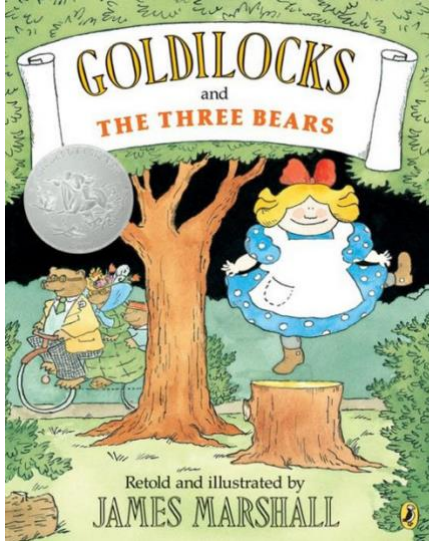


LESSON: Goldilocks and the Three Bears (Grades K-2)

+ OVERVIEW



In this design challenge, students will receive a problem inspired by the story *Goldilocks and the Three Bears* by James Marshall. In the story, Goldilocks is assigned the task of buying muffins in the next village, but is warned not to take the shortcut through the forest. However, Goldilocks does as she pleases and ends up finding the three Bears' home. She walks right into the house without knocking and starts causing mischief. Having tried the Bear's food, chairs, and beds, Goldilocks eventually falls asleep. When the Bear family returns, they find a sleeping Goldilocks who awakes startled and runs home. Although everyone is safe in the end, the Baby Bear's chair is destroyed.

Students will engage in a STEM challenge to build a chair for the Bear family's guest in 25 minutes. Teams will receive bonus points if a student from the team can sit in the chair.

+ 2021 Science TEKS covered in this design challenge

Kinder TEKS: K.1.B, K.1.E, K.1.G, K.6.A

Grade 1 TEKS: 1.1.B, 1.1.E, 1.1.G, 1.6.A, 1.6.C

Grade 2 TEKS: 2.1.B, 2.1.E, 2.1.G, 2.6.A, 2.6.C

+ Math TEKS covered in this design challenge

Kinder TEKS: K.2.A, K.2.C, K.5, K.6.E, K.7.A

Grade 1 TEKS: 1.3.D, 1.3.E, 1.5.A, 1.7.A

Grade 2 TEKS: 2.2.B, 2.4.A, 2.9.D

+ ELAR TEKS covered in this design challenge

Kinder TEKS: K.7.C, K.8.A

Grade 1 TEKS: 1.1.D, 1.8.C, 1.9.A

Grade 2 TEKS: 2.1.D, 2.6.C, 2.8.C, 2.9.A

+ Technology Applications TEKS covered in this design challenge

Kinder TEKS: K.3.A, K.3.B

Grade 1 TEKS: 1.3.A, 1.3.B, 1.5.A

Grade 2 TEKS: 2.3.A, 2.3.B, 2.5.A

+ The students will be able to:

- > Read *Goldilocks and the Three Bears* by James Marshall
- > Build a strong structure by applying an understanding of the physical properties of objects, and smaller units can be combined to make new objects
- > Classify building materials by their physical properties
- > Count forward and backward to at least 20 with and without objects
- > Use measuring tools to measure the length of objects
- > Give an example of a measurable attribute of a given object, including length, capacity, and weight
- > Work with a budget
- > Solve a problem using the engineering design process
- > Describe the elements of plot development, including the main events, the problem, and the resolution, for texts read aloud with adult assistance or independently
- > Demonstrate knowledge of distinguishing characteristics of well-known children's literature such as folktales, fables, fairy tales, and nursery rhymes
- > Work collaboratively with others by following agreed-upon rules for discussion, including listening to others, speaking when recognized, making appropriate contributions, and building on the ideas of others
- > Make and correct or confirm predictions using text features, characteristics of genre, and structures
- > Explore and collect many types of data, such as preferences or daily routines of people, events, or objects
- > Identify and collect non-numerical data, such as weather patterns, preferred reading genres, and holidays

+ Students will use the following STEM fluency skills:

- > Communication
- > Collaboration
- > Creativity
- > Critical Thinking
- > Resilience
- > Time/Resource Management
- > Innovation
- > Adaptability

+ Materials needed for this design challenge and their cost:

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|----------------------|----------------------|
| > Construction Paper | 1 counter per sheet |
| > Toilet Paper Rolls | 1 counter per roll |
| > Foam Sheet | 1 counter per sheet |
| > Scotch Tape | 3 counters per roll |
| > Duct Tape | 5 counters per roll |
| > Cardboard | 2 counters per sheet |
| > Scissors | 1 counter per pair |
| > Chenille Stick | 1 counter per stick |
| > Bear Guest | No cost |

Teacher's Note: For Kindergarten–Grade 2, students are given counters instead of play money to purchase materials at the store. Students may have some trouble using adhesives and scissors. As a result, extra care and monitoring will be needed to assist students.

