PICTURE THIS...

STEM STARTER PACK

5 COMPLETE LESSONS

01 Build a Flying Machine

02 Designing for Tough Environments

03 Inventive Prototypes and Engineering Design

04 Problem-Solving and Perseverance

05 Building Comfort: Creating a SEL Machine



Title: Build a Flying Machine - Picture Book Lesson Guide
Featured Book: Chicken in Space by Adam Lehrhaupt
Primary Subject: Engineering and Design Thinking
Grade Level Range: 1–5 (with adaptations)
Estimated Time: 1–2 class periods
Materials Needed:

- Egg cartons
- paper towel tubes
- paper
- string
- tape
- scissors
- rulers/yardsticks

SECTION 1: QUICK OVERVIEW

What This Activity Does:
This imaginative STEM challenge encourages students to prototype, test, and refine a flying machine using household materials—just like Zoey the chicken in Chicken in Space!

Learning Objectives:

- Students will apply design thinking to build a prototype
- Students will test and evaluate the effectiveness of their design
- Students will revise based on peer feedback

Why It Works:
Hands-on engineering combined with a humorous, engaging read-aloud makes this lesson a hit for all learners.

At-a-Glance Standards:

- **CCSS.ELA-LITERACY.RL.2.1** – Ask and answer questions about key details in a text
- **NGSS 3-5-ETS1-1** – Define a simple design problem reflecting a need or a want
- **21st Century Skills:** Collaboration, Critical Thinking, Creativity

SECTION 2: STEP-BY-STEP IMPLEMENTATION

Pre-Reading Preparation:

1. Set Up Your Space: Clear space for small group building areas. Set up a materials buffet table students can draw from.

2. Preview the Book: Introduce Zoey the chicken. Discuss the concept of flight and flying machines. Define key vocabulary: prototype, launch, design.

3. Gather Materials: Provide a wide variety of recycled and basic materials. If supplies are limited, assign students to bring one item from home.

4. Prepare Students: Ask students to imagine what they would need if they wanted to fly. Have them draw or list ideas.

During Reading Activities:

1. Opening Hook: 'Would you ride in a flying machine made from an egg carton? Zoey did!'

2. Interactive Reading Strategies: Pause to ask, 'What material do you think Zoey will use next?'

3. Student Participation Opportunities: Let students call out ideas for improving Zoey's design as you read.

4. Comprehension Checks: After reading, ask, 'What worked? What didn't?'

1. Core Activity:
   a. Challenge students to build their own flying machine.
   b. Choose goals: distance, airtime, or safe landing.
   c. Conduct test flights and record data.
   d. Redesign and test again.

2. Wrap-Up Discussion: 'What would you do differently next time?' 'What surprised you about your flight?'

3. Assessment Opportunities: Observe teamwork, design reasoning, and application of feedback.

SECTION 3: COMMON CORE STANDARDS ALIGNMENT

Reading: CCSS.ELA-LITERACY.RL.2.1 – Ask and answer questions about key details in a text

Writing: CCSS.ELA-LITERACY.W.2.8 – Recall information from experiences to answer questions

Speaking & Listening: CCSS.ELA-LITERACY.SL.2.1 – Participate in collaborative conversations

Language: CCSS.ELA-LITERACY.L.2.6 – Use acquired words and phrases

Cross-Curricular: NGSS 3-5-ETS1-1 – Define a design problem with specified criteria

SECTION 4: DIFFERENTIATION STRATEGIES

For English Language Learners:
- Use labeled visuals of materials
- Provide vocabulary cards with pictures
- Pair with native-speaking buddies

For Students with Special Needs:
- Provide templates or partially built models
- Use checklists with visual icons
- Offer timers for structure

For Advanced Learners:
- Add design constraints (e.g., only 3 materials allowed)
- Include measurement conversions and graphing results

For Struggling Readers:
- Offer read-aloud or audio version of the book
- Simplify instructions with visual cues

SECTION 5: LEVELING GUIDE

Scaling DOWN for Younger Students (1–2):
- Simplify building goals (e.g., just get airborne)
- Offer more support with materials
- Use pre-cut shapes and fewer parts

Scaling UP for Older Students (4–5):
- Add constraints (e.g., budget or weight limits)
- Introduce peer reviews or design journals

SECTION 6: EXTENSION ACTIVITIES

Same-Day Extensions:
- Create a paper glider contest
- Draw design schematics for another Zoey mission

Week-Long Extensions:
- Create a 'Flight Journal' tracking redesign iterations
- Write a sequel story for Zoey's next invention

Cross-Curricular:
- Math: Measure and graph flight distances
- Language Arts: Write persuasive ads for their machines
- Social Studies: Research early flight pioneers

SECTION 7: PARENT INVOLVEMENT & HOME SUPPORT

Take-Home Information:
- This week, we're building and testing flying machines inspired by Zoey the chicken's wild invention!

