STEM Careers Coalition

SOLUTION SEEKER ACTIVITY

Changing Perspective to Solve Problems

OBJECTIVES

Students will:

- Analyze data to determine a solution
- Synthesize information from a variety of perspectives to develop a plan
- Redesign the existing plan to meet changing criteria

OVERARCHING QUESTION

How can we use the engineering design process to develop a solution to rapidly changing needs in our community?

STANDARDS

Next Generation Science Standards

- Engineering Design
    - MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Common Core English Language Arts

- Writing:
    - W.4: Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- Speaking and Listening:
    - SL.1: Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
    - SL.2: Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.

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Instructional Note:

The following activity has been designed so you can tailor it to your current mode of instruction.

- The *Introduce*, *View and Reflect*, and *Conclude* sections can be presented virtually, by video, or through a shared document.
- The *Challenge* section is designed for students to complete independently at home using the accompanying Challenge handout. Students can either print and fill out the handout or answer the questions separately in a format that can be shared with you.

ACTIVITY OVERVIEW

Introduce

1. Begin by building a general concept of health-care infrastructure. Ask students to consider the following.
    - Describe some places you have been to see a doctor (primary care, urgent care, hospitals, etc.).
    - Where are the nearest hospitals to you? How many miles away is the nearest hospital? (Rural areas on average are 34 miles from a hospital.)
    - Why aren't there more hospitals if they are so useful? (The average cost of building a hospital is $60–187 million.)
    - Why would it be difficult for some people to visit a doctor? (Consider age, access to transportation, lack of health insurance, and distance to doctor's office.)
    - How could health-care companies make it easier to meet the needs of people who find it difficult to visit a doctor? (Would mobile medical units help?).
2. Explain that students are about to watch a short video that features Lee-Jah Chang, a scientist who is the director of clinical development for high-dose flu vaccines, and how he is using his STEM skills and knowledge to help patients affected by COVID-19.

View & Reflect

1. Before the class watches the video, have students take out a sheet of paper and fold it into fourths. In each box, have students write four STEM skills that will help them succeed across all STEM careers. Ask students to discuss with an elbow partner what they think each skill means; then, compare their thoughts with the explanations below.
    - Creativity—The ability to develop original or innovative solutions to new problems
    - Communication—The ability to effectively share your thoughts, ideas, and questions and also listen to and understand the messages of others
    - Critical thinkin—The ability to gather and analyze information to solve problems and form conclusions
    - Collabortation—The ability to work effectively, respectfully, and flexibly with others

2. Explain to students that as they watch the Career Profile Video, they will be responsible for providing examples of how Dr. Chang uses each of the four skills they listed in his work. Students may find it useful to view the video more than once.
3. After watching the video, review the steps of the engineering design process:
    - Identify the need
    - Research the problem
    - Develop possible solutions
    - Select the most promising solution
    - Construct a prototype
    - Test and evaluate the prototype
    - Communicate the design
    - Redesign
4. Share with students that in the engineering design process, the problem can change but the the same process is still used to help us solve for it. Have students identify the problem Dr. Chang encountered and describe how the engineering design process helped guide solutions he is providing for COVID-19.

CHALLENGE

1. Explain that the class will now be challenged to take on the role of the director of health and human services and work to develop multiple solutions to a significant problem.
2. Share the Challenge handout and review the instructions. Students will be proposing a plan for the mass distribution of COVID-19 vaccines.