+ Facilitator materials needed:

- > *Goldilocks and the Three Bears* by James Marshall
- > Projector and computer
- > Slide deck for the lesson
- > Copies of the scorecard for each group
- > Timing device

+ FACILITATION GUIDE

SECTION	PROCEDURE
INTRODUCTION	Slide 1: Goldilocks and the Three Bears Slide 2: Read Aloud > Read <i>Goldilocks and the Three Bears</i> ▪ Summarize what happened on each page. ▪ Ask students if they think their chair is <i>just right</i>. If not, why? How can the chair feel <i>just right</i> for them? ▪ Explain to students that there are jobs that specialize in designing and building furniture. The people who do these jobs are called engineers. They help design and build the things people see and use every day. Slide 3: Engineering Design 1 > Ask students the question: What is engineering? ▪ Explain to students that engineering is when engineers take what they know and apply it to solve problems by designing a product or process. ▪ For example, phones could once only be used at home or in specific locations. Why is this a problem? (Needing to make a call outside the home). What solution did engineers design to fix that problem? (Cell phones). • <i>Teacher's Note: Any example can be used here, but focus on examples that students are familiar with.</i> Slide 4: Engineering Design 2 > Ask students the question: What are some examples of engineering jobs? ▪ <i>Teacher's Note: If students have trouble giving examples, ask students who makes the things they use. Who makes refrigerators, cars, helmets, cell phones, and sneakers?</i> Slides 5-6: STEM Careers > Show students pictures related to careers connected to the story. > Architecture ▪ Ask students what they see in the pictures. ▪ Explain to students that the process of building these buildings is called architecture, which is the combination of art and science to design and build buildings.

	▪ Ask students who they think built the Bear's house. Explain to students that an architect would have been in charge of designing the house for the Bear family. > Materials Engineering ▪ Ask students what they see in the pictures. ▪ Explain to students that the chairs are all made from different materials. Ask students which chair looks the most comfortable. Ask students which chair looks the most expensive. Ask students why chairs are made from different materials. ▪ Explain to students that engineers need to consider a material's properties and its cost to determine what material would be the best fit for a project. Sometimes, a cheaper, less comfortable chair is the solution. Other times, a more expensive, very comfortable chair can be the solution. Materials engineers are always trying to figure out how to improve the materials used to build things like chairs, shoes, and even the tables in this room. ▪ Ask students if the chairs in the Bears' house looked comfortable. Slides 7-8: Try the Trade > Carpentry ▪ Ask students what they see in the pictures. ▪ Explain to students that people who design and build furniture are called carpenters. Ask students what they think a carpenter does. Explain that just like architects, carpenters combine art and science. Some of the work they do can be making furniture look nice. They also design solutions that make furniture do multiple things at once, such as a sofa bed. A sofa bed is a couch that can also be a bed. ▪ Ask students if they remember any furniture from the story. Explain to students that a carpenter made the furniture in the Bears' house. > Architectural and Civil Drafting ▪ Ask students what they see in the pictures. ▪ Explain to students that these are building plans or blueprints created by architectural and civil drafters. ▪ Ask students what they think a blueprint is used for. Explain that drafters create detailed drawings that show builders how to construct homes, bridges, roads, and other structures.
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Slide 9: Engineering Design 3

- > Ask students the question: Who can be an engineer?
 - Anyone!

Slide 10: Engineering Design Process

- > Ask students if they think all engineers solve their problems in one try. Explain to students that it takes many tries to get something correct in engineering. In engineering, there is no such thing as a mistake, only opportunities to learn. It is okay to fail. Just find the mistake and correct it. In engineering, there is never one correct solution. There are always many solutions to a problem, and there are always improvements that can be made. The steps that engineers take to find these solutions are called the *engineering design process*.
- > The teacher reads the first step to the students. (Identify)
 - What does identify mean? (To point out or find). Engineers design solutions. What do they need to know first before they can find the answer? (The problem)
 - How do people know when they have found the correct answer? In engineering, there are no correct answers, just better ones. Explain to students that there are expectations that engineers must meet, called *criteria*. For example, when engineering a football, what does a football need to do? (Bounce, look a certain way, have laces, have air inside, etc.). Those things are all called criteria. By comparing the design to the criteria, an engineer can determine if their solution will work. Is a child-sized football the same as an adult football? The criteria for both footballs include leather, white laces for the fingers, and shape. However, the two footballs would have different size criteria. The footballs are similar but differ in certain criteria.
 - Once the criteria are understood for the design challenge, what are some potential challenges that could make it difficult for an engineer to design their solution? (Money, time, materials, etc.) Explain to students that these rules are called *constraints* or rules that engineers must follow. Engineers are given constraints they must follow when solving a problem. Think about football again. What are college and professional footballs made from? (Leather). What if, instead, the rule (or constraint) was not to use leather? Could another type of football be made instead? Many of the footballs for sale are made of rubber because the engineer had different constraints.