Home Extension Activities:
- Build a flying object together at home
- Visit a local science center or museum of flight

Communication Tools:
- Newsletter Blurb: 'We're inventing flying machines in class! Ask your child what Zoey used to fly.'
- Student Reflection Sheet: 'Today I built ____. It flew ____. Next time I would ____.'

SECTION 8: ASSESSMENT & DOCUMENTATION

Formative Assessment Ideas:
- Observe collaboration and problem-solving
- Use self-assessment checklists

Summative Assessment Options:
- Evaluate redesign logic and final performance
- Use a design thinking rubric

Documentation Tools:
- Collect photos and quotes during testing
- Save design sketches and journals

SECTION 9: TROUBLESHOOTING & TIPS

Common Challenges:
- Students rush designs: emphasize planning phase
- Frustration with failure: frame as part of design process

Adam's Pro Tips:
- Always test your own prototype first—it gets students excited to beat your design
- Make time for celebration, even if nothing flies well!

Resource Alternatives:
- Use digital simulation tools if supplies are limited
- Partner with art teacher for materials or co-teaching

Title: *Designing for Tough Environments: The Floating Field Challenge*
Featured Book: *The Floating Field* by Scott Riley
Primary Subject: STEM (Engineering, Design Thinking, Environmental Science)
Grade Level Range: 3-5 (with adaptations for K-2)
Estimated Time: 60-90 minutes
Materials Needed:

- Construction paper
- Straws, popsicle sticks, rubber bands
- Small plastic containers (to simulate water)
- Tape and glue
- Measuring tape or rulers
- Markers and crayons for sketching
- Computers/tablets (optional for research)

SECTION 1: QUICK OVERVIEW

What This Activity Does:
In this hands-on activity, students will explore the engineering challenges faced by the boys who built a floating soccer field in *The Floating Field*. They will design their own structures to withstand difficult environments such as water, rocky terrain, or icy conditions. This activity focuses on understanding the importance of adaptation, teamwork, and resilience in engineering design.

Learning Objectives:

- Students will apply the engineering design process to create functional prototypes.
- Students will consider environmental challenges and how to design solutions for specific conditions (e.g., water, ice, rock).
- Students will develop teamwork and collaboration skills as they work together to solve design problems.

Why This Activity Works for Diverse Learners:
This activity allows for creative problem-solving and offers multiple avenues for engagement, including drawing, hands-on prototyping, and group collaboration. The challenge of designing for difficult environments makes it relevant and engaging for students with diverse learning needs.

At-a-Glance Standards:

Primary Common Core Standards Addressed:

- **Reading:** CCSS.ELA-LITERACY.RL.4.1 – Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences.
- **Writing:** CCSS.ELA-LITERACY.W.4.8 – Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

- **Speaking & Listening:** CCSS.ELA-LITERACY.SL.4.1 – Engage effectively in a range of collaborative discussions with diverse partners.
- **Language:** CCSS.ELA-LITERACY.L.4.6 – Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases.

Cross-Curricular Connections:

- **Science:** Study of materials and their properties, adaptation in nature
- **Math:** Measurement, scale, and geometry in building
- **Social Studies:** Engineering in different cultures and environments

21st Century Skills Developed:

- Critical thinking and problem-solving
- Communication and collaboration
- Creativity and innovation

SECTION 2: STEP-BY-STEP IMPLEMENTATION

Pre-Reading Preparation:

1. **Set Up Your Space:**
   Arrange the classroom into small workgroups to encourage collaboration. Ensure there are plenty of materials available for prototyping. Consider using trays or shallow containers to simulate water environments.
2. **Preview the Book:**
   Introduce *The Floating Field* and discuss the challenges the boys faced in designing and building a floating soccer field. Ask the students to think about what kinds of environments might make building difficult. Focus on water, ice, or rough terrain.
3. **Gather Materials:**
   Provide each group with a set of building materials, including straws, rubber bands, popsicle sticks, and construction paper. Have measuring tools available for students to check the size and stability of their structures.
4. **Prepare Students:**
   Discuss the concept of designing for difficult environments. Ask students: “What would you need to think about if you had to design something to work on water?” Encourage them to consider things like stability, material strength, and environmental impact.

During Reading Activities:

1. **Opening Hook:**
   Ask students to imagine building something in a place with harsh conditions, like a snowy mountain or a flooded area. Have them describe what problems they might face. This will help them connect the concept of designing for difficult environments to their own experiences and spark their curiosity about the story.

2. **Interactive Reading Strategies:**
   As you read, pause to ask questions like: “How did the boys figure out how to keep the field afloat?” “What challenges did they face in the process?” Encourage students to make predictions about what might come next and discuss how the design process might be applied to other environments.
3. **Student Participation Opportunities:**
   After each challenge mentioned in the book, ask the students how they might overcome that problem. For example: “How could you make a field float in a frozen lake? What changes would you have to make?”
4. **Comprehension Checks:**
   After reading, ask questions like: “What environmental factors made this project difficult?” “How did the team work together to find a solution?” This will help assess understanding of both the engineering process and the teamwork involved.