CONCLUDE

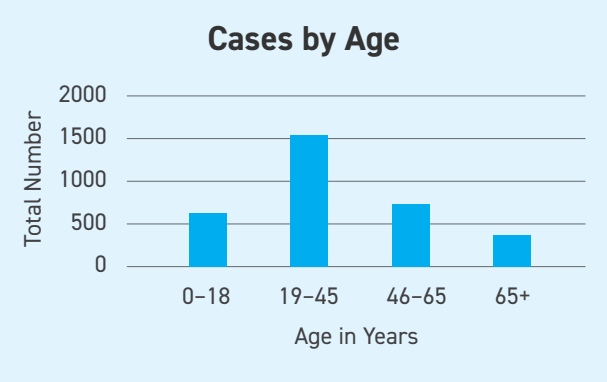
1. Once the Challenge activity is complete, invite students to communicate the plans they developed, identify the key differences between the two states, and justify the reasoning behind each plan.
2. If possible, encourage students to compare the plans they developed and consider how they could redesign their solutions based on the feedback of their peers.
3. Wrap up by encouraging students to describe how they would use STEM skills to address the following scenarios:
    - Recent polling shows only half of Americans plan on getting the COVID-19 vaccine once it is made available. The Director of Health and Human Services will be tasked with improving this percentage and reducing the population's hesitancy.
    - After the vaccine has been administered, some scientists have discovered new evidence showing the need for multiple doses.

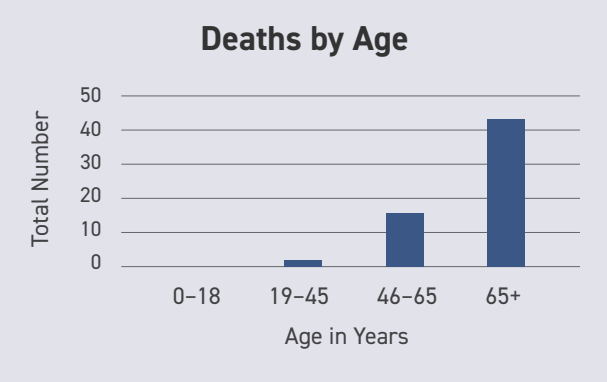
CHALLENGE

Directions: Examine the data, synthesize the information, and propose a plan for mass distribution of COVID-19 vaccines. Use the engineering design process to guide your decision-making process to meet the needs of each state.

Background: The CDC provides each state a daily allocation of vaccine based on population. Generally, states are encouraged to follow national guidance to ensure fairness and uniformity of distribution across the United States. States will have the authority (within the parameters of the guidance) to distribute the vaccine to meet the specific needs of their populations. Currently, there are only enough vaccines to meet the needs of half the population of each state.

STAGE A

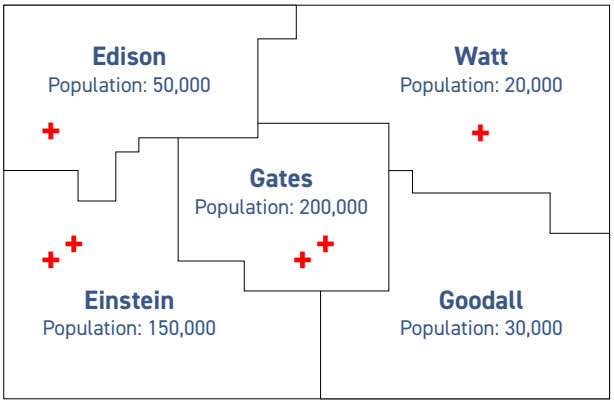




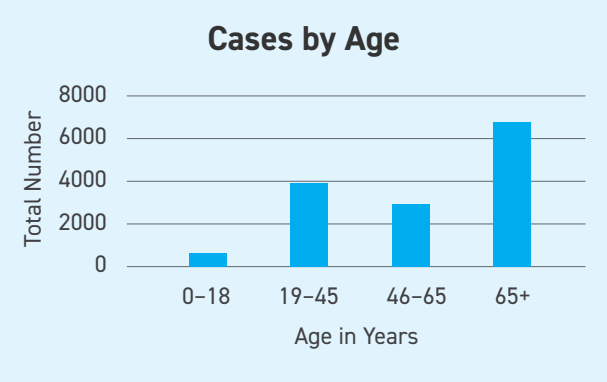
Population by County (by Age)

