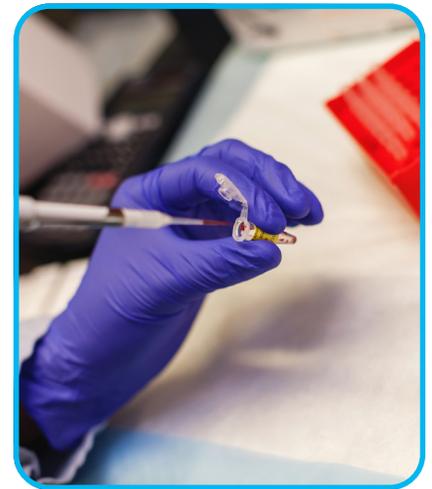


Tech for Global Good Vaccine Distribution Challenge

Grade Levels: 7-12

Duration: Four sessions (60 minutes each)

In this lesson, students consider the complexities of infrastructure, public health and sociocultural landscapes in designing a solution to distribute a life saving vaccine. Each team of students develops and presents plans that target the needs and constraints of a different community around the globe.



Outline

Session 1: Frame the Challenge 60 min

This first session sets the stage for the challenge. Teams research the problem and begin brainstorming solutions.

Session 2: Develop Solutions 60 min

Teams develop solutions, give and receive feedback.

Session 3: Iterate 60 min

After reviewing examples of real-world solutions, teams refine their ideas and prepare to present them to others.

Session 4: Present 60 min

The project culminates as teams present their ideas.

Grade Levels: 7-12

Duration: Four sessions (60 minutes each)

Concepts/Skills

Public health, brainstorming, problem-solving, communication, systems thinking

Objectives

Students will:

- Identify a specific problem within the complex vaccine distribution needs of a city.
- Create solutions that address the needs of their city.
- Refine their solution based on feedback from another team.
- Present their ideas to communicate the need addressed, their solution and the impact.

Materials and Preparation

Materials

| The Tech for Global Good videos | Materials |
|---|---|
|  <ul style="list-style-type: none"> □ 3 videos based on the 2017 Tech for Global Good laureate PATH <ul style="list-style-type: none"> • The Problem (0:59) • The Solution (1:01) • The Impact (1:30) | <ul style="list-style-type: none"> □ City Packets (assign 1 city per team and 1 City Packet per student) <ul style="list-style-type: none"> • Cebu City, Philippines • Kigoma, United Republic of Tanzania • Minneapolis, USA • Rome, Italy □ Devices for students to watch videos (1 per team of 3-6 students) □ Sticky notes (3 colors) □ Chart paper □ Markers, pen/pencil and other writing utensils      |

Preparation

1. Watch and review all of the resources to become familiar with the material:
 - 4 City Packets (Cebu City, Kigoma, Minneapolis, Rome).
 - 3 PATH videos.
2. Divide students into teams of 3-6 and assign each team one of the four cities. (If possible have at least two teams working on each of the cities)
 - Prepare one City Packet for each participant.
3. Set up and organize materials for student brainstorming and presentations.
4. Determine the format, process and audience for student presentations. See **Presentation Options** on the next page for specific ideas.



Adaptations for Distance Learning

- Have students research their cities asynchronously.
- Use an online collaborative tool for brainstorming and creation (Jamboard, Slides, Padlet, Seesaw etc).
- Have teams or students develop their solutions asynchronously and come back together for feedback and presentations.
- Invite special guests to a virtual presentation and celebration.

For more tips on adapting Design Challenges to a virtual setting see our [Educator Tips for Remote STEM Learning](#).



Presentation Options

There are a number of options for presentations which can vary from an informal class discussion to a formal event. Choose a format and tools that fit your resources and focus. When possible, involve students in the planning and process, especially if you are able to invite additional audience members to attend.

Presentation Tools

- Posters
- Slide decks
- Videos
- Online tool: document, web page, etc.
- Prototypes: storyboards, 3D models, diagrams, etc.



Audience

Consider inviting additional audience members to the presentations as well.

- Another group of learners
- Family and friends
- Professionals or community stakeholders
(For example: healthcare professionals, councilmembers, engineers etc.)

