

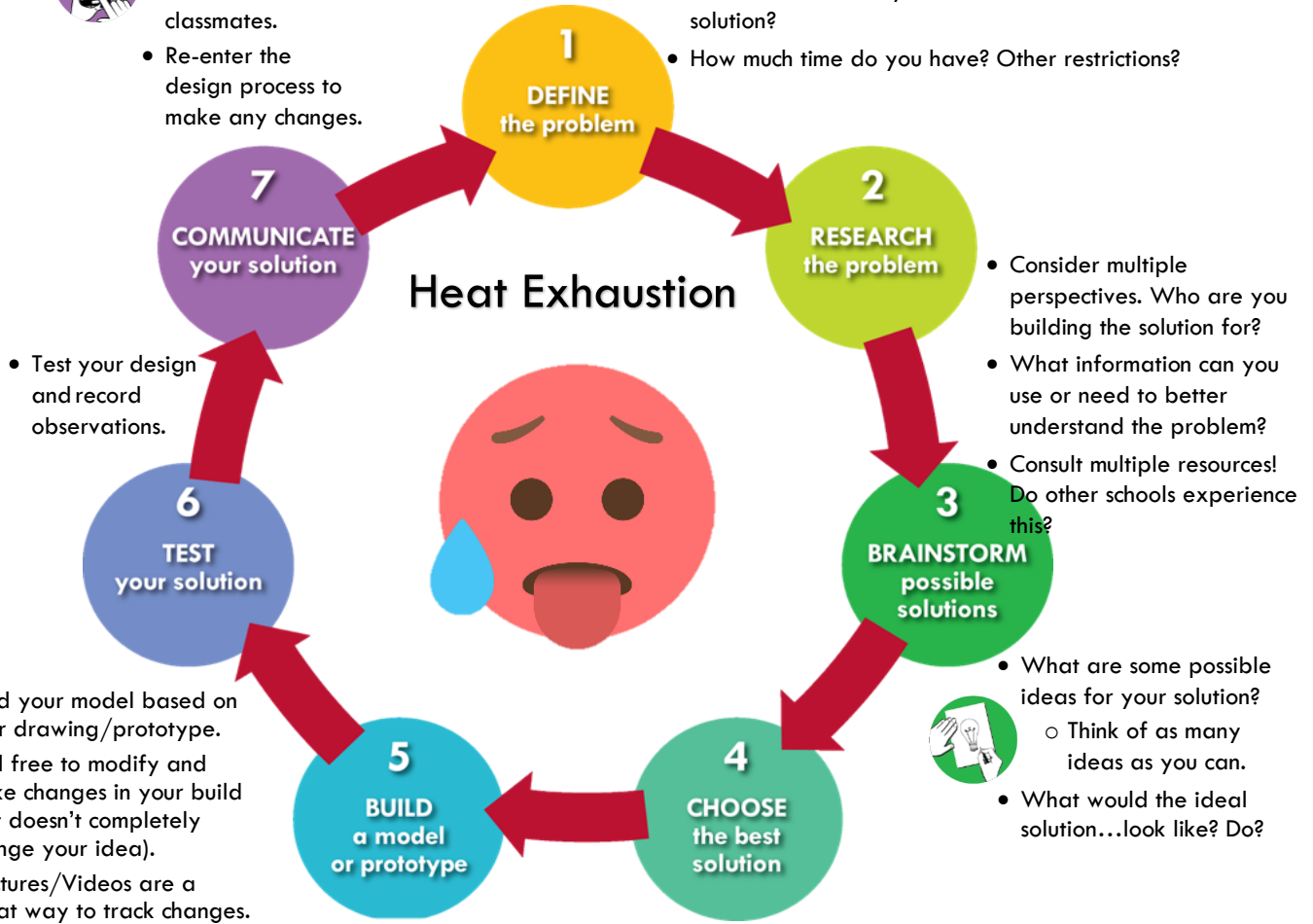


Think like a Bioscience professional and design a solution for keeping students and teachers from overheating at schools during specific activities.



- Share with other classmates.
- Re-enter the design process to make any changes.

- When and where are students and teachers being exposed to the heat from the sun?
- What are the problems/issues when that is happening?
- What resources do you have available to create a solution?
- How much time do you have? Other restrictions?



Describe your situation. What is the need or problem?



