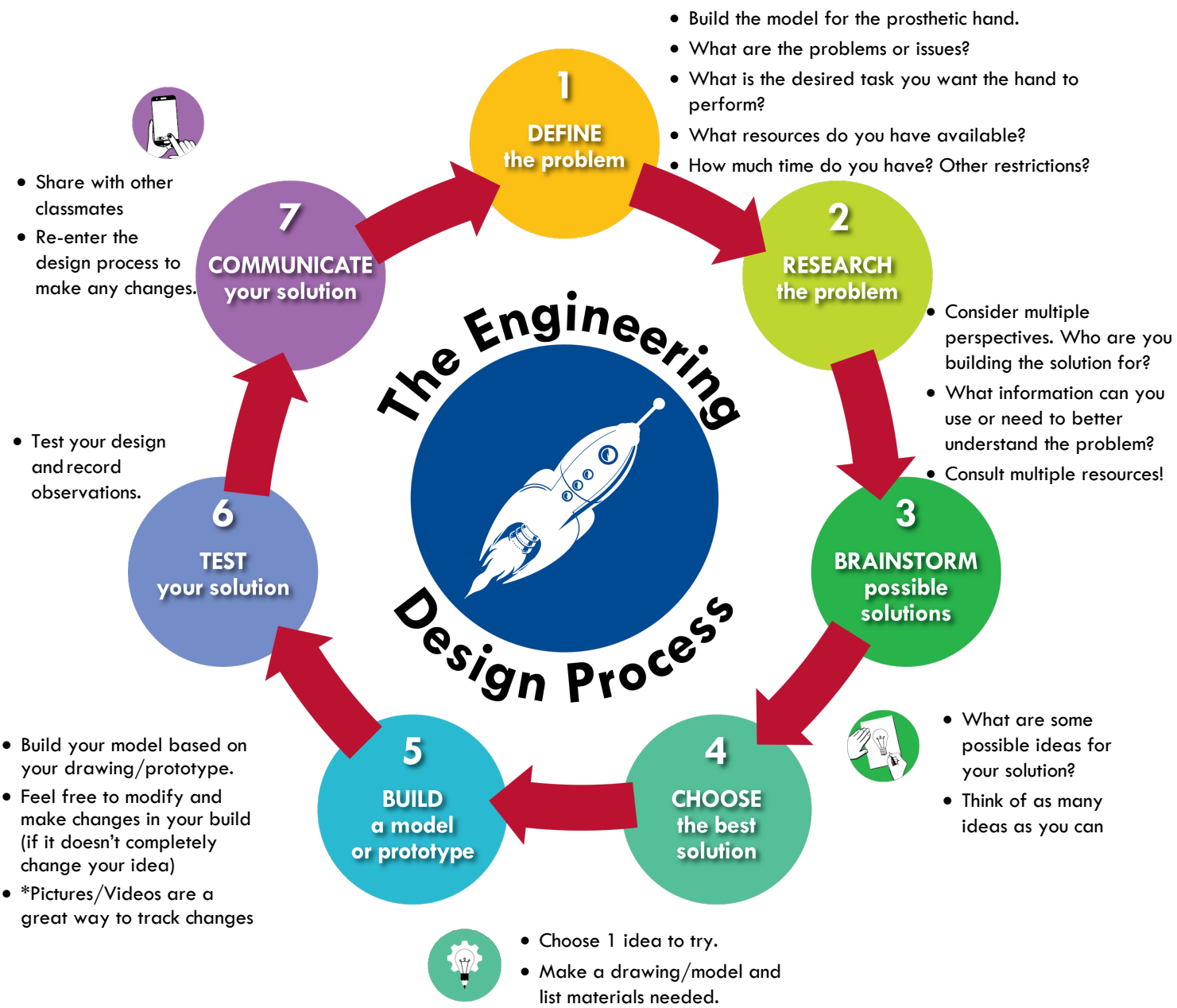
Solve It- STEM Challenge

STEM Challenge: Think like a Bioscience professional and design a solution for a model of a prosthetic hand that can perform a desired task.