Process

- **Gallery Walk:** Teams set up tables or posters with their information. Half of the class presents while the other half rotates and provides feedback. After a set time period, teams switch roles.
- **Class Presentations:** Teams take turns standing up in front of the class and presenting their ideas with accompanying visual aides (posters, slide decks, etc.)
- **Panel:** A panel of special guests provides additional targeted feedback.
- **Asynchronous:** Teams share their work online (web page, documents or videos) and receive feedback via an online form.

Consider combinations of these options as well. For example: Presentations followed by an untimed gallery walk.

Background Information

Tech for Global Good

[The Tech for Global Good](#) is an initiative to create the next generation of innovators ready to tackle the toughest challenges facing our planet. Every year we recognize innovators who use technology to improve lives. Their stories are inspiration for the Tech for Global Good Design Challenges. These design challenges engage students in taking a systematic and empathetic approach to addressing social and engineering problems faced around the world.



**The Tech
for Global Good**

Systems Design Challenges

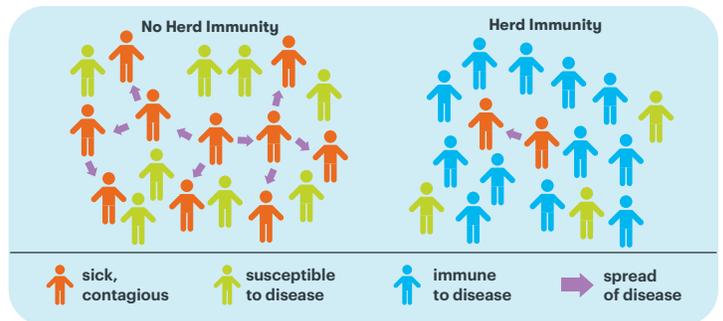
Systems Design Challenges present students with a real-world problem that is part of a complex system. Students examine the intricate parts of that problem as they design potential solutions. By the end of a systems design challenge, students will be able to articulate a potential solution, the real-world problem it addresses, and the effects their idea might have on other components of that larger system. Systems Design Challenges use the Innovation Design Process and the Innovator Mindsets. This focus on the *process* builds students' problem-solving capacity and self-confidence, preparing them for careers of the future and empowering them to create change in the world.



Set the Stage (10 min)

1. Describe The Tech for Global Good program. Tell students that during this project they will have the opportunity to try to solve a global problem by designing a solution that uses technology for good.
2. Invite learner responses and lead a short discussion about vaccines and their role in preventing deadly diseases.
 - **Guiding Question:** *Why might vaccines be considered one of the greatest medical advancements?*
3. Help learners make connections between current events and the real-world situations they will encounter in the challenge.
 - *For example:* Share the current status of COVID-19 vaccines or other vaccines relevant to your area. Discuss topics like vaccination rates or herd immunity.

| Session One | 60 min total |
|-------------------------|--------------|
| Set the Stage | 10 min |
| Introduce the Challenge | 10 min |
| Researching | 20 min |
| Brainstorming | 15 min |
| Debrief and Share | 5 min |



Terminology

Vaccine: A substance that is given to stimulate the body's immune response against a specific infectious disease.

Virus: A sub-microscopic agent that can only grow and multiply in living cells. Viruses can cause diseases in humans, animals and plants such as chickenpox, measles, mumps, COVID-19, rubella, pertussis and hepatitis.

Herd Immunity: A situation where a high proportion of a population is immune to an infectious disease, making its spread from person to person unlikely. This provides protection to people who are not immune, because the disease has less opportunity to spread. Herd immunity may be reached through vaccination and/or prior illness. (Also known as population immunity or community immunity.)

Resources

- [Learning from smallpox: How to eradicate a disease - Julie Garon and Walter A. Orenstein, YouTube](#), uploaded by TED-Ed, Mar 10, 2015 (5:45 min)

There are a number of resources to simulate and visualize herd immunity including:

- [Visualizing Herd Immunity \(with 500 Mousetraps!\) \(feat. @The Slow Mo Guys\), YouTube](#), Feb 4, 2021 (15:36 min)
- [Simulation: How Herd Immunity Works and What Stands in Its Way](#), National Public Radio, Thomas Wilburn and Richard Harris, February 18, 2021

Introduce the Challenge (10 min)

1. Play PATH video [The Problem](#) (0:59). 
 - Encourage students to make connections between the problems presented in the video and current events.
2. Introduce the **Design Challenge Scenario**:

You and your team run a pharmaceutical company in California that has developed, tested and produced a vaccine that can prevent a deadly disease (measles). Four cities have reached out to your company for help with their current immunization crisis. Your team will use your skills as communicators, researchers, collaborators and creative problem-solvers to assist one of the city governments in developing plans to help immunize their communities.

