

Enchanted Engineering: Let's Get Started!

Anything is possible in a fairy tale! The ideas for an engineering connection is limitless. Fairy tales are already part of the elementary school curriculum, therefore, these lessons can be easily integrated into the curriculum.

Before beginning each lesson, it is crucial to give your students ample time for exploration through play. Children are natural born scientist and engineers, it's fun to sit back and watch them soar!

I have included in the lessons many "what" questions. "What" questions help students to focus on what they are noticing and doing. "How" questions implies that there is a correct answer.

The scaffolding of these lessons enables the students to take their play to higher levels of learning.

Please note: *Scientist* or *Engineer* notebooks are not provided. I use composition notebooks and students use them throughout the school year.

The Three Billy Goats Gruff: Modeling the skill, giving clues and asking "what" questions. There is a simple reflection sheet to wrap up the unit. Science notebooks can be introduced. Encouraging drawing, documentation, writing of the design makes the learning visible.

Jack and the Beanstalk: Provide the initial support to move on to the next level. "What are you thinking?", "What else is possible here?". Students will use their science notebooks to draw their design and label or write a sentence, reflecting about their design.

The Three Little Pigs: Students will use one of the design recording sheets, included with this unit. The students will imagine and draw their design. To wrap up, the students draw what their design looks like and reflect upon possible improvement. Students can attach the recording sheets into their science notebooks. This can also be a tool to help students revisit their learning process and the ability to return to this topic with or without the teacher.

MRET Purchases for Teacher Planned Unit July, 2017.

The materials listed below will support the development of teacher curriculum.

These materials will be shared from educator to educator. Please use with care.

1. **Keva Planks:** Students will utilize these materials to explore engineering design. They will design and build bridges, specifically related to The Three Billy Goats Gruff.
2. **Marble Genius Run:** Students will utilize these materials to explore the engineering design, specifically related to Jack and the Beanstalk.
3. **Lego Duplo Bricks:** Students will utilize these materials to explore the engineering process. They will build houses, specifically related to The Three Little
4. **Look at That Building:** This book will be used as an introduction to structure and design.
5. **When I Build with Blocks:** This book will be used as an introduction to structure and design.
6. **Pop's Bridge:** This is a true story of the building process for the Golden Gate Bridge. This will help the students relate to a real world experience.
7. **Twenty One Elephants:** This is a true story about an engineer wanting to prove the strength the Golden Gate Bridge. This book will provide learning through a meaningful real world experience.
8. **Jack and the Beanstalk:** This book will stimulate student's imaginations. The students will develop an engineering design for a slide that will help Jack escape from the Giant.
9. **The Three Billy Goats Gruff:** This book will stimulate student's imaginations. The students will develop an engineering design for a bridge that will help keep the Gruff's safe from the Troll.
10. **The Three Little Pigs: An Architectural Design:** This book will introduce three known architects and their design for a house for the pigs. The students will develop an engineering design for a house to keep the pigs safe from the wolf.
11. **Pete the Cat: Construction Destruction:** This book will stimulate student's imagination as they listen to a cat's experience as an engineer working at a construction site.
12. **The Most Magnificent Thing:** This book will increase student's awareness of growth mindset and strategies to use to overcome a challenge.
13. **Beautiful Oops!:** This book will increase student's awareness of growth mindset and strategies to use to overcome a challenge.
14. **The Dot:** This book will help increase a student's imagination and creativity. The student's will use this increased awareness to help them successfully complete an engineering design project.

MRET 5E Template

Rev. for Teacher's Use in Elementary Classroom

Name of Lesson	Help Jack Escape!!
Author of lesson	Jan Seebeck
Sources used to compose lesson:	Read: <u>The Most Magnificent Thing</u> . This book will help students identify strategies, perseverance and imagination, to use when facing a challenge.
Summary of Skills & knowledge students must learn	Students will work together to successfully complete a meaningful real world engineer challenge. Students will observe, engage, share findings and record their observations.



Relevant STEM practices

Practice	Description / Connection to Lesson	Language you will use to help students see the connection to STEM practitioners	Standards
Collaborate	Partners must work together to successfully complete a meaningful challenge.	Scientist and Engineers work together to solve a problem. How can you work like an engineer to build a slide that will help Jack quickly escape from the giant. What will you do to be able to share the materials?	<ul style="list-style-type: none"> · C.K2.CS-CS.2.3 Provide and accept criticism on a collaborative project. · MAFS.K.G.2.5 Model shapes in the world by building shapes from components. · MAFS.K.G.2.4 Analyze and compare two and three - dimensional shapes. · MAFS.K.G.2.6 Compose simple shapes to form larger shapes. · K12.MP.2.1 Reason abstractly and quantitatively. · LAFS.K.RL.4.10 Actively engage in group reading activities with purpose and understanding. · LAFS.K.RI.1.1 With prompting and support, ask and answer questions about key details in a text. · LAFS.K.SL.1.1 Participate in collaborative conversation with diverse partners about Kindergarten topics.