	> The teacher reads the next step. (Imagine) ▪ Ask students what imagine, or imagination, means. Are these things real or tangible? They may not be real, but they help us imagine what things could be. In this step, see what materials are available, then brainstorm possible ideas/solutions to the problems. ▪ Explain to students that there are no right answers in engineering. Start with as many ideas as possible. > The teacher reads the next step. (Plan) ▪ The third big step of the engineering design process is to plan out the idea. Make sure that what is designed can be repeated. A plan will help an engineer identify where mistakes happen so they can be fixed. ▪ When planning, begin with the brainstorming phase. Each team member will contribute their ideas, and then the team will combine the different ideas! ▪ Once ideas are combined into a single group idea, determine what materials will be used for the solution and make sure the design meets the criteria and constraints of the project. > The teacher reads the next step. (Create) ▪ The fourth step is to create! Since this is the very first creation, it is called a <i>prototype</i>. A prototype is a first or preliminary model of something from which other forms are developed or copied. A prototype is created to test the engineer's idea or concept. Engineers ask themselves, "Did the idea work the way we wanted it to?" After testing the idea, the engineer will make improvements to the prototype. > The teacher reads the last step. (Improve) ▪ Finally, the last step is to improve. How does an engineer know if the prototype did well on the test? It must meet certain expectations and follow some rules. But how do engineers determine how well it met expectations and followed the rules? In school, how do you know if you mastered something? (Grades). The prototypes made today will be scored using a scorecard or rubric. By looking at the score, each team will determine if the design could be better. If improvements are needed, the team will revisit the plan and decide how to improve the score. Remember, there are no correct answers in engineering, just better solutions.
IDENTIFY	Slide 11-12: Identify - Problem > The teacher will read the bolded scenario to students. ▪ Ask students what problem the Bear family has.

- > Explain to students that they will put on their engineering hat today to help the Bear family build a chair that is *just right* if a Bear guest visits the family.

Slide 13: Identify - Criteria: (Desired Outcomes)

- > Explain to students that criteria are what engineers use to determine if they have successfully solved the engineering problem.
- > Explain to students that a solution will be successful if the chair:
 - Does not break into pieces when the Bear guest sits on it
 - It is not too big and not too small for the Bear guest
 - *Teacher's Note: Students in K-2 should not be expected to use volume as a form of evaluating space nor measure length using standard measurement. There should be approximately 3 centimeters of space on either side of the Bear guest when the guest is sitting in the chair. The teacher may use any object, like an eraser, to demonstrate 3 centimeters, or they can press their fingers together (pointer and middle finger) on one hand to demonstrate how much 3 centimeters is.*
 - Has the seat at least 15 centimeters off the ground
 - *Teacher's Note: Students in K-2 should not be expected to measure their chairs using standard measurements. The teacher will need to measure and mark a 15 -centimeter-high mark at the station where students are working. If there is no place to mark a height, a teacher could use a 15-centimeter-long string or a 15-centimeter-long dowel to measure next to the chair. Teachers may differentiate for higher-achieving students by setting the criteria to 30 centimeters.*
 - Extension Activity: Bonus points will be awarded if a student can sit on the chair.
 - *Teacher's Note: Success will be determined by a student sitting on the chair for 5 seconds without the chair breaking.*

Slide 14-15: Identify - Constraints (Rules)

- > Explain that constraints are the rules that engineers must follow.
- > Explain the following constraints for this engineering design activity:
 - Time Limit: Students will have 25 minutes to build the chair.

	• <i>Teacher's Note: The teacher will time the design challenge and give the students time checks periodically to assist the teams with their time management.</i> ▪ <u>Materials</u>: Students will be able to use no more than 20 items to build the chair. ▪ <u>Counters</u>: Students will have 20 counters to complete this challenge. • <i>Teacher's Note: 20 counters will be given to each group. Pre-bag the counters for easy distribution to each group. When students go to the supply table, they will hand the teacher one counter for each item they "buy." They can buy up to 20 items to build their prototype.</i> ▪ <u>Collaboration</u>: One design element from each team member must be used in the final design. Explain to students that a design element is taking one part of someone's idea and adding it to another. ▪ <u>Redesign</u>: Each team can test their prototype as many times as needed during the 25-minute design phase. Remind students what a prototype is. It is the first creation of our design. • <i>Teacher's Note: When a team is ready to test their design, they should raise their hand, and the teacher should assist the team with their score. If the team receives a low score on any part of the design, the team should redesign if they still have time.</i>
IMAGINE	Slide 16: Imagine - Explore Materials > Introduce materials to students by showing each item as it is read out loud on the materials list. Explain to students that when engineers describe items, they talk about properties like color, size, and flexibility. Ask students to identify the properties of each material. After each material, ask students if it is similar to any of the other materials they have seen and what the similarities and differences are. ▪ Ask students to reclassify the objects based on what they are made of or how they can be used. > After students have practiced classifying the materials, they will be allowed to combine the materials however they wish to build a chair that meets the criteria for the Bear family.

	Slide 17: Imagine – Brainstorm Ideas > Give students one minute to individually design and draw a plan of what they think the Bear family's chair should look like. Emphasize that students should not talk during this minute or share ideas with each other. Remind students that their ideas will be used as design elements for the final design. > After a minute, give students five minutes to present and share their ideas with their group. Let students know that, when sharing, they should focus on the key aspects of their idea they like and want to use as design elements in the final design. ▪ <i>Teacher's Note: If students are struggling with an idea for their design, provide ideas without giving the solution. For example, "This is a design that I tried earlier, but it failed. What could I do to improve it?" Emphasize that the design failed to reinforce that it is okay to fail and to let students know they cannot copy the design and expect success.</i>
PLAN	Slide 18: Plan – Gather Materials > Hand out the scorecard that will be used during the design challenge. Review the testing criteria with the class and answer questions. The testing criteria will inform their design decisions. > Have students collaborate to come up with a final design. Let students know they must include at least one element from each team member for their final design. > Review the design criteria: A successful chair design should include the following: ▪ Does not break into pieces when the Bear guest sits on it ▪ It is not too big and not too small for the Bear guest ▪ Has the seat at least 15 centimeters off the ground Bonus points will be awarded if a student can sit on the chair. ▪ <i>Teacher's Note: Students will not be expected to rank themselves or calculate their scores, but the teacher should explain how they will earn points. The testing criteria will inform their design decisions.</i> > They will need to select the materials to be used for the design. Students will have 20 counters to "purchase" materials for their build at the classroom supply table. The prices used in this challenge can be found in the materials list. Students will raise their hands when they are ready to purchase materials and will be guided by the teacher. Students can go over the counter limit if they want, but remind them that they will lose points on their scorecard.

	Slide 19: Plan – Team Member Responsibilities (Career Role-Playing) > Assign each student a career role within their team. As students complete the challenge, they should make decisions and contribute from the perspective of their assigned career. This activity models how STEM and skilled trade professionals collaborate in the real world to design, build, test, and improve prototypes. ▪ <u>Architect</u>: Checks that the chair design is strong and tests the chair while holding the bear ▪ <u>Architectural and Civil Drafter</u>: Draws the team's plan for the chair and manages the budget ▪ <u>Carpenter</u>: Builds the house with assistance from the team ▪ <u>Materials Engineer</u>: Tests that materials are working as planned and keeps track of the building materials
CREATE	Slide 20: Create – Design Your Chair > Let students know to have fun, be creative with their designs, and work together. > Remind students that being an engineer is not about getting the solution on the first try. There is no right answer, just better solutions. Slide 21: Identify – Criteria > Display the reminder slide for students to look at while working. Slide 22-23: Create – Test > The teacher will bring the Bear guest to the student teams when they are ready to test. > The teacher will then recap the point total with the students and how many points the team received for each category.
IMPROVE	Slide 24: Improve – Redesign/Discussion > Students will reflect on their scores and discuss: ▪ What worked? • <i>Teacher's Note: Focus on the materials being used and ask what properties of those materials might have helped. Check whether any students combined materials to make their chairs stronger. Check whether any students cut or folded the materials to strengthen their chairs.</i> ▪ What did not work? • <i>Teacher's Note: Focus on the materials being used and ask what properties of those materials made them not work well. Check whether any</i>

students cut or folded their materials and whether that made the chair weaker.

- What do you want to improve?
 - *Teacher's Note: Focus on engineering aspects with students. Ask students if they found a solution or just part of one. Reinforce that it is okay not to succeed on the first try and that engineering is about making improvements over time. Ask students if they would design their tower differently if they had no rules. Ask students if working together was difficult. Learning to work together is very important, and it is easier to find a solution with many ideas than with just one.*