Post-Reading Extension:

1. **Core Activity:**
   - **Step 1:** Students will choose an environment (water, ice, rocky terrain) and design a structure (it could be a bridge, a soccer field, or any type of functional design).
   - **Step 2:** They will use the materials provided to create a model of their structure that can stand up to the chosen environment.
   - **Step 3:** After building, each group will test their structure in a simulated environment (e.g., floating in water, or placing it on a rocky surface).
2. **Wrap-Up Discussion:**
   After testing their designs, have each group share their creations. Ask: “What did you learn about designing for a tough environment?” “How did you make sure your design would hold up?” Discuss how engineers and designers need to consider environmental factors and adapt their solutions accordingly.
3. **Assessment Opportunities:**
   Evaluate the students’ designs based on creativity, functionality, and how well they adapted to the chosen environment. Encourage students to self-assess their work by reflecting on what worked and what could be improved.

SECTION 3: COMMON CORE STANDARDS ALIGNMENT

Primary Standards Addressed:

- **Reading:** RL.4.1
- **Writing:** W.4.8
- **Speaking & Listening:** SL.4.1
- **Language:** L.4.6

Evidence of Standard Mastery:

- Students will demonstrate mastery of the standards by explaining the challenges faced during the project and how they overcame them. Their design presentations will reflect their understanding of engineering, teamwork, and problem-solving.

SECTION 4: DIFFERENTIATION STRATEGIES

For **English Language Learners:**

- Provide visual aids and vocabulary support, such as illustrated engineering terms.
- Encourage peer discussion in small groups to help clarify concepts.

For **Students with Special Needs:**

- Offer modified materials or additional time to complete the design and prototype.
- Provide extra scaffolding by breaking the activity into smaller, manageable steps.

For **Advanced Learners:**

- Challenge students to design a more complex structure or develop additional design features (e.g., making their structure not only float but also carry weight).
- Encourage them to research real-world engineering projects that deal with similar environmental challenges.

For **Struggling Readers:**

- Provide alternative formats for the story (audio versions, graphic novel versions) to support comprehension.
- Offer more direct support during the reading and discussions.

SECTION 5: LEVELING GUIDE

Scaling DOWN for Younger Students (K-2):

- Focus on the basic concept of building something that works in an environment. Use simple materials and shorter design times.
- Reduce the complexity of the structures and focus more on creativity than functionality.

Scaling UP for Older Students (3-5):

- Encourage more detailed, functional designs that must be tested for stability.
- Allow students to present their designs in a formal presentation, discussing the challenges they overcame and the scientific principles they used.

SECTION 6: EXTENSION ACTIVITIES

Same-Day Extensions:

- Have students draw or write about the challenges they faced in designing for their environment.
- Create a class-wide voting system to choose the most innovative designs.

Week-Long Extensions:

- Students can refine their designs over a week, adding more features or conducting further testing.
- Encourage them to research real-world examples of structures designed for harsh environments.

Cross-Curricular Extensions:

- **Math:** Have students calculate the surface area or weight distribution of their structures.
- **Science:** Explore the science of buoyancy, weight, and stability in different environments.
- **Social Studies:** Research how different cultures build in difficult environments.

SECTION 7: PARENT INVOLVEMENT & HOME SUPPORT

Take-Home Information:

- Send home a simple explanation of the activity and the environmental challenges students worked on.
- Encourage families to discuss real-world examples of structures built for difficult environments.

Home Extension Activities:

- Have students identify structures in their community that were built to withstand tough conditions (e.g., bridges, dams).
- Encourage students to think about what materials might be used to improve these structures.

SECTION 8: ASSESSMENT & DOCUMENTATION

Formative Assessment Ideas:

- Observe student discussions during group work.
- Check their design sketches and prototypes for understanding of the environmental challenges.

Summative Assessment Options:

- Use a rubric to assess the functionality and creativity of their designs.
- Have students reflect on their design process and what they learned.

SECTION 9: TROUBLESHOOTING & TIPS

Common Challenges:

- Some designs may fail to meet the environmental challenge. Encourage students to view this as an opportunity to iterate and improve their designs.

Adam's Pro Tips:

- Encourage students to think outside the box and embrace trial and error. Some of the best solutions come from unexpected ideas.

Resource Alternatives:

- Offer digital design tools (e.g., Tinkercad) for older students to create more advanced models.

Title: *STEM with Picture Books: Inventive Prototypes and Engineering Design*
Featured Book: *Invent-a-Pet* by Vicky Fang
Primary Subject: STEM (Engineering, Design Thinking)
Grade Level Range: K-5 (with adaptations)
Estimated Time: 60-90 minutes
Materials Needed:

- Construction paper
- Markers, pencils, and crayons
- Scissors and glue
- Recyclable materials (bottles, caps, straws)
- Tape
- Computers/tablets (optional for research)
- Book: *Invent-a-Pet* by Vicky Fang
- Printable templates (optional)

SECTION 1: QUICK OVERVIEW

What This Activity Does:
This activity lets students dive into the world of inventing by exploring cause and effect, iteration, and programming logic. Using *Invent-a-Pet* as inspiration, students will design their own pet-making machines and prototype ideas to improve the pets they create.