Discover	Scientist and engineers are learning new things that make the world a better place to live.	Using these materials, imagine how you can build a way for Jack to get away quickly from the giant. What do we need to know about the materials we are using?	
Record Data	Scientist and engineers write down what they have created to help them remember new ideas and ways to make their creation even better.	Introduce protocol: How to write like a scientist. 1. Observe closely 2. Draw exactly what you see. 3. Label the picture.	

Engage: Before presenting the challenge, give students time to discover through free exploration.

Goal	What you will say / do	Expected student responses / actions
Collaboration	Read: <u>Jack and the Beanstalk</u> . What are some of the problems that Jack has? Brainstorm with your engineering partner. What can you build to help Jack get away from the giant quickly? Let's chart your ideas. Engineers and scientist work with each other to decide how to solve a problem. What are some ideas that you want to try? What do you notice about the materials you are using? What does your engineer partner think will work?	Jack needs to get away from the giant quickly to get back home and safe from the giant. The students will do a Think-Pair-Share to discuss the objective. Students evaluate their answers and use the building pieces to construct a model that will solve the problem.

Goal	What you will say / do	Expected student responses / actions
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Discovery	<p>Scientist and engineers are always making careful observations about materials they want to use. This way they can find out what things work and make them work even better. What do we need to know about the materials we are using? How strong does the slide need to be to get Jack home safely? How high will it need to be? How fast will it go?</p>	<p>Students communicate about the attributes of the marble run pieces . Students will build a structure that will quickly get Jack away from the giant. Students will collaborate with their partner and peers.</p>

Elaborate: *Teacher should chart students responses to these questions. This anchor chart will be used for future reference and resource.*

Goal	What you will say / do	Expected student responses / actions
<p>Students will know that working together, sharing ideas and materials produces quality work. Students will have a better understanding of the engineering process.</p>	<p>What did you do that made you think hard?</p> <ul style="list-style-type: none"> ● What happened today that made you keep going? ● What can you learn from this? ● How did you work with your partner? ● What mistake did you make that taught you something? ● What did you try hard at today? What did you do that made you think hard? ● What happened today that made you keep going? ● What can you learn from this? ● How did you work with your partner? ● What surprised you? 	<p>Students will answer questions appropriately. Students will identify strategies they will use again in a challenge. Students can plant beans and grow their own beanstalk/plant..`</p>

Evaluate: *How will you assess the extent to which learning goals are met, during / by the end of the lesson?*

(Remember to include some sort of review of the lesson/ revisit the response to “Essential Question” before you get to the evaluation.)

Goal	What you will say / do	Expected student responses / actions
Students will know that working together, sharing ideas and materials produces quality work. Students will have a better understanding of the engineering process.	<ul style="list-style-type: none"> • What did you do today that made you think hard? • What happened today that made you keep going? • What mistake did you make that taught you something? • How well did you work with your partner? • Did you learn something new from your friend’s design? 	<ul style="list-style-type: none"> • Students will answer questions appropriately. • Students will identify strategies they will use again when building a slide. • Students will draw and label in their science notebook. • Students will time how fast it takes for the marble to reach “home”. • Students could have marble races. • Students will share their design in a “team meeting”. • Students will celebrate their learning and discovery.

MRET 5E Template

Rev. for Teacher’s Use in Elementary Classroom

Name of Lesson	The Wolf’s Unlucky Day
Author of lesson	Jan Seebeck
Sources used to compose lesson:	Read: <u>The Three Little Pigs: An Architectural Tale</u> . With this lesson, offer the Duplo blocks, Keva planks and other material resources you may have in your classroom. From the story, students will infer which building materials they feel would work best to build a house.
Summary of Skills & knowledge students must learn	Students will work together to successfully complete a meaningful real world engineer challenge. Some of the concepts students will discover while building: balance, problem solving, teamwork, quantitative math, compare/contrast. The students will gain a better understanding of the engineering practice.

