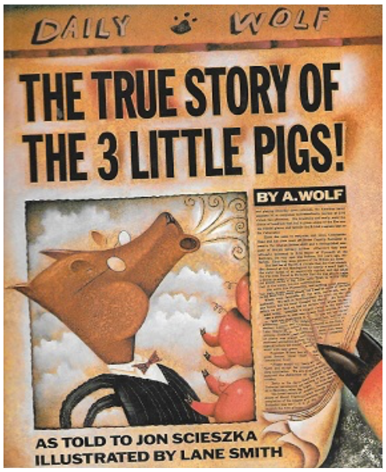
LESSON: The True Story of the Three Little Pigs (Grades K-2)

+ OVERVIEW



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In this design challenge, students will receive a problem from the story *The True Story of the Three Little Pigs* by Jon Scieszka. In the story, the wolf tells his side of the story of *The Three Little Pigs*. The wolf was planning to bake a birthday cake for his grandma and needed to get a cup of sugar. However, on his journey, he sneezes and blows down the homes of the three little pigs. The students will be presented with the following problem, “The eldest brother of the three little pigs is looking to rebuild the destroyed homes in his community after the sneezing wind disaster caused by the wolf.” Students will put on their engineering hats to help the eldest brother rebuild homes in the community. Students will engage in a STEM challenge to build a house in 25 minutes that can withstand the wolf’s sneeze for 5 seconds. Teams will receive bonus points if their house can withstand the wolf’s super sneeze for 5 seconds while protecting the pig inside.

+ 2021 Science TEKS covered in this design challenge

Kinder TEKS: K.1.B, K.1.E, K.1.G, K.6.A, K.10.C, K.11.A

Grade 1 TEKS: 1.1.B, 1.1.E, 1.1.G, 1.6.A, 1.6.C. 1.11.A

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

+ Math TEKS covered in this design challenge

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

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

Grade 2 TEKS: 2.2.B, 2.4.A

+ ELAR TEKS covered in this design challenge

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

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

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

+ Technology Applications TEKS covered in this design challenge

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 *The True Story of the Three Little Pigs*
- 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
- Solve a problem using the engineering design process
- Observe practical uses for rocks, soil, and water
- Desribe how humans use rocks, soil, and water
- Count forward and backward to at least 20 with and without objects
- 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
- Demonstrate personal skills and behaviors, including effective communication, following directions, and mental agility, needed to implement a design process successfully
- Recognize characteristics of persuasive text with adult assistance and state what the author is trying to persuade the reader to think or do
- Describe plot elements, 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, concluding 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

+ 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:

> Popsicle Sticks	1 counter per 5 sticks
> Straws	1 counter per 5 straws
> Construction Paper	1 counter per sheet
> Tape	5 counters per roll
> Glue Stick	4 counters per stick
> Paper Clips	1 counter per paper clip
> Scissors	5 counters per pair
> School Yard Soil (4 oz. mini paper cup)	3 counters per 4 oz. cup
> Water (4 oz. mini paper cup)	5 counters per 4 oz.cup

Teacher's Note: For Kindergarten, we recommend providing students with notched popsicle sticks and straw connectors if available. Students will have some trouble using adhesives and scissors. As a result, extra care and monitoring will be needed to assist students. Higher achieving students can be offered less sticks and straws per counter.

+ Facilitator materials needed:

- > *The True Story of the Three Little Pigs* by Jon Scieszka
- > Projector and computer
- > Slide deck for the lesson
- > Copies of the scorecard for each group
- > Timing device
- > Fan with multiple speeds
- > Plastic cups (16 oz.)

* After the competition of this activity, soil can be returned to the school yard unless students mix chemicals in the soil such as glue. If soil is contaminated it should be disposed of according to the local waste management guidelines.

+ FACILITATION GUIDE

SECTION	PROCEDURE
INTRODUCTION	**Slide 1: The True Story of the Three Little Pigs** **Slide 2: Read Aloud** > Read *The True Story of the Three Little Pigs.* ▪ Summarize what happened on each page. ▪ Ask students whether they believe the wolf's story. Ask students what went wrong with the first two houses, and why they think the last house survived the sneeze. ▪ Explain to students that there are jobs that specialize in building houses, although not in the same way as the three little pigs. 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). • *Teacher's Note: Any example can be used here, but focus on examples that students are familiar with.* **Slide 4: Engineering Design 2** > Ask students the question: What are some examples of engineering jobs? ▪ *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?* **Slides 5-7: Engineering Jobs 1-3** > Show students pictures related to engineering jobs connected to the story. > Architecture ▪ Ask students what they see in the pictures. ▪ Explain to students 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 houses. Explain to students that an architect would have been one in charge of designing and building the houses for the three little pigs. Do

you think one pig designed and built all the houses? Maybe each of the pigs was an architect?