3. Share that in tackling this challenge they will use the [Innovation Design Process](#).
 - Explain that students will examine a complex systemic design problem, develop solutions to the problem, and then share and present their ideas.
 - Note that the design process is iterative and they will revisit phases throughout.
4. Explain the design problem and presentation. Address any questions students have:

| | | |
|-----------------------|---|---|
| Design Problem | <p>Your pharmaceutical company has helped develop and ship 200,000 vaccines for measles to [your city]. Now your team needs to come up with a plan for vaccine distribution. Depending on your city you may have to consider:</p> <ul style="list-style-type: none"> • Who needs the vaccine the most. • Where and how to distribute (ex: plans for of rural communities and storage temperatures). • How to inform people. • How to convince people to get vaccinated. |  |
| Presentation | <p>Your pharmaceutical team will need to create a presentation, including:</p> <ul style="list-style-type: none"> • The vaccination problem your team has addressed. • Your team’s solution for this problem. • Story of how your solution will impact one person in the city (a child, a parent, a healthcare worker, etc.) |  |

5. Divide students into teams and distribute the City Packets. Each team will tackle different aspects of the larger design problem. (See pgs 2-4 in the City Packets.) Their first task will be to determine the specific problems facing their city.
 - [Cebu City, Philippines](#)
 - [Kigoma, United Republic of Tanzania](#)
 - [Minneapolis, USA](#)
 - [Rome, Italy](#)

Tech Tips

See our [educator guides and videos](#) for more design challenge facilitation techniques. For this lesson check out:

- Innovation Design Process
- Facilitating Brainstorming
- Sharing Solutions



Researching (20 min)

1. Have students read the background information about their city. (See pgs 4-7 in the City Packets.)
 - Try a jigsaw reading in which they divide the reading between team members and share what they have learned with each other.
2. Students should use the information and questions in the packet to guide their discussion.
3. They should take notes and collect information for their brainstorm and later presentations.
4. Encourage teams to conduct additional research on the topic throughout the entire design process. This can be done through background information and resources you provide or their own research online.



Real-world Connections

- Provide students with context by directing them to resources about vaccine distribution during current events like the COVID-19 pandemic or Ebola outbreaks.
- Similarly, historical information about vaccine distribution, disease eradication, and global pandemics may be valuable tools. Examples include: smallpox, polio and the Spanish flu pandemic of 1918.
- Consider providing resources that examine the biological and scientific elements of the vaccine or virus as well.



Brainstorming (15 min)

1. Once teams understand the situation, they should move on to brainstorming aspects of the problem and possible solutions. (See pg 8 in the City Packets.)
2. As these problems are complex, it can help to break down the various aspects of the problem before looking at potential solutions.
3. Possible **Facilitation Questions** include:
 - *Who needs the vaccine most? Young, old, certain careers, etc.*
 - *What challenges will you need to confront in order to distribute this vaccine?*
 - *What are the communication challenges within this community? What about infrastructure or other challenges?*



Brainstorming Tech Tip

Remind teams to encourage anything and everything during brainstorming.

- Think of wild ideas.
- Go for quantity over quality.
- Be creative!

For suggestions on structuring a brainstorm session see **Tech Tip: Facilitating Brainstorming** ([PDF](#) and [Video](#)).



Debrief and Share (5 min)

1. Have teams share their progress and next steps. Let students know they will continue working in the next session.
 - This can be as simple as asking them to share one idea from their brainstorm which they are excited about.



Review Design Process (10 min)

1. Remind students what their final presentation will include their focused problem, a solution, and an impact story.
2. Let students know that during this session they will work on developing their solution and share their initial ideas with another team to receive feedback.
3. Remind them that they are working on a systems design challenge, so both the problem and solutions can be multifaceted.
 - *For example:* Their solution could be a plan which outlines the process for production, distribution, information, marketing or funding. It could even combine one or more of these categories into a comprehensive plan.
4. Similarly, the design product they create in their solution will vary depending on the problem they are trying to solve. It could be anything from a technology, event, space, marketing campaign, or business.

For example:

 - If they need to raise awareness about the vaccine, then they may develop a commercial.
 - If they need to solve for communication between organizations, then they may develop an app that tracks distribution of data across different agencies.