Learning Objectives:

- Students will understand the engineering design process (problem identification, ideation, prototyping, testing).
- Students will explore the concepts of input and output in engineering.
- Students will practice iteration, learning to refine their designs based on feedback and trial and error.

Why This Activity Works for Diverse Learners:
This activity encourages creativity and hands-on exploration, offering visual, tactile, and kinesthetic opportunities to engage with STEM concepts. It supports diverse learners by offering multiple ways to represent and test their ideas.

At-a-Glance Standards:

Primary Common Core Standards Addressed:

- **Reading:** CCSS.ELA-LITERACY.RL.3.1 – Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- **Writing:** CCSS.ELA-LITERACY.W.3.8 – Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

- **Speaking & Listening:** CCSS.ELA-LITERACY.SL.3.1 – Engage effectively in a range of collaborative discussions with diverse partners.
- **Language:** CCSS.ELA-LITERACY.L.3.6 – Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases.

Cross-Curricular Connections:

- **Math:** Understanding measurements (when designing a prototype)
- **Science:** Problem-solving and cause and effect
- **Art:** Sketching and creating prototypes
- **Social Studies:** Engineering in the real world and diverse cultures

21st Century Skills Developed:

- Critical thinking and problem solving
- Communication and collaboration
- Creativity and innovation

SECTION 2: STEP-BY-STEP IMPLEMENTATION

Pre-Reading Preparation:

1. **Set Up Your Space:**
   Arrange the classroom with clear spaces for group work, access to materials, and a board for sharing ideas. Ensure each student has access to materials for prototyping.
2. **Preview the Book:**
   Introduce the book *Invent-a-Pet* and discuss the concept of creating inventions. Talk about what makes an invention useful and how it should serve a purpose (input, output, problem-solving). Introduce vocabulary such as "prototype," "iteration," and "engineering."
3. **Gather Materials:**
   Provide materials for students to prototype their machines. You can use recyclable materials, construction paper, markers, and glue to keep it budget-friendly.
4. **Prepare Students:**
   Discuss how inventions help solve problems. Ask students to think of something they would love to invent. Encourage them to consider a pet they wish could be created to fulfill a need.

During Reading Activities:

1. **Opening Hook:**
   Start with a fun question: “What if you could make your own pet? What would it do, and how would it help you?” Show an image of different invention prototypes and ask students to imagine what a pet-making machine would look like.
2. **Interactive Reading Strategies:**
   As you read, ask students to think about the process in the book: What materials do the

characters use? How do they test their machines? Pause after important scenes to discuss the engineering principles mentioned.

3. **Student Participation Opportunities:**
   Ask students to draw their own ideas for a pet-making machine. They can share these ideas with a partner, then explain how their machine would work. This encourages active participation and collaboration.
4. **Comprehension Checks:**
   Ask questions like: "How did the main character know her machine wasn't working?" "What did she change to improve it?" Use student responses to guide discussions on the iterative design process.

Post-Reading Extension:

1. **Core Activity:**
   - **Step 1:** Have students create their own pet-making machines using the materials provided.
   - **Step 2:** They will need to sketch their idea, create a prototype, and then test it (even if it's just a model).
   - **Step 3:** Allow students to modify their designs based on feedback and testing.
2. **Wrap-Up Discussion:**
   Lead a class discussion on how their designs worked or didn't work. Ask reflection questions like: "What did you learn about making things that help solve a problem?" "How did you feel when your first idea didn't work? What did you do next?"
3. **Assessment Opportunities:**
   Document the students' prototypes and ideas. Create a checklist of expected skills (creativity, problem-solving, communication) to assess their participation.

SECTION 3: COMMON CORE STANDARDS ALIGNMENT

Primary Standards Addressed:

- **Reading:** RL.3.1
- **Writing:** W.3.8
- **Speaking & Listening:** SL.3.1
- **Language:** L.3.6

Evidence of Standard Mastery:

- Students will demonstrate their understanding by successfully creating and presenting their pet-making machines.
- Teachers will document the iterative process through sketches and prototypes, aligning with writing and design standards.

SECTION 4: DIFFERENTIATION STRATEGIES

For **English Language Learners:**

- Provide sentence starters and a visual glossary of key vocabulary.
- Use peer mentors to explain concepts in simpler terms.

For **Students with Special Needs:**

- Provide tactile materials for students who benefit from sensory input.
- Allow extra time for prototyping and testing.

For **Advanced Learners:**

- Offer opportunities to design more complex prototypes and encourage independent research about famous inventors or inventions.

For **Struggling Readers:**

- Offer pre-reading support by reviewing key vocabulary.
- Use audio versions of the book if available, and allow students to work in pairs.

SECTION 5: LEVELING GUIDE

Scaling DOWN for Younger Students (K-2):

- Focus on basic concepts like "What does an invention do?"
- Use simplified instructions with picture prompts.
- Limit the scope of their prototypes to simpler designs.