Draw your design (include labels).



Take a picture or video of your final design and share with us at: [stem@maricopa.gov](mailto:stem@maricopa.gov).



**EDUCATOR PRO CONNECT**

\*[Register for EPC](#) to match with an Industry professional to share your solution or learn more.

<b>Topic:</b> Heat Exhaustion and Bioengineering	<b>Materials:</b> <ul style="list-style-type: none"> <li>• Map of school</li> <li>• School schedule and list of regular activities students and/or teachers participate in.</li> <li>• Thermometers – to measure air temp.</li> <li>• Thermometers – to measure body temp.</li> <li>• *Materials for designing and building a solution will vary depending on the identified problem at each school.</li> </ul>
<b>Challenge:</b> Think like a Bioscience professional and design a solution for keeping students and teachers from overheating at schools during specific activities.	
<b>Real World Connection/Resources:</b> AZ Heat Safety Resource Guide: <a href="https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/heat/az-heat-safety-resource-guide.pdf">https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/heat/az-heat-safety-resource-guide.pdf</a> AZ Department of Health Services: <a href="https://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/heat-safety/index.php#heat-home">https://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/heat-safety/index.php#heat-home</a> Tips for Preventing Heat-related Illness: <a href="https://www.cdc.gov/disasters/extremeheat/heattips.html">https://www.cdc.gov/disasters/extremeheat/heattips.html</a> National Integrated Heat Health Information System: <a href="https://www.heat.gov/pages/planning-and-preparing-heat-illness-prevention">https://www.heat.gov/pages/planning-and-preparing-heat-illness-prevention</a> Heat Illness Prevention: <a href="https://www.osha.gov/heat/">https://www.osha.gov/heat/</a> Heat Relief Network: <a href="https://azmag.gov/Programs/Heat-Relief-Network">https://azmag.gov/Programs/Heat-Relief-Network</a> 108 degrees Critical Response : <a href="https://az.pbslearningmedia.org/resource/108-degrees/108-degrees-critical-response/">https://az.pbslearningmedia.org/resource/108-degrees/108-degrees-critical-response/</a> The Science of Keeping Cool: <a href="https://az.pbslearningmedia.org/resource/nvmms.sci.phys.cool/the-science-of-keeping-cool/">https://az.pbslearningmedia.org/resource/nvmms.sci.phys.cool/the-science-of-keeping-cool/</a> Feeling the Heat and Staying Cool Lets Learn: <a href="https://az.pbslearningmedia.org/resource/1197-feeling-heat-staying-cool-video/lets-learn/">https://az.pbslearningmedia.org/resource/1197-feeling-heat-staying-cool-video/lets-learn/</a> Explore on-demand interviews with professionals sharing their career journey and talking about their workplace: <a href="https://schoolsup.org/stem-pro-live">https://schoolsup.org/stem-pro-live</a> Connect with professionals to enhance real-world application and bring awareness to college and career pathways: <a href="http://educatorproconnect.org">educatorproconnect.org</a> Explore Pathways to Life and Bioscience Careers: <a href="https://schoolsup.org/bioscience">https://schoolsup.org/bioscience</a>	

Sequence of Instruction	
Define the Problem:	
Guided Questions	Teacher Notes
<ul style="list-style-type: none"> <li>• What do you have available to work with when designing your solution?</li> <li>• What would a successful solution look like? How will you know if your design is successful?</li> <li>• What are your constraints or limitations?</li> </ul> <p><b>Developing Solutions with Empathy</b> requires thinking about the problems from the perspective of the user.</p> <ul style="list-style-type: none"> <li>• <b>Who</b> is your solution intended for?</li> <li>• <b>What</b> are the challenges they are facing?</li> <li>• <b>How</b> is their current experience impacting their physical and emotional life?</li> <li>• Finally, you need to try to understand what is causing them to have this experience. Understanding the <b>Why</b> is the most critical step in developing a successful solution.</li> </ul>	<ul style="list-style-type: none"> <li>• Have your students start by looking at or building a model (paper, 3D, or digital) of the school campus.</li> <li>• Next, make a list of all activities that students/teachers are doing throughout the day that would expose them to heat from the sun.</li> <li>• If possible, have your students make observations about the activities (including data recording the air temp and</li> </ul>