- Build the model for the prosthetic hand.
- What are the problems or issues?
- What is the desired task you want the hand to perform?
- What resources do you have available?
- How much time do you have? Other restrictions?

- Consider multiple perspectives. Who are you building the solution for?
- What information can you use or need to better understand the problem?
- Consult multiple resources!

- What are some possible ideas for your solution?
- Think of as many ideas as you can

- Choose 1 idea to try.
- Make a drawing/model and list materials needed.

- Build your model based on your drawing/prototype.
- Feel free to modify and make changes in your build (if it doesn't completely change your idea)
- *Pictures/Videos are a great way to track changes

- Test your design and record observations.

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

Describe your situation. What is the need or problem?

Draw your design (include labels).

Take a picture or video of your final design and email us at: stem@maricopa.gov

EDUCATOR PRO CONNECT

*Register for EPC to match with an Industry professional to share your solution or learn more.

FLINN FOUNDATION

Office of the Maricopa County School Superintendent Steve Watson

Topic: Prosthetic Hands and Bioengineering	**Materials:** • Scissors • Paper (various types with different rigidity) • Plastic Straws • String • Tape • *Optional- plastic sewing needle to help thread the string through the straws.
Challenge: Think like a Bioscience professional and design a solution for a model of a prosthetic hand that can perform a desired task.	

Real World Connection/Resources:

Kaplan Early Learning- DIY Robot hand activity: https://blog.kaplanco.com/ii/diy-robot-hand
Robotic Hand Science Project: https://www.youtube.com/watch?v=_-cTge2mZLs
e-NABLE collection of 3D printable assistive devices: https://enablingthefuture.org/upper-limb-prosthetics/
GRABCAD Community resource of CAD Prosthetic files: https://grabcad.com/library/tag/prosthetic
The history of prosthetics video: https://www.youtube.com/watch?v=0CpiQdgV81g
Overview of Limb Prosthetics: https://www.merckmanuals.com/home/special-subjects/limb-prosthetics/overview-of-limb-prosthetics
The Anatomy of Prostheses: How prosthetic limbs work: https://www.goodrx.com/healthcare-access/research/how-prosthetic-limbs-work
Explore on-demand interviews with professionals sharing their career journey and talking about their workplace: https://schoolsup.org/stem-pro-live
Connect with professionals to enhance real-world application and bring awareness to college and career pathways: educatorproconnect.org
Explore Pathways to Life and Bioscience Careers: https://schoolsup.org/bioscience

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? **Developing Solutions with Empathy** requires thinking about the problems from the perspective of the user. • **Who** is your solution intended for? • **What** are the challenges they are facing? • **How** is their current experience impacting their physical and emotional life? • Finally, you need to try to understand what is causing them to have this experience. Understanding the **Why** is the most critical step in developing a successful solution.	• Have your students start by building a model of a prosthetic hand. This can be done using common materials (paper version), 3D printed, or using CAD. • Have your students make observations about the current model and consider the benefits and challenges of using the model. • Next have your students attempt to perform various tasks using the prosthetic. The list of activities can be pre-determined or open to students to choose (tie a shoe, shake hands, catch or throw an object, etc.) • Have students make observations and describe their experience then

	define what they think the problem is with the current models. • *Remember to support developing an empathetic solution. • 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? • Who are you building the solution for?	• Have students research what are the concerns related to current prosthetics. • Use the links in the real-world connections to learn more about the field. • Have the students research how prosthetics are changing and improving with new technology.
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 2 possible designs that they could use to improve the model they first built. • 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 and make a plan to "build" a new model.
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 their intended solution to the problem. • Is their choice based on thinking empathetically as to what the user would want?
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 without first recording what they are changing and why.
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 and then 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. • Take a picture or video of your final design and email us at: stem@maricopa.gov