Scaling UP for Older Students (3-5):

- Incorporate more detailed designs, including data collection (measurements of time, distance, etc.).
- Allow students to build a more advanced prototype with added functions.

SECTION 6: EXTENSION ACTIVITIES

Same-Day Extensions:

- Students can draw or write about their pet-making machine.
- Engage in a class debate about the "best" invention and why it works.

Week-Long Extensions:

- Students can develop a prototype and refine it throughout the week, making improvements based on peer feedback.

Cross-Curricular Extensions:

- **Math:** Calculate materials needed, measure components, or chart their testing results.
- **Science:** Explore the principles of force, motion, and simple machines used in the pet-making process.

SECTION 7: PARENT INVOLVEMENT & HOME SUPPORT

Take-Home Information:

- Provide families with a summary of the activity and ask them to brainstorm other problems their child could solve with an invention at home.

Home Extension Activities:

- Encourage students to ask their families about inventions they use at home and discuss how they work.
- Provide a list of related books for further exploration.

SECTION 8: ASSESSMENT & DOCUMENTATION

Formative Assessment Ideas:

- Monitor students' prototypes for creativity and functional design.
- Have students self-assess their designs.

Summative Assessment Options:

- Use a rubric that assesses creativity, problem-solving, and presentation skills.

SECTION 9: TROUBLESHOOTING & TIPS

Common Challenges:

- Students may get frustrated if their designs don’t work as expected. Provide encouragement and remind them that failure is a part of learning.

Adam’s Pro Tips:

- Keep things light and fun—don’t worry if a machine doesn’t work perfectly. The goal is for students to practice iterating and improving.

Title: *Inventing the Most Magnificent Thing: Problem-Solving and Perseverance*
Featured Book: *The Most Magnificent Thing* by Ashley Spires
Primary Subject: STEM (Engineering Design, Problem-Solving, Perseverance)
Grade Level Range: 3-5 (with adaptations for K-2)
Estimated Time: 60-90 minutes
Materials Needed:

- Paper and markers for sketching ideas
- Construction paper
- Scissors, glue, tape, and rubber bands
- Recyclable materials (e.g., cardboard, plastic bottles, bottle caps)
- Rulers or measuring tape
- Computers/tablets (optional for research or inspiration)

SECTION 1: QUICK OVERVIEW

What This Activity Does:
This activity encourages students to take on the challenge of creating their "most magnificent thing," just like the protagonist in *The Most Magnificent Thing*. Through hands-on engineering, students will experience the iterative process of designing and refining a prototype, learning the importance of perseverance, problem-solving, and creative thinking in overcoming challenges.

Learning Objectives:

- Students will engage in the engineering design process: identifying problems, ideating solutions, and creating prototypes.
- Students will practice perseverance and resilience by learning from failure and iterating their designs.
- Students will develop teamwork and communication skills as they collaborate to solve problems.

Why This Activity Works for Diverse Learners:
This hands-on activity allows for creativity and experimentation, engaging students with various learning styles (visual, kinesthetic, auditory). The iterative nature of the design process supports all learners by encouraging them to test, fail, and improve their ideas, fostering a growth mindset.

At-a-Glance Standards:

Primary Common Core Standards Addressed:

- **Reading:** CCSS.ELA-LITERACY.RL.3.1 – Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.
- **Writing:** CCSS.ELA-LITERACY.W.3.8 – Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.

- **Speaking & Listening:** CCSS.ELA-LITERACY.SL.3.1 – Engage effectively in a range of collaborative discussions with diverse partners.
- **Language:** CCSS.ELA-LITERACY.L.3.6 – Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases.

Cross-Curricular Connections:

- **Science:** Experimentation and analysis in the engineering design process
- **Math:** Measurement, geometry, and spatial reasoning in creating prototypes
- **Art:** Sketching and illustrating ideas before building prototypes
- **Social Studies:** The role of inventors in society and the impact of innovation

21st Century Skills Developed:

- Critical thinking and problem-solving
- Communication and collaboration
- Creativity and innovation

SECTION 2: STEP-BY-STEP IMPLEMENTATION

Pre-Reading Preparation:

1. **Set Up Your Space:**
   Arrange the classroom into small groups with plenty of materials for prototyping. Make sure each group has access to recyclable materials, glue, tape, and scissors.
2. **Preview the Book:**
   Introduce *The Most Magnificent Thing* by discussing what makes something "magnificent." Ask students to think about inventions they know and how they were created. Discuss the idea of problem-solving through design and how inventors face challenges in the process.
3. **Gather Materials:**
   Provide students with construction paper, recyclable materials, scissors, tape, and other basic prototyping supplies. Make sure there are enough materials for multiple rounds of prototyping and testing.
4. **Prepare Students:**
   Introduce the concept of iteration in design: the idea that we often need to try, fail, and improve our designs. Explain that the goal of the activity is not to create a perfect prototype on the first try but to learn from mistakes and make it better with each attempt.

