO**: *Brainstorm together a robot's home. Discuss homes for different robots and why they might be constructed differently.*
- **YOU DO:** *Design and draw a home for a robot of choice. Share designs with their small group.*

Key Questions

- How will the houses be the same/different?
- How will the robot get in/out of the house?
- What shapes will you use in your design?
- What materials would you use?



Materials

- Robots, Robots Everywhere / Robot Pete book
- Robot Prototype Designs (SG2); Materials
- Chart Paper and Markers

FOCAL EXPERIENCE

design process | debugging | hardware/software

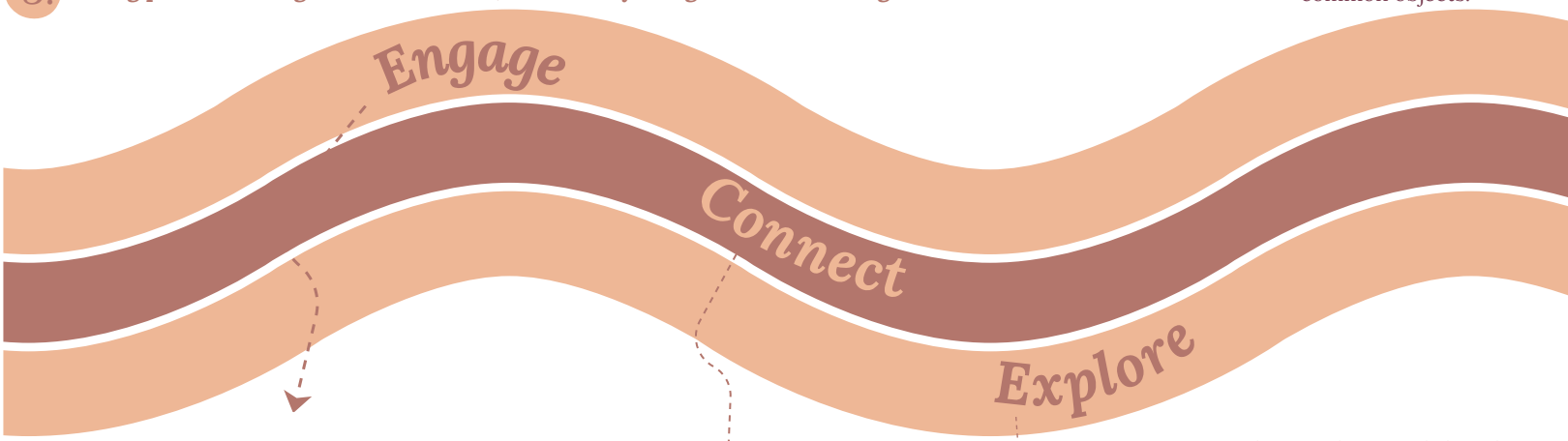
Build a Community Robot

Objective: Children will use the design process to build a prototype for a class robot and work together to co-construct a community robot from loose parts.

1. **Share robot designs/plans from SG #2. Discuss children's design choices, material selections, and robot functions.**
2. **With prompting and using the design process, collaborate to design a shared robot that will address problems.**
3. **Using previous designs and new ideas, collectively design robot including materials and functions.**

Outcomes

PK4.I.A.4 *Child shows initiative in trying new activities and demonstrates perseverance when attempting to overcome obstacles or challenges*
PK4.VI.A.1 Child observes, investigates, describes, and discusses characteristics of common objects.



Connect to children's prior knowledge and introduce key concepts

- **"What features did you include in your prototype?"**
- "What makes a robot a robot? How do you know?"
- "How do you think robots get built? What steps do they take?
- "When you built/designed your robot prototype, what materials did you use/plan to use? What functions did your robot have? How did/would you build it?"

Link initial ideas to computer science ideas and prepare children for activity

- **Robots can be used to solve community problems!"**
- "What problems have you noticed in our classroom, school, or community?"
- "Let's discuss how robots might be helpful to address some of these problems. What functions might they need?"

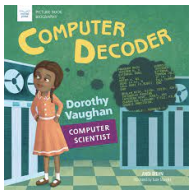
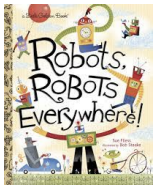
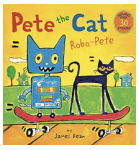
Support children in participating in the activity. Ask questions and help make connections

- **"Let's design a shared robot to solve problems!"**
- "I want you to be engineers and think about what robot components we would need to address the problem?"
- "What materials could we use to create these components?"
- "Let's sketch what this will look like."
- "Let's see if our design will solve the problems we noticed."

