

TURNING IDEAS INTO REALITY: ENGINEERING A BETTER WORLD

Facilitator Guide

The Three Little Pigs

Prior to Facilitating Activity

- Carefully read the facilitator guide and PowerPoint presentation. Skim the full activity description
- Check kit to ensure all of materials needed for the activity are included (see material list taped to lid of kit). If not, please see Beth Hart in KL261 or call 937-229-5080.
- Contact teacher to:
 - o Confirm the time and location where you will be facilitating this activity.
 - o Confirm the length of time you will have to facilitate the activity.
 - o Make sure you have completed all necessary training and/or background checks with the teacher(s).
 - o Confirm any sign in policies, dress code requirements, etc.
 - o Provide the teacher with your phone number, so she/he can reach you if needed.
 - o Confirm technology available in the classroom. Many activities include YouTube videos; therefore, confirm that the school's network will not block them.
- Check the kit's memory stick for the activity's PowerPoint presentation by opening it on your personal computer.
- School technology is not always reliable, so take your personal computer for back up if needed.
- Divide materials into prepared sets for each team.

Day of Design Challenge Activity

- Arrive at school at least 15 minutes prior to your time scheduled to facilitate the activity.
- Connect projector and download PowerPoint from memory stick.
- Check that all technology is working (speakers, projection, etc.).
- Set-up as needed for the activity.
- Facilitate activity as indicated below.
- After activity, please cleanup, give the teacher feedback form to the teacher and ask him/her to fill it out (request it be completed before you leave), fill out facilitator feedback form.
- Return kit, pre/post-activity student surveys, teacher feedback, and all other forms to Beth Hart at KL261 (please note: pre and post-surveys may need to be eliminated if there is very short time for facilitating the activity).

Facilitator Tips

This material is based upon work supported by the National Science Foundation under Grant No. EEC – 1009607 and through EiF grant 14.06

- Always keep in mind that your first priority is to have fun with the children!
- Introduce yourself to the students (remind them you are normal!):
 - Name
 - Major
 - Where you are from
 - What you like to do for fun or a club or activity you are in at school
- As you go through the PowerPoint, be sure to engage the students in discussion by asking lots of questions rather than just presenting information.
- Make sure students know what materials they have to construct their design, any time constraints and how the design will be tested (this information should be in PowerPoint)
- Resist the temptation to let the students skip the individual and team brainstorming steps. They will most likely want to jump right in to building the design; do not let them. It is important that they experience brainstorming and designing, as they are crucial engineering elements. Before allowing teams to work with materials, require them have you approve their sketch of the team's prototype design idea.
- As the students are building their prototypes, walk around the room and ask them probing questions about their design. For example:
 - What are your reasons for selecting that material?
 - How did you combine your individual design ideas?
 - Why did you choose that design?
 - How did you create the idea for this design?
 - Suppose a company decided to use your team's prototype as a model for an actual product they plan to produce. How effective do you think it would be in solving someone's problem?
- Encourage teams to "test" components of their prototypes as they build them.
- Point out aspects of their design that impress you.
- Whether the design works or not, ask what modifications could be made in order to improve its effectiveness.
- Be sure students understand that failure is normal in engineering, which is why engineers use readily available, cost-effective materials when initially designing and testing a prototype idea. True failure occurs only when the designer is not persistent in brainstorming ways to improve their design.
- Ask students:
 - What do you like best about your design?
 - What do you like least about your design?
 - What aspects of other team designs stood out to you, and/or gave you ideas for improving your own team's design?
 - What modifications would you make if we had time to complete the design challenge again?

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- Do not allow students to criticize each other and try to get the “shy” or quiet students involved. This can be achieved by explaining that crazy/unachievable ideas frequently lead team members to think more creatively, which results in a better final design.

Activity Timeframe and Overview (58 minutes)

Activity	Time	Overview
Introduction	<i>2 minutes</i>	Introduce Yourself Provide Brief Activity Overview to Foster Excitement
Pre-Assessment	<i>3 minutes</i>	Administer Kit’s Pre-Activity Survey
Design Challenge Introduction	<i>10 minutes</i>	Begin PowerPoint Presentation: <ul style="list-style-type: none"> Guide Discussion Present the Engineering Design Challenge Explain the Engineering Design Process
Individual Brainstorm	<i>5 minutes</i>	Team Members Individually: <ul style="list-style-type: none"> Write 1-2 Solution Ideas
Prototype Design and Construction	<i>20 minutes</i>	Teams Collaboratively: <ul style="list-style-type: none"> Discuss Individual Ideas Choose and Sketch Final Idea for Approval Gather Materials and Construct Team Prototype
Testing	<i>10 minutes</i>	Perform and Observe Prototype Testing
Conclusion	<i>5 minutes</i>	Relate to Engineering; They Did What Engineers Do Connect to Types of Engineering
Post-Assessment	<i>3 minutes</i>	Administer Kit’s Post-Activity Survey

Material List

Material	Quantity per Team	✓
Combine following supplies in a baggie		
Play dough	1 small tub or stick	
Painters Tape	1 yard	
Glue Sticks or Bottles	1	
Popsicle Sticks	16	
Deck of Cards	6 cards	
Straws	20	