During Reading Activities:

1. **Opening Hook:**
   Ask students to think about an invention they would like to create. It could be something that solves a problem they face at home, at school, or in the world. Have them briefly describe their invention before diving into the book.

2. **Interactive Reading Strategies:**
   As you read *The Most Magnificent Thing*, pause to discuss the protagonist's frustrations when her first designs don't work. Ask questions like: “What was the first problem she faced?” “How did she feel when her first designs didn’t work?” Encourage students to think about how they would solve those same problems.
3. **Student Participation Opportunities:**
   After reading a section where the protagonist fails, ask students: “What could she try next?” “How might she change her design to make it work better?” Encourage students to share their thoughts and solutions, promoting collaborative problem-solving.
4. **Comprehension Checks:**
   After reading, ask questions like: “What did the girl learn from her mistakes?” “Why is it important to keep trying even when something doesn’t work?” This will assess the students’ understanding of perseverance and the iterative process.

Post-Reading Extension:

1. **Core Activity:**
   - **Step 1:** Students will brainstorm an idea for their own “most magnificent thing” that solves a problem they’ve identified.
   - **Step 2:** They will sketch their invention, just like the protagonist did, and make a plan for how to build it with the materials provided.
   - **Step 3:** Students will create their prototype using the materials and start testing it.
   - **Step 4:** If their prototype doesn’t work as expected, students will identify the problem, brainstorm solutions, and iterate on their design.
2. **Wrap-Up Discussion:**
   After the students have finished their prototypes, ask them: “What went well in your design?” “What didn’t work, and how did you fix it?” Discuss the importance of resilience in the face of failure and how iteration leads to better results.
3. **Assessment Opportunities:**
   Assess the students’ participation, creativity, and ability to iterate on their designs. Use a rubric to evaluate their final prototype, focusing on functionality, creativity, and problem-solving skills.

SECTION 3: COMMON CORE STANDARDS ALIGNMENT

Primary Standards Addressed:

- **Reading:** RL.3.1
- **Writing:** W.3.8
- **Speaking & Listening:** SL.3.1
- **Language:** L.3.6

Evidence of Standard Mastery:

- Students will demonstrate their understanding by explaining the challenges they encountered and how they overcame them. Their prototype and reflection on the design process will showcase their mastery of problem-solving, resilience, and iterative design.

SECTION 4: DIFFERENTIATION STRATEGIES

For **English Language Learners:**

- Provide visual vocabulary supports for words like "prototype," "iteration," and "design."
- Use peer collaboration for explaining design processes in simple terms.

For **Students with Special Needs:**

- Allow extra time for prototyping and iteration.
- Use tactile materials for students who need sensory input, and provide simplified instructions with step-by-step visuals.

For **Advanced Learners:**

- Encourage students to research real-world examples of inventors who faced failure and improved their designs.
- Challenge students to create more complex inventions or refine their prototypes further.

For **Struggling Readers:**

- Offer audio versions of the story, if available, or use simpler texts to reinforce the story's themes.
- Provide additional support during discussions and group work to ensure comprehension.

SECTION 5: LEVELING GUIDE

Scaling DOWN for Younger Students (K-2):

- Simplify the prototyping process by focusing on basic design concepts, such as "What can we create that's useful?"
- Reduce the complexity of the materials and instructions, focusing on fun, trial-and-error building.

Scaling UP for Older Students (3-5):

- Incorporate more detailed planning, including measurements and calculations for the prototypes.
- Allow students to present their prototypes in a more formal setting, explaining the process of iteration and what they learned from failure.

SECTION 6: EXTENSION ACTIVITIES

Same-Day Extensions:

- Have students draw additional sketches of their inventions or write a short reflection on the design process.
- Create a class gallery where students can display their prototypes and explain the challenges they overcame.

Week-Long Extensions:

- Students can revisit and refine their prototypes over a week, making improvements and testing their designs.
- Encourage students to research real-world problem-solving and engineering examples related to their inventions.

Cross-Curricular Extensions:

- **Math:** Measure dimensions and calculate the structural stability of prototypes.
- **Science:** Discuss the principles of physics, such as balance, force, and gravity, in relation to their designs.
- **Art:** Sketch or illustrate the inventions in more detail, integrating design concepts with creativity.

SECTION 7: PARENT INVOLVEMENT & HOME SUPPORT

Take-Home Information:

- Send home a brief summary of the activity and ask parents to discuss problem-solving with their child.
- Encourage families to think about problems they face at home and brainstorm solutions together.

Home Extension Activities:

- Have students talk to their parents about what inventions they would create at home.
- Provide resources for learning about famous inventors and the iterative process of design.

SECTION 8: ASSESSMENT & DOCUMENTATION

Formative Assessment Ideas:

- Observe student collaboration and engagement during the brainstorming and building process.
- Have students complete a self-reflection sheet, explaining what they learned about design and iteration.

Summative Assessment Options:

- Use a rubric to assess the prototypes on creativity, functionality, and perseverance.
- Include peer feedback as part of the evaluation process, allowing students to assess each other's inventions.

