TURNING IDEAS INTO REALITY:
ENGINEERING A BETTER WORLD
Facilitator Guide

Save Max!

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:
  - Confirm the time and location where you will be facilitating this activity.
  - Confirm the length of time you will have to facilitate the activity.
  - Make sure you have completed all necessary training and/or background checks with the teacher(s).
  - Confirm any sign in policies, dress code requirements, etc.
  - Provide the teacher with your phone number, so she/he can reach you if needed.
  - 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 for facilitating the activity).

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Facilitator Tips

- 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 it 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 *(45 minutes)*

Activity	Time	Overview
Introduction	*2 minutes*	Introduce Yourself Provide Brief Activity Overview to Foster Excitement
Pre-Assessment	*3 minutes*	Administer Kit’s Pre-Activity Survey
Design Challenge Introduction	*10 minutes*	Begin PowerPoint Presentation: ● Guide Discussion ● Briefly Explain How Life Vests Work ● Present the Engineering Design Challenge ● Explain the Engineering Design Process
Individual Brainstorm	*2 minutes*	Team Members Individually: ● Write Solution Ideas on Post-It Notes
Prototype Design and Construction	*15 minutes*	Teams Collaboratively: ● Discuss Individual Ideas ● Choose and Sketch Final Idea for Approval ● Gather Materials and Construct Team Prototype
Testing	*10 minutes*	Prove Device Can be Put on Can in Less Than 20 Sec. Perform and Observe Prototype Testing
Conclusion	*5 minutes*	Cleanup Relate to Engineering; They Did What Engineers Do Connect to Types of Engineering
Post-Assessment	*3 minutes*	Administer Kit’s Post-Activity Survey

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.
- Sort materials into groups to be ready for quick distribution to teams.
- Prepare a bowl/bucket by filling it with enough water to completely submerge a soup can that is standing upwards (to test designs).

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Team Size

2-4 students (3 preferred) [expecting 8 groups approx.]

Design Challenge Problem/Scenario

You are on a vacation at your friend's lake house. You and your friend's family decide take Max, the family dog, and go out on the lake for a boat trip. While out on the boat, the water becomes rough and Max falls overboard into the water. Since Max is still a puppy, he does not know how to swim yet.

Engineering Design Challenge

Your team's challenge is to use supplies that are on the boat to create a life vest that will keep Max afloat. Max has already fallen overboard, so the life vest must be put on quickly to save him.

The goal for the students to design and test a floatation device to keep a soup can above the water. The device must be in one attached piece and able to be affixed to the can within a 20 second period (so students cannot just add attach foam or balloons to the can -- but they could assemble their floatation device and then put their can in it, or wrap it around the can). Some portion of the can must touch the water and get wet. The can should not be placed in a boat, for example, where it would remain dry.

To add more of a challenge and/or extra time, limit the amount of materials they can use for their design (or even eliminate some materials from the design).

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 2 to 4 students (preferably 3 is possible).
4. Slides 2 and 3: Discuss engineering and what engineers do.
5. Present the engineering design problem and challenge, following presentation:
    - Slide 4: Explain that students will be taking on the role of mechanical engineers as they complete the engineering design challenge.
    - Slide 5: Present the real-world engineering design problem (scenario).
    - Slide 6: Introduce the Engineering Design Challenge.
    - Slide 7: Share Engineering Design Goals.
    - Slide 8: Introduce resources (materials) available to each team.

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- 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.)*
   - 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?
   - What was special properties of the materials you used in your design helped it be able to float?
9. Slide 13: Conclude by cleaning up and 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.

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Prototype Building - Notes

Hint for success: Put floatation pieces on two opposite sides of the can. Also, keep it simple (more items = more weight for the life vest).

Table of Materials for Prototype

Material	Quantity per Team	✓	Quantity per Kit	✓
Tomato Soup Cans	~		3 (testing)	
Bucket	~		1	
Balloons	1		8	
Foam Pieces	1		8	
Paper Cups	1		8	
Rubber Bands	3		24	
Paper Clips	4		32	
String	1 foot		8 feet	
Elmer's Glue	1 bottle		8 bottles	
Ziploc Snack Bags	2		16	
Paper	5 sheets		40 sheets	
Pencils	5		40	

Prototype Testing - Notes

During testing, the design must be attached to a soup can in 20 seconds or less. After attaching the device to the can it will be place into the bucket of water (as indicated in the setup). The design passes if the can remains above water and floats for more than 20 seconds (time can be adjusted depending on the amount of time left for the activity). If the design fails to float, it needs should be quickly modified and tested again.

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

Very useful resource that provides explanation of the activity:
"Live Vest Challenge" http://www.tryengineering.org/lessons/lifevest.pdf

(Life vest challenge, n.d.)

References

Life vest challenge. (n.d.). *Tryengineering.com*. Developed by IEEE as part of TryEngineering. Retrieved from: http://www.tryengineering.org/lessons/lifevest.

Ohio's new learning standards. *Ohio department of education*. 08 Aug 2014. Retrieved from: http://education.ohio.gov/Topics/Ohio-s-New-Learning-Standards/Ohios-New-Learning-Standards.

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