Key Vocabulary

- Design/ design process
- Program(mer)
- computer scientist
- Prototype
- Algorithm

UNIT 2 TEXT CONNECTIONS

Text Title	Connection to Unit and Powerful Ideas	Possible Extensions	Questions (before, during, and after reading)
Computer Decoder 	This book is about Dorothy Vaughan, a groundbreaking African American computer scientist.Use this book to discuss who can do STEM and who uses the **design process.**	Discuss who computer scientists are and what they do - draw pictures of them in art center and discuss the problems they work to solve.	**Before**: What do you think it means to be a *computer decoder*? **During**: Can we see parts of the design process in her work? **After**: Who can help me remember the *sequence* of the story? What happened in Dorothy's life that led her to be a computer scientist?
The Astronaut with a Song for the Stars 	This book is about the first female Latina astronaut Dr. Ellen Ochoa and how she made her dreams come true. Use this book to talk further about people who use the **design process** and do STEM.	Talk to the children about what they want to be when they grow up and the steps that they need to get there.	**Before**: I see a woman in space on the cover with a flute. What do you think she is doing? Why? **During**: Why is it important for her not to give up? What steps did she take to realize her dreams? **After**: What is something you want to learn to do? Who will help you achieve your goal?
Robots, Robots, Everywhere 	The robots in this book are busy doing tasks that help humans. From milking cows to planting gardens, to helping vacuum around the chairs robots are everywhere! This book supports understanding of **hardware/software.**	Use design materials in the art center to draw and design robots. Connect to the book - what can our designed robots do to help us like the robots from the book?	**Before**: Is a phone/iPad a robot? How do we know if something is or isn't a robot? **During**: What do you see in this picture? How is the robot helping? **After**: What are some of things the robots did in this book? How is what they did the same/different from what other robots do (Robot Mouse, phones, etc.)?
Pete the Cat: Robot Pete 	Pete The Cat wants to play catch but all of his friends are busy doing other things. In an effort to solve his problem Pete builds a robot so he won't have to play alone.Use this book to talk about **design process** and **debugging**.	In small group, do a picture walk and discuss the **sequence** of Pete's robot creation. Talk about the materials used and how they support the robot working, and how Pete communicates with his robot. Make connections to **the design process.**	**Before**: What do you think this part of the robot does? How do you think that the robot moves? What makes it turn on and off? **During**: What does Pete program Robot Pete to do? **After**: How did Pete Debug Robo Pete when he wouldn't play the music quieter?

OTHER POSSIBILITIES

This list contains other possibilities and extensions, small groups and centers, and large group opportunities that were not developed as a part of the Tex:CS program but could be used in this unit.

LARGE GROUP IDEAS

- Read focal texts about robots and computer science. Look at pictures of robots. Discuss and chart characteristics of robots. Use robot puppet to support discussions about robots.
- Read Robots, Robots Everywhere. Use the electronic KWL chart visual for students.
- Define robot. Use focal texts, prior experiences with robots, and classroom robots to create a shared definition of what a robot is. Emphasize that robots have both hardware and software that help them to do different things.

SMALL GROUPS AND CENTER IDEAS

- Draw a computer scientist. Draw an engineer. Read books about computer scientists and engineers and ask children to draw their own pictures of computer scientists or engineers at work.
- Design and draw robots. Brainstorm the process of designing a robot and the materials needed to draw one (or build one with clay, blocks, etc.).
- Continue robot center and small group activities with varying levels of teacher support. For example, use Robot Mouse board game, STEM-based loose parts (e.g., pipe cleaners, cardboard, tape), Code-a-pillar, Robot Mouse, blocks, LEGOs, etc.

EXTENSIONS

- Use the **design process** throughout the day. Brainstorm and test solutions to problems with students, for example. Discuss classroom/school/community problems that robots could solve.
- Discuss robot functions for those in the classroom and not (e.g., phones, computers, vacuums, etc.) to emphasize **hardware/software**
- Provide opportunities to see **debugging** in play - help children identify problems (e.g., a falling block structure) and determine approaches for solving.

OTHER TEXTS