SECTION 9: TROUBLESHOOTING & TIPS

Common Challenges:

- Some students may feel discouraged if their designs don’t work right away. Encourage persistence and remind them that failure is a part of the learning process.
- Time management can be an issue; ensure students have enough time for multiple rounds of testing and iteration.

Adam’s Pro Tips:

- Let students know that the best inventions are often the result of many failures.
- Keep the atmosphere light and fun—this is all about learning through trial and error!

Resource Alternatives:

- If materials are limited, encourage students to use digital design tools or simple materials like paper and tape to prototype.

Title: *Building Comfort: Creating a Hug Machine*
Featured Book: *How to Build a Hug: Temple Grandin and Her Amazing Squeeze Machine* by Amy Guglielmo and Jacqueline Tourville
Primary Subject: STEM (Engineering, Emotional Support, Neurodiversity)
Grade Level Range: 3-5 (with adaptations for K-2)
Estimated Time: 60-90 minutes
Materials Needed:

- Cardboard, straws, fabric, string, and rubber bands
- Markers, crayons, and construction paper
- Glue, tape, and scissors
- Rulers or measuring tapes
- Soft materials (e.g., cotton balls or sponges) to represent "comfort" in prototypes
- Optional: Computers/tablets for researching the science of emotional regulation and neurodiversity

---

SECTION 1: QUICK OVERVIEW

What This Activity Does:
In this activity, students will explore how Temple Grandin used engineering to create a device that provides comfort through deep pressure, known as the squeeze machine. Students will design their own "hug machines" or comfort devices that help with emotional regulation. This lesson teaches both empathy and engineering, highlighting how inventions can meet personal and social needs.

Learning Objectives:

- Students will learn about neurodiversity and Temple Grandin's innovative work.
- Students will apply engineering principles to create prototypes designed to address emotional or physical needs.
- Students will explore how designs can support emotional well-being, using engineering to create comfort or reduce stress.

Why This Activity Works for Diverse Learners:
This activity integrates emotional intelligence and STEM, which provides opportunities for social-emotional learning, problem-solving, and creativity. It encourages students to design solutions for real-world problems, making it accessible for all learners while promoting empathy and understanding of neurodiversity.

At-a-Glance Standards:

Primary Common Core Standards Addressed:

- **Reading:** CCSS.ELA-LITERACY.RL.3.1 – Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

- **Writing:** CCSS.ELA-LITERACY.W.3.8 – Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
- **Speaking & Listening:** CCSS.ELA-LITERACY.SL.3.1 – Engage effectively in a range of collaborative discussions with diverse partners.
- **Language:** CCSS.ELA-LITERACY.L.3.6 – Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases.

Cross-Curricular Connections:

- **Science:** The science of emotional regulation and sensory input.
- **Math:** Measurement of materials, space, and design dimensions.
- **Art:** Drawing and sketching designs, creativity in building prototypes.
- **Social Studies:** Understanding neurodiversity and the social impact of inclusive inventions.

21st Century Skills Developed:

- Critical thinking and problem-solving
- Communication and collaboration
- Creativity and empathy

SECTION 2: STEP-BY-STEP IMPLEMENTATION

Pre-Reading Preparation:

1. **Set Up Your Space:**
   Arrange the classroom into small groups with enough materials for prototyping. Ensure there are enough supplies (cardboard, fabric, scissors) for each group to build a comfort device.
2. **Preview the Book:**
   Introduce *How to Build a Hug* by Temple Grandin and discuss the concept of neurodiversity. Explain how Grandin's squeeze machine was designed to provide comfort through pressure. Talk about the importance of comfort devices and how they can help with stress, anxiety, or sensory overload.
3. **Gather Materials:**
   Provide materials such as cardboard, fabric, straws, and soft materials like cotton balls to represent "comfort." Ensure each student has access to rulers or measuring tapes to help with their designs.
4. **Prepare Students:**
   Explain that in this activity, students will be designing a machine or device that can provide comfort. Encourage them to think about what makes them feel safe and calm and how they could incorporate those elements into a design.

During Reading Activities:

1. **Opening Hook:**
   Ask students: “What helps you feel calm or comfortable when you're upset or stressed?” Discuss different ways people find comfort (e.g., a hug, a soft blanket, a favorite song). Connect this to Temple Grandin’s design.
2. **Interactive Reading Strategies:**
   As you read *How to Build a Hug*, pause to discuss the challenges Temple faced in designing the squeeze machine. Ask: “What was her goal when designing the squeeze machine?” “How did she test her design?” Encourage students to think about the design process as it relates to their own experiences.
3. **Student Participation Opportunities:**
   After reading a section of the book where Temple refines her design, ask students what they think she could improve next. Have them draw or write about how they would improve the squeeze machine to make it better for comfort.
4. **Comprehension Checks:**
   Ask questions such as: “What did Temple learn about her machine after testing it?” “How did she know the machine was working?” Use these questions to gauge the students’ understanding of both the engineering process and the social-emotional aspects of the story.