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Waxed Paper	1 square foot (approx.)	
Fan or Blow Dryer <i>(For testing)</i>	~	
Cups for Water and Beans <i>(For testing)</i>	~	
Tub or Bin <i>(To catch water and beans during testing)</i>	~	
Container or Jug <i>(for holding water used in testing)</i>		
Beans <i>(For testing)</i>	~	
Memory Stick <i>(With power point and handouts)</i>	~	
Pre-Activity Survey	~	
Post-Activity Survey	~	
Cardstock	1 sheet	
Paper <i>(For individual brainstorming)</i>	1 sheet	
Paper <i>(For team design sketch)</i>	1 sheet	

Set-Up

- Designate space for displaying and gathering available materials.
- Designate space for each team to collaborate and build their design ideas. Also, make sure all students will be able to see the presentation.
- Designate space for design testing. Make sure there is room for all students to observe.
- Prepare materials for each team by counting and separating them ahead of time.
- Prepare the testing materials before you begin the project. You will need to have the blow dryer (or fan), water, cup, bin, and beans ready for testing.

Team Size

3 students per team

Design Challenge Scenario

You have finally earned enough money to build the house of your dreams near a Florida beach. You want to make sure your structure is built to withstand the destructive force of a big bad wolf's huffing and puffing to blow you house down! WAIT...where you are building, hurricanes occur more frequently than the huffing and puffing of a big bad wolf. In that case, a better idea

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is to make sure your structure is built to withstand the destructive forces of a hurricane's wind, rain, and hail.

Engineering Design Challenge

Your team's challenge is to build three different houses, each constructed with a material similar to what The Three Little Pigs used.

Straw, stick, and brick houses, built by The Three Little Pigs, were tested for their ability to withstand the destructive force of The Big Bad Wolf's huffing and puffing. Your drinking straw, popsicle stick, and card houses will be tested for their ability to withstand the destructive forces of a hurricane's wind, rain, and hail.

Step-by-Step Facilitator Instructions

Note: The activity's PowerPoint presentation guides instruction and visually presents information to students. Therefore, the instructions include corresponding slide numbers.

1. Slide 1: As the pre-activity survey is distributed to students, introduce yourself and provide enough of an activity overview to gain students excitement.
2. Allow time for students to individually complete their pre-activity survey.
3. Divide group into teams of 3 students each (4 students will also work).
4. Slides 2 and 3: Discuss engineering and what engineers do.
5. Present the engineering design problem and challenge, following the presentation:
 - Slide 4: Explain that they will be taking on the role of civil engineers.
 - Slide 5: Present the real-world engineering design problem (scenario).
 - Slide 6: Introduce the Engineering Design Challenge.
 - Slide 7: Discuss Engineering Design Goals.
 - Slide 8: Introduce resources (materials) available to each team.
 - Slide 9: Explain prototype-testing procedures.
6. Slide 10: Introduce the Engineering Design Process. Explain that engineers use it as a tool to help them more effectively solve problems.
7. Slide 11: Explain how teams will use the engineering design process as they complete the challenge:

Imagine (10 min.)

- INDIVIDUALLY: observe available materials, and brainstorm and write design ideas (5 min.)
- TEAM: share individual ideas (5 min.)

Plan (5 min.)

- Choose and sketch a team design plan

Create (10 min.)

- Gather materials
- Construct your team design plan

Improve and Test (10 min.)

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- Teams decide on and make any last minute improvements before testing
 - Each team tests their prototype while other teams observe.
8. Slide 12: Facilitate a whole group reflection on final prototype design and testing results by asking questions such as the following.
 - What do you like best about your design?
 - What do you like least about your design?
 - What aspects of other team designs stood out to you, and/or gave you ideas for improving your own team's design?
 - What modifications would you make if we had time to complete the design challenge again?
 - How did the materials affect the ability for the houses to withstand the forces applied to them?
 9. Slide 13: Conclude by discussing the following questions as post-activity surveys are distributed.
 - What ideas do you have for engineering a better world?
 - How can you turn ideas into reality?
 10. Allow time for students to complete their post-activity survey.

Prototype Building - Notes

Designs must be built on the piece of wax paper provided. It is most likely that the house built out of cards will be the best design. The play dough is best used when packed in the bottom of the houses as a foundation to the structure.

Prototype Testing - Notes

The houses will be tested in a bin so that the water and beans are contained. Place the house in a bin and first start with wind. Turn the blow dryer to high, and hold it directly over the house to see if the house falls apart. If the house passes this test, move on to testing the house for withstand hail. Take a cup filled with the beans and pour it on top of the house. If the house does not fall apart, move on to testing for withstanding rain. Fill a cup with water and pour it over the house. If the house is still standing still without any destruction, the house design is successful.

Follow-up / Reflection - Notes

Use this time to ask the students what they liked best about their design and what they would change about their designs. You can also relate the specific activity to a type of engineering. Ask the students if they have any ideas as to what type of engineer might design this item. If you have done something similar through co-op or a class project, share your experiences (in simple terms) with the students. Celebrate everyone's design by having the class applaud for that team after that team shares their design. Thank the students and teacher for their time, collect any post-tests or forms.

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Background Information / Additional Resources

The facilitator will need to be familiar with the story of the three little pigs in order for them to fully explain the beginning of the PowerPoint and engage with the kids.

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