Note: Keep this variety of solutions in mind, but wait to provide teams with specific examples until they are struggling to come up with ideas on their own.
5. Introduce the following steps then let teams work:
 - First, teams should review ideas from their brainstorm and pick or combine ideas to focus on for the core problem(s) they are addressing.
 - Then they should choose the brainstormed solutions that align with the problem(s) they are addressing
 - Remind them that they can use articles and technology provided to do more research in order to refine their solutions.

| Session Two | 60 min total |
|-----------------------------------|--------------|
| Review Design Process | 10 min |
| Creating Solutions | 30 min |
| Sharing Solutions & Peer Feedback | 20 min |



Creating Solutions (30 min)

1. Give students time to develop their focused problem and solution for that problem. (See pg 9 in the City Packets.)
2. Rotate around the room and engage in discussions with teams in order to:
 - Have them articulate the problem they are addressing
 - Help them move past a sticking point by prompting them to make a decision or research more to inform their solution.
 - Have them share interesting findings from their research.



Sharing Solutions & Peer Feedback (20 min)

1. Share the process for the *Listen and Help Feedback Protocol*. (See pg 10 in the *City Packets*.)

- Explain that the goal for the activity is to get thoughtful and critical feedback from friends.
- Encourage students to focus on both strengths and next steps in their feedback. If using simple sentence frames introduce them at this time. *For example: I like...I wonder...*

Listen and Help Feedback Protocol

| | Team Presenting | Audience |
|-------|---|----------------------------------|
| 3 min | Present their design solution. | Silently listen. Take notes. |
| 3 min | Respond to clarifying questions. | Ask clarifying questions. |
| 2 min | Silently listen. Take notes. | Provide feedback. |

2. Pair up teams. (If possible, pair up teams that are working on the same city.)

- Assign one team in each pair to present first. The other team will be the audience to listen and provide feedback.

3. After the first team has presented, they should switch roles and repeat the process. Ensure all teams stay on schedule.

4. After the *Listen and Help Feedback Protocol* is finished, have students take a few minutes to reflect on the feedback and think about how this affects their perspective on their solutions.

5. Have teams share initial thoughts and next steps for Session 3. (See pg 10 in the *City Packets*.)



Tip: See The Tech's [Peer Feedback Protocol](#) for more suggestions on facilitating this process including Distance Learning adaptations.



Real-World Solutions (5 min)

- Iteration is an important part of the Innovation Design Process. In this session, students will revise their solutions based on feedback and new information.
- Before they begin iterating, have students reflect on the solution developed by a Tech for Global Good laureate.
- Use the following videos to share about PATH.
 - [The Solution](#) (1:01) 
 - [The Impact](#) (1:30)
- Have students reflect on what they noticed about PATH's solutions and how that might change their thoughts on solving this problem.
 - In addition, they can consider how the "Impact" video influences how they can tell the impact story of their own plan.

| Session Three | 60 min total |
|-------------------------|--------------|
| Real-World Solutions | 5 min |
| Refining Solutions | 20 min |
| Preparing Presentations | 35 min |

Additional Resources

If students need additional inspiration as they iterate and improve their designs, refer them to other examples of real-world solutions to their problem. Again, you can draw from current events or historical examples. Here are some resources from the COVID-19 vaccine distribution.

- Another Tech for Global Good Laureate, [Zipline, delivers vaccines to remote areas using drones.](#)
- These teens at Rocky Mountain School of Expeditionary Learning in Denver decided to [combat misinformation by making their own video series.](#)



Refining Solutions (20 min)

- Give teams time to develop their second iteration of a solution.
 - They should incorporate feedback they received in Session 2 and any inspiration they got from the PATH example.
 - Encourage learners to do additional research as needed.
- With 10 minutes remaining, ensure students have moved on to also create their impact story.
- Facilitation questions** can include:
 - Who would be most positively impacted by your solutions?*
 - Think about a compelling way to share that story (target audience, making human connection).*



Preparing Presentations (35 min)

1. Describe the format and process for student presentations. (Reminder: See [Preparation](#) for detailed options.)
2. Encourage learners to think about how they can both show and tell their ideas.
3. Address any questions regarding:
 - Presentation tools
 - Presentation process and timing
 - Audience
4. Remind students of the content of the presentation.

| | | |
|---------------