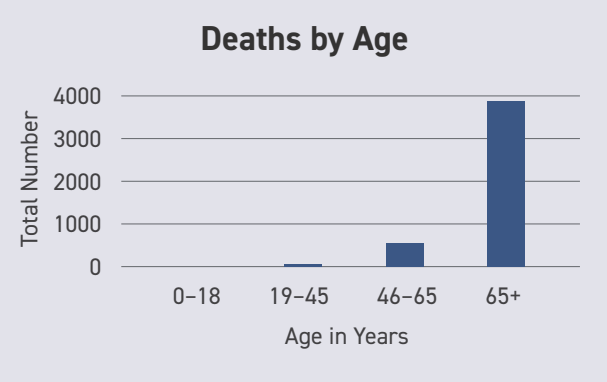
County	0–18	19–45	46–65	65+
Edison	11,500	17,500	12,500	8,500
Einstein	34,500	52,500	37,500	25,500
Gates	46,000	70,000	50,000	34,000
Goodall	6,900	10,500	7,500	5,100
Watt	4,600	7,000	5,000	3,400
		Total Population:		450,000

Location of Hospitals



STAGE B

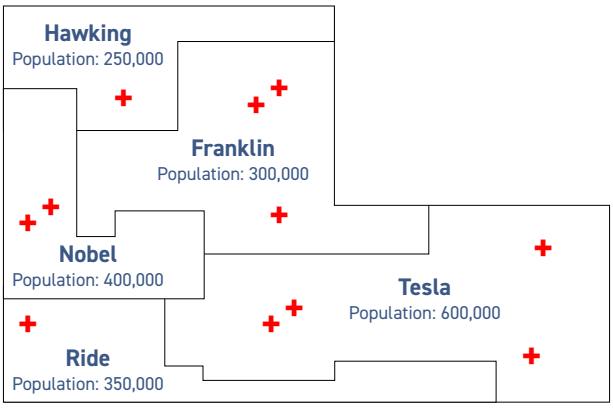




Population by County (by Age)

County	0–18	19–45	46–65	65+
Franklin	60,000	105,000	81,000	54,000
Hawking	50,000	87,500	67,500	45,000
Nobel	80,000	140,000	108,000	72,000
Ride	70,000	122,500	94,500	63,000
Tesla	120,000	210,000	162,000	108,000
		Total Population:		1,900,000

Location of Hospitals



STATE A—VACCINE DISTRIBUTION PLAN

TOTAL POPULATION = 600,000

TOTAL NUMBER OF VACCINES = 300,000

1. **Identify the need.**
2. **Research the problem.**
   - **a.** Use the information from the graphs, data tables, and diagrams to complete the table below.

County	Total Population	Number of Hospitals	Total Number of People Most Affected	Total Number of People Who May Die
Edison				
Watt				
Einstein				
Gates				
Goodall				

   - **b.** Use the link below to identify people who have an increased risk of dying from COVID-19. https://www.cdc.gov/media/releases/2020/p0625-update-expands-covid-19.html
   - **c.** Are there any occupational groups that may need the vaccine first?

3. **Develop possible solutions.**

   Develop a distribution plan that considers the information you gathered. In your plan address the following questions:

   - **a.** How many vaccines will each county receive?
   - **b.** What distribution centers will receive the vaccines? (hospitals, doctors offices, pharmacies, mobile medical units, etc.)
   - **c.** Who will receive the vaccine first? How did you reach this decision?

STATE B—VACCINE DISTRIBUTION PLAN

TOTAL POPULATION = 1,900,000

TOTAL NUMBER OF VACCINES = 950,000

1. **Identify the need.**
2. **Research the problem.**
   - **a.** Use the information from the graphs, data tables, and diagrams to complete the table below.

County	Total Population	Number of Hospitals	Total Number of People Most Affected	Total Number of People Who May Die
Hawking				
Franklin				
Nobel				
Tesla				
Ride				

   - **b.** Use the link below to identify people who have an increased risk of dying from COVID-19. https://www.cdc.gov/media/releases/2020/p0625-update-expands-covid-19.html
   - **c.** Are there any occupational groups that may need the vaccine first?

3. **Develop possible solutions.**

   Develop a distribution plan that considers the information you gathered. In your plan address the following questions:

   - **a.** How many vaccines will each county receive?
   - **b.** What distribution centers will receive the vaccines? (hospitals, doctors offices, pharmacies, mobile medical units, etc.)
   - **c.** Who will receive the vaccine first? How did you reach this decision?