Post-Reading Extension:

1. **Core Activity:**
   - **Step 1:** Students will brainstorm their own ideas for a comfort device that could help them or others feel calm.
   - **Step 2:** Have students sketch their designs, taking into consideration what type of comfort they are trying to provide (e.g., calming pressure, soft textures, or secure spaces).
   - **Step 3:** Students will build their prototypes using the materials provided. They will consider functionality (e.g., will it fit around a person, or can it be easily adjusted?) and comfort (e.g., how will it make a person feel calm or secure?).
2. **Wrap-Up Discussion:**
   Once students have completed their prototypes, hold a class discussion. Ask: “What features did you include in your design to make it comforting?” “How would you test your design to make sure it works?” Discuss how different people might need different types of comfort and how engineering can address those needs.
3. **Assessment Opportunities:**
   Assess students based on their participation, creativity, and the functionality of their designs. Use a rubric to evaluate how well students incorporated emotional support elements into their comfort devices. Encourage students to reflect on how their design can help others feel calm.

SECTION 3: COMMON CORE STANDARDS ALIGNMENT

Primary Standards Addressed:

- **Reading:** RL.3.1

- **Writing:** W.3.8
- **Speaking & Listening:** SL.3.1
- **Language:** L.3.6

Evidence of Standard Mastery:

- Students will demonstrate mastery of these standards by explaining their design process, using engineering and emotional vocabulary. Their ability to reflect on the emotional aspects of their designs will show understanding of the social-emotional learning objectives.

SECTION 4: DIFFERENTIATION STRATEGIES

For **English Language Learners:**

- Provide visual aids and vocabulary support (e.g., diagrams of comfort devices).
- Pair students with peers to explain the design process in simpler terms.

For **Students with Special Needs:**

- Offer more tactile materials or pre-constructed elements to help students who may struggle with fine motor tasks.
- Allow extra time for designing and testing.

For **Advanced Learners:**

- Encourage students to research other inventions that support emotional well-being, like weighted blankets or sensory rooms.
- Challenge them to create a more complex prototype or design that addresses a variety of comfort needs.

For **Struggling Readers:**

- Use audio versions of the book if available, or provide a summary before reading.
- Allow students to work with a peer to discuss the reading before completing the design challenge.

SECTION 5: LEVELING GUIDE

Scaling DOWN for Younger Students (K-2):

- Focus on simpler designs, such as a soft, comforting blanket or a simple hug machine using limited materials.
- Reduce the amount of writing required and focus more on the hands-on prototyping and discussing how comfort feels.

Scaling UP for Older Students (3-5):

- Encourage students to incorporate more complex elements into their designs, such as adjustable features or more detailed measurements.
- Allow students to explore the emotional and scientific concepts behind deep pressure therapy and other sensory aids.

SECTION 6: EXTENSION ACTIVITIES

Same-Day Extensions:

- Have students share their designs with the class and explain the features they included for comfort.
- Create a group discussion or write a short reflection on the importance of comfort devices for different people.

Week-Long Extensions:

- Students can refine their designs over the week, adding more features or conducting tests with different materials.
- Introduce additional concepts like sensory integration and the science behind comfort devices.

Cross-Curricular Extensions:

- **Math:** Measure and calculate the dimensions of their prototypes or weigh materials to understand pressure.
- **Science:** Study how different materials provide comfort (e.g., soft fabrics, firm pressure, temperature regulation).
- **Social Studies:** Research historical figures or modern-day inventors who created technologies for emotional or physical support.

SECTION 7: PARENT INVOLVEMENT & HOME SUPPORT

Take-Home Information:

- Send home a simple explanation of the activity and invite parents to discuss comfort devices with their children.
- Provide parents with resources for learning about neurodiversity and the importance of emotional support devices.

Home Extension Activities:

- Encourage students to design a comfort item at home (e.g., a pillow fort, cozy blanket, etc.) that provides comfort when stressed or upset.

- Discuss comfort strategies families use and share those with the class.

SECTION 8: ASSESSMENT & DOCUMENTATION

Formative Assessment Ideas:

- Observe students' engagement in the prototyping process and their ability to explain their design decisions.
- Provide a self-reflection sheet where students can assess their work and describe what worked well and what they might change.

Summative Assessment Options:

- Use a rubric to assess creativity, functionality, and the emotional aspects of the designs.
- Collect student prototypes for display and encourage peer feedback.

SECTION 9: TROUBLESHOOTING & TIPS

Common Challenges:

- Some students may struggle to conceptualize their designs. Encourage them to start with simple shapes and features, focusing on comfort first.
- Time management may be an issue—ensure there's enough time for multiple iterations and testing.

Adam's Pro Tips:

- Keep the activity fun and open-ended—this is all about creativity and learning through trial and error.
- Remember that different people experience comfort in different ways, so there's no "wrong" way to design a comfort device!

Resource Alternatives:

- If materials are limited, students can use digital tools (like a 3D modeling app) to create and present their designs.