Relevant STEM practices

Practice	Description / Connection to Lesson	Language you will use to help students see the connection to STEM practitioners	Standards
Discover	<p>Scientist and engineers are learning new things that make the world a better place to live. Students will focus on materials, objects and everyday structures.</p>	<p>Using the materials you picked, imagine how you can build a house to keep out the wolf's huffs and puffs. Engineers and scientist plan their design and draw it in their science notebook. Draw a design of what you imagine your house to look like.</p>	<ul style="list-style-type: none"> ● SC.K2.CS-CS.2.3 Provide and accept criticism on a collaborative project. ● MAFS.K.G.2.5 Model shapes in the world by building shapes from components. ● MAFS.K.G.2.4 Analyze and compare two and three dimensional shapes. ● MAFS.K.G.2.6 Compose simple shapes to form larger shapes. ● K12.MP.2.1 Reason abstractly and quantitatively. ● LAFS.K.RL.4.10 Actively engage in group reading activities with purpose and understanding. ● LAFS.K.RI.1.1 With prompting and support, ask and answer questions about key details in a text.
Record Data	<p>Scientist and engineers write down what they have</p>	<p>Introduce protocol: How to write like a</p>	

	created to help them remember new ideas and ways to make their creation even better.	scientist. 1. Observe closely 2. Draw exactly what you see. 3. Label the picture.	
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Engage: Introduce the context in which this lesson is situated in the unit. *How will you invite students into the lesson, access prior knowledge, get them excited?*

Goal	What you will say / do	Expected student responses / actions
Collaboration	Read: <u>The three Little Pigs: An Architectural Tale</u> . What are some problems that the three pigs have? Brainstorm with your engineering partner. What are some strategies from the book? Let's chart your ideas. What materials will you decide to use?	The pigs need to build a house that will keep them safe from the big bad wolf. The students will do a Think-Pair-Share to discuss the objective. Students will work with their "engineer partner". Students evaluate their answers and draw a design. Students will use the building pieces to construct a model that will solve the problem.

Explore: Give students an opportunity to practice the skills, or engage in meaningful work with the knowledge they need to learn. *How will you organize student activities and thinking as they explore the S/K in this lesson?*

Goal	What you will say / do	Expected student responses / actions
Students will learn that objects have observable characteristics		
Discovery	Scientist and engineers are always making careful observations about materials they want to use. This way they can find out what things work and make them work even better. <ul style="list-style-type: none"> What do we need to know about the 	Students will learn about the materials through open ended play. Students will pick materials to use in their project using the senses of observation and touch.

	<p>materials we are using?</p> <ul style="list-style-type: none"> • How strong does the house have to be for the bad wolf to go away angry? • Did the number of items used to construct your house make a difference? 	
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Elaborate: Emphasize the connection of what is contained in this lesson and how it will be used in the classroom and/or lab setting. *How will you connect this experience with other ideas or real world applications?*

Goal	What you will say / do	Expected student responses / actions
Students will understand that there are different kinds of houses where they live and around the world.	Show examples of different houses and designs around the world. Youtube: Houses Around the World; Different Kinds of Houses. Who built these houses?	Students will draw a picture of the house they live in and compare it to their design house.

Evaluate: *How will you assess the extent to which learning goals are met, during / by the end of the lesson? (Remember to include some sort of review of the lesson/ revisit the response to “Essential Question” before you get to the evaluation.)*

Goal	What you will say / do	Expected student responses / actions
Students will know that working together, sharing ideas and materials produces quality work. Students will have a better understanding of the design process.	<ul style="list-style-type: none"> • What did you do today that made you think hard? • What happened today that made you keep going? • What mistake did you make that taught you something? • How well did you work 	<p>Students will test their design by using a “big, bad wolf “ hair blower to see if their house blows away.</p> <p>Students will identify strategies they would use to build a house again.</p> <p>Student will evaluate if their design was a good solution to the problem.</p>

with your partner?

- Did you learn something new from your friend's design? What did you do today that made you think hard?
- What happened today that made you keep going?
- What mistake did you make that taught you something?
- How well did you work with your partner?
- Did you learn something new from your friend's houses?
- What strategy will you try tomorrow?

An Engineer is someone who...

**observes
and
wonders**

**Discovers
and creates
new things**

**shares
their
curiosity**

**Explores
the world
around
them**

**ASKS
questions**

**constructs
inventions**

**uses
tools to
solve
problems**



An Engineer is someone like you!

I can Engineer!

My plan

How did I improve?

1

How did I improve?

2

It worked: better worse



It worked: better worse