- Civil Engineering
    - Ask students what they see in the pictures. Ask them: How does it look different from architecture?
    - Explain to students what they are seeing in the pictures is called civil engineering. While architecture combines art and science to build buildings, civil engineers use math and a type of science called physics to build buildings that help people. Architects and civil engineers are also different because while architects mainly focus on buildings, civil engineers will build many structures like bridges, highways, towers, and water systems!
    - Ask students which house was the safest. Why do they think that house was the safest, what was wrong with the other houses? How could they have made the other houses safer? Explain to students that a civil engineer would be the one to help make buildings safer.
- Wind Engineering
    - Ask students what they see in the pictures.
    - Explain to students that what they are seeing are wind turbines or windmills. Ask students what they think a windmill does. Explain that these structures help convert the wind into energy!
    - Ask students, how could learning about the wind be important? Explain to students there are many positive and negative aspects of wind. It can help people cool down on a hot day, but what if it's too strong? If the wind is too strong it could blow things down and be very dangerous!
    - Ask students if the straw house and wood house would be okay during a windy day. Explain to students that it may have been dangerous since the houses blew apart from just the wolf's sneeze!

Slide 8: Engineering Design 3

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

Slide 9: 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 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, the white laces for fingers, and the shape. However, the two footballs would have different criteria for the size. The footballs are similar but different because of different 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 finding the solution to a problem. Think about football again. What are college and professional footballs made from? (Leather). What if instead, the rule (or constraint) was to not 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 give us ideas about what things could be. In this step, see what materials are available, then brainstorm, or think about 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 combines 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 has met 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 *prototype*. 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 the expectations and how well it 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 should be made, then the team will revisit the plan and decide what to do to improve the score. Remember, there are no correct answers in engineering, just better solutions.
IDENTIFY	**Slide 10-11: Identify** - Problem > The teacher will read the bolded scenario to students. ▪ Ask students what problem is the elder brother having right now. > Explain to students that they will put on their engineering hats today to help the eldest brother rebuild homes for his community. **Slide 12: Identify** - Criteria (Desired Outcomes) > Explain to students that criteria are what engineers use to determine if they have successfully solved the engineering problem. > A successful house design should include the following: ▪ Space available to fit a little pig inside ▪ Withstand the wolf's sneeze for 5 seconds • Demonstrate the fan set to low or "1" for students and let them feel the moving air. ▪ A roof Bonus points will be awarded if the house can withstand the wolf's super sneeze for 5 seconds. • Demonstrate the fan set to medium for students and let them feel the moving air.

	Slide 13-14: Identify - Constraints (Limitations) > 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 house. • *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.* ▪ Materials: Students will be able to use no more than 20 items to build the house. ▪ Counters: Students will have 20 counters to complete this challenge. • *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.* ▪ Collaboration: 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. ▪ Redesign: 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. • *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.*
IMAGINE	**Slide 15: Identify** - 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 their 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 the house that meets the criteria for the elder brother.

	Slide 16: Imagine - Brainstorm > Give students one (1) minute to individually design and draw a plan of what they think the house should look like. Emphasize that students should not talk during this minute or share ideas with each other. Remind students their ideas will be used as design elements for the final design. > After a minute, give students five minutes (5) to present and share their ideas with their group. Let students know that they should focus on key aspects of their idea that they like and want to be used as design elements for the final design when sharing. ▪ *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.*
PLAN	**Slide 17: 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 house design should include the following: ▪ Space available to fit a little pig inside ▪ Withstand the wolf's sneeze for 5 seconds ▪ A roof Bonus points will be awarded if the house can withstand the wolf's super sneeze for 5 seconds. ▪ *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.* > 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. ▪ If students wish to use soil, they will ask a teacher or facilitator for soil. The facilitator or teacher will fill the mini paper cup (4 oz.) with soil and bring it back to the team. If a team wishes to use more than 4 oz. of soil, the soil will be transferred to a 16 oz. plastic cup and then brought back to the team.

	▪ If students wish to use water in their design, they will ask a teacher or facilitator for water. The teacher or facilitator will fill the mini paper cup (4 oz.) with water and bring it back to the team. **Slide 18: Plan** – Team Member Responsibilities > Each team member must be given a responsibility, such as materials manager, banker, head engineer, and quality control manager.
CREATE	**Slide 19: Create** - Design Your House > 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 20: Identify** - Criteria (Desired Outcomes) > Display the reminder slide for students to look at while working. **Slide 21-22: Create** - Test > The teacher will bring the fan to each team when they are ready to test. They will go through each of the categories on the scorecard with the students as testing is done by the teacher. > The teacher will then recap the point total with the students and how many points the team received for each category.
IMPROVE	**Slide 23: Improve** - Redesign: Discussion > Students will reflect on their scores and discuss: ▪ What worked? • *Teacher's Note: Focus on the materials being used and ask what properties of those materials might have helped. Check and see if any students combined materials to make their house stronger. Check and see if any students cut or folded the materials to make their house stronger.* ▪ What did not work? • *Teacher's Note: Focus on the materials being used and ask what properties of those materials made it not work well. Check and see if any students cut or folded their materials and if that made the house 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 house differently if they had no rules, how?*

	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 rather than just one idea.