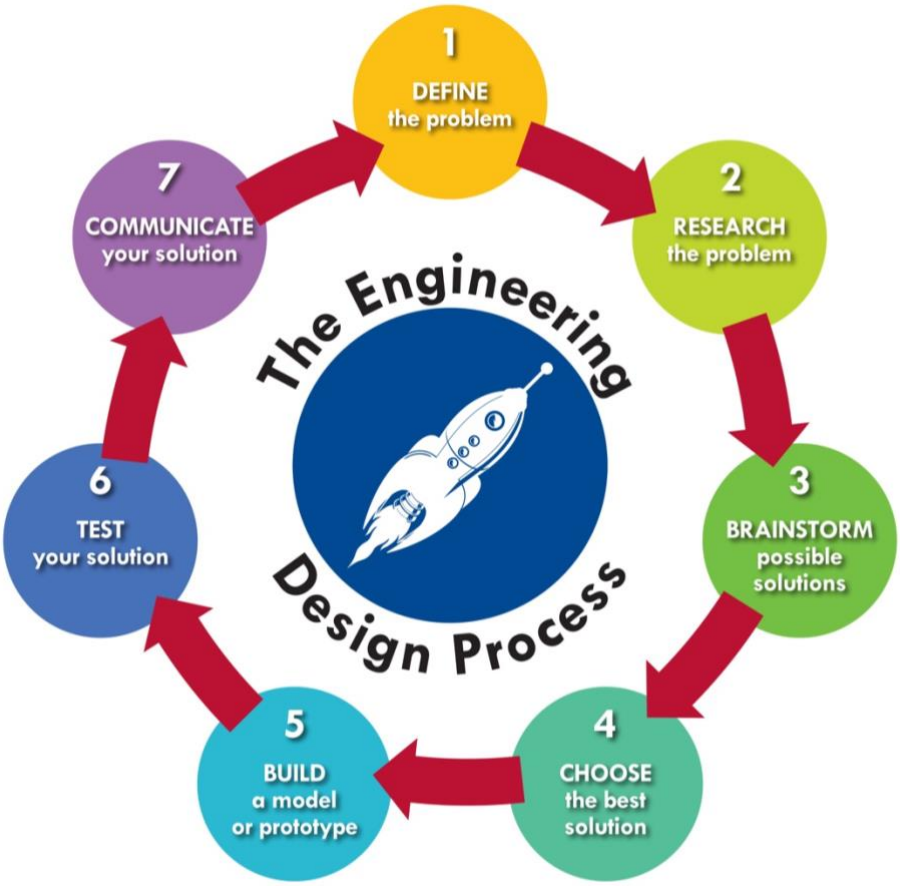
Solve It: A Student STEM Challenge



Topic: Air Quality **Challenge:** Design a better system for your school's before and after school drop off and pick up system.	**Materials:** • Timers • Computers or print out of campus from Google Earth • *potential video cameras to record before and after school event

Real World Connection:

U.S. Department of Energy's Idle Box Toolkit for Idling Reduction Projects: https://cleancities.energy.gov/technical-assistance/idlebox/

EPA's Idle Free Schools: https://www.epa.gov/region8/idle-free-schools

Arizona Department of Environmental Quality Idle Reduction Program: http://legacy.azdeq.gov/ceh/bus.html

"Waste Busters" video, Idling Myths, Connecticut Department of Environmental Protection: https://www.youtube.com/watch?v=BnpLUitvhFQ

MCAQD Air Monitoring Links: https://www.maricopa.gov/1643/Air-Monitoring and http://alert.fcd.maricopa.gov/alert/Google/v3/air.html

Air Quality Education Resources:

https://airnow.gov/index.cfm?action=learning.forteachers

http://www.itsourair.org/

http://kidsmakingsense.org/

http://cleanairmakemore.com/the-classroom/

STEM Pro Live! with Maricopa County Air Quality: https://goo.gl/icV8cg

MCESA | Maricopa County Education Service Agency

Sequence of Instruction	
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?	• Have students make observations of cars during drop-off/pick-up time. • Have students make a scaled map of their school including surrounding streets that provide entrance/exits. • Have students define what they think the problem is. • Establish your parameters (groups, roles, time limit, # of trials, amount of material allowed to use, etc.).
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? •	• Have students research what are the concerns related to idling cars. • Use the MCAQD website to look at the data for current air quality conditions: https://www.maricopa.gov/1643/Air-Monitoring • Have the students research current laws and restrictions around idling cars in Arizona and other states.
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 a design to make a plan to "build".
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 students 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.*