	<p>body temp) and consider the dangers and challenges of prolonged sun exposure.</p> <ul style="list-style-type: none"> <li>• Next have your students attempt to pick an audience (students or teachers) and an activity that they want to focus on creating a solution. This can be a whole-class decision or vary from group to group. The list of activities can be pre-determined or open to students to choose from (before school drop-off, recess, PE, transition periods, after school pick-up, etc.)</li> <li>• Have students make new and additional observations about their selected activity then define what they think the challenge or problem is with the current activity.</li> <li>• *Remember to support developing an empathetic solution.</li> <li>• Establish your parameters (groups, roles, time limit, # of trials, amount of material allowed to use, etc.).</li> </ul>
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**Research the Problem:**

Guided Questions	Teacher Notes
<ul style="list-style-type: none"> <li>• What is already known about the problem?</li> <li>• What are some current solutions that can be built upon/improved?</li> <li>• What technology is available to help you understand the problem better?</li> <li>• What are some obstacles, challenges connected to your problem?</li> <li>• Who are you building the solution for?</li> </ul>	<ul style="list-style-type: none"> <li>• Have students research what are the concerns related to heat exposure.</li> <li>• There are a lot of resources listed in the <b>Real-world Connections</b> section.</li> <li>• Have the students research how other schools or cities are changing and improving their designs/policies/practices to keep students and teachers safe.</li> <li>• What new technology exists that can support</li> </ul>

	with better understanding the problem?
<b>Brainstorm Possible Solutions:</b>	
<u>Guided Questions</u>	<u>Teacher Notes</u>
<ul style="list-style-type: none"> <li>• How many ideas can you come up with individually?</li> <li>• How many ideas can you come up with as a group?</li> <li>• How can you use/build on the groups ideas to refine your own?</li> </ul>	<ul style="list-style-type: none"> <li>• Have students individually come up with at least 2 possible designs or ideas which could improve the activity they selected.</li> <li>• Have students share designs with a group. <i>*Encourage a variety of ideas and a safe environment.</i></li> <li>• Encourage reflection and refinement of ideas</li> </ul>
<b>Choose the Best Solution:</b>	
<u>Guided Questions</u>	<u>Teacher Notes</u>
<ul style="list-style-type: none"> <li>• Which solution(s) could you build using the materials/time you have available?</li> <li>• Which solution(s) could you build considering the constraints/limitations?</li> <li>• Which solution do you think has the best chance to be successful?</li> </ul>	<ul style="list-style-type: none"> <li>• Have students choose a design and make a plan to "build" a model to represent their idea.</li> </ul>
<b>Build a Model or Prototype:</b>	
<u>Guided Questions</u>	<u>Teacher Notes</u>
<ul style="list-style-type: none"> <li>• What materials will you need?</li> <li>• Does your design meet the lesson objective?</li> <li>• Does your design clearly communicate your selected solution to the problem?</li> </ul>	<ul style="list-style-type: none"> <li>• Revisit the objective and make sure the students design matches their intended solution to the problem.</li> <li>• Is their choice based on thinking empathetically as to what the user would want?</li> </ul>
<b>Test your Solution:</b>	
<u>Guided Questions</u>	<u>Teacher Notes</u>
<ul style="list-style-type: none"> <li>• Did you record your observations?</li> <li>• How will you know if your design worked as intended?</li> <li>• How will you know if your design was successful?</li> </ul>	<ul style="list-style-type: none"> <li>• Have students make and record observations during their trial(s).</li> <li>• Encourage students to stay true to their design and not make modifications while testing without first recording what they are changing and why.</li> </ul>

<b>Communicate your Solution:</b>	
<u>Guided Questions</u>	<u>Teacher Notes</u>
<ul style="list-style-type: none"> <li>Did your design work as intended? How do you know?</li> <li>Did it solve the problem that you identified? How do you know?</li> <li>Do you still think your solution is the best one for the problem? Why or why not?</li> <li>What would you do differently if you could do it again? Why?</li> </ul>	<ul style="list-style-type: none"> <li>Have students reflect individually and then record responses.</li> <li>Have students share responses with their group then whole class.</li> <li>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.</li> <li>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.</li> <li>Take a picture or video of your final design and email us at: <a href="mailto:stem@maricopa.gov">stem@maricopa.gov</a></li> </ul>