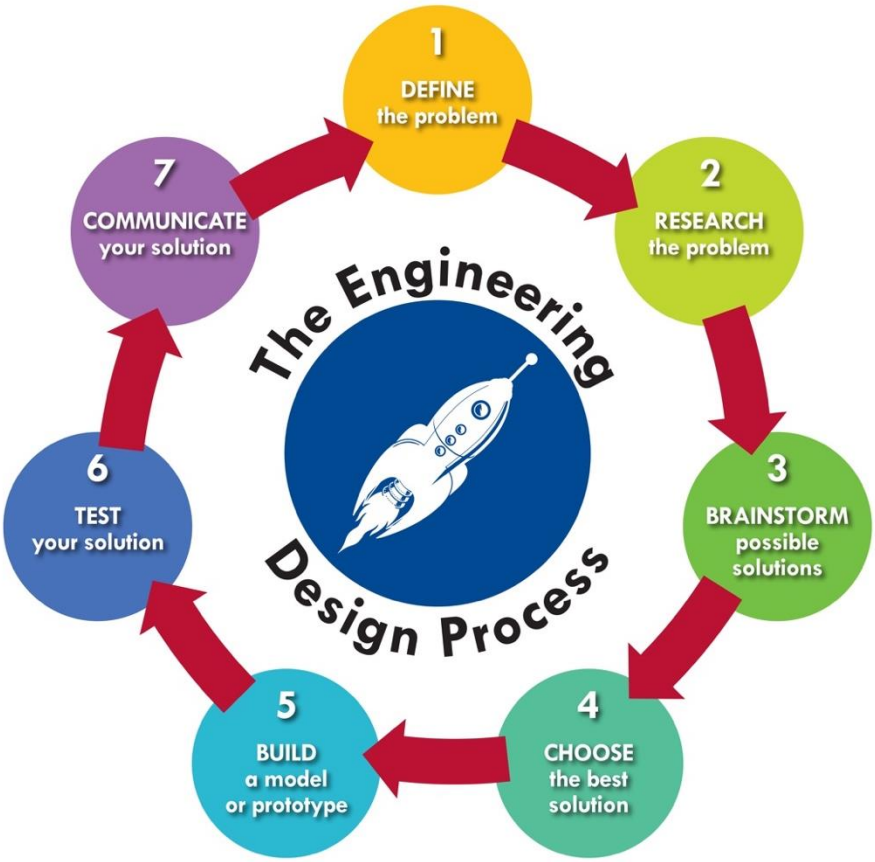
Solve It: A Student STEM Challenge



Topic: Manufacturing and Nutrition

Challenge:

To research the challenges and obstacles with the current Milk carton and design a solution to how milk is being served to students at cafeterias everywhere during the school day.

Materials:

- Computers for research
- Milk cartons from cafeteria (empty and full)
- Additional drink containers for research
- Paper or Whiteboards for brainstorming and sharing of ideas

Real World Connection:

- Milk carton Patent: file:///C:/Users/HoffnerB/Documents/Solve%20It/Abbott/US1157462A%20-%20Folded-blank%20box.%20-%20Google%20Patents.html
- Struggling to open the milk carton: https://www.youtube.com/watch?v=DuYLgEstc1Y&t=103s
- Plastic bags used for milk in schools: https://www.youtube.com/watch?v=JIlB7dogVWI
- Redesigning a Milk Carton: https://www.vanityfair.com/news/2009/07/redesigning-a-milk-carton
- The trendy world of Creative Milk Packaging: https://www.marstudio.com/blog/2013/08/the-trendy-world-of-creative-milk-packaging/
- A milk jug for a clean Earth: https://www.nytimes.com/2008/06/30/business/30milk.html
- How a milk carton is made: http://www.madehow.com/Volume-4/Milk-Carton.html
- STEM Pro Live! with Abbott: https://schoolsup.org/stemprolive/

Define the Problem:	
Guided Questions	Teacher Notes

• What do you have available to work with when designing your solution?
• What would a successful solution look like? How will you know if your design is successful?
• What are your constraints or limitations?
	• Establish your parameters (groups, roles, time limit, # of trials, amount of material allowed to use, etc.).
	  • Taking your students through the Engineering Design Process will vary depending on your school's current milk carton they are using.
	  • How often are students drinking milk from the cafeteria?
	  • What are the typical challenges and obstacles with the current design?
	  • What are the other options and type of drinks/containers that are being served in your cafeteria? What can be learned or modified based off of other designs?

Research the Problem:	
Guided Questions	Teacher Notes
• What is already known about the problem? • What are some current solutions that can be built upon/improved? • What technology is available to help you understand the problem better? • What are some obstacles, challenges connected to your problem?	Once you have narrowed down the problem you want to solve you will want to identify what solutions currently exist to decide how to implement or improve a solution. This is a great time to show them the benefits and limitations of the different modes of communication.
Brainstorm Possible Solutions:	
Guided Questions	Teacher Notes
• How many ideas can you come up with individually? • How many ideas can you come up with as a group? • How can you use/build on the groups ideas to refine your own?	• Have students individually come up with at least 4 possible designs that they could use in their solution • Have students share designs with a group. **Encourage a variety of ideas and a safe environment.* • Encourage reflection and refinement of ideas

Choose the Best Solution:	
Guided Questions	Teacher Notes
• Which solution(s) could you build using the materials/time you have available? • Which solution(s) could you build considering the constraints/ limitations? • Which solution do you think has the best chance to be successful?	• Have students choose an idea to design and make a plan to build/create (*even if you have no intention to actually build). • Have students draw a model of their prototype and label the parts (*if applicable). • List the materials that will be needed to build (*if applicable). • Describe how the materials will be used.
Build a Model or Prototype:	
Guided Questions	Teacher Notes
• What materials will you need? • Does your design meet the lesson objective? • Does your design clearly communicate your selected solution to the problem?	• Revisit the objective and make sure the student's design matches what they chose for their solution to the problem.
Test your Solution:	
Guided Questions	Teacher Notes
• Did you record your observations? • How will you know if your design worked as intended? • How will you know if your design was successful?	• Have students make and record observations during their trial(s). • Encourage students to stay true to their design and not make modifications while testing.
Communicate your Solution:	
Guided Questions	Teacher Notes
• Did your design work as intended? How do you know? • Did it solve the problem that you identified? How do you know? • Do you still think your solution is the best one for the problem? Why or why not? • What would you different if you could do it again? Why?	• *Have students reflect individually first and record responses.* • *Have students share responses with their group then whole class.* • *To make iterations, you will want to re-enter the Engineering Design Process and begin thinking about defining the problem(s) they had with the initial idea.* • *The purpose is to provide a process for them to formalize their thinking and not rely on*

	trial and error to merely accomplish a task. • *Share your students' designs and ideas with us at: stem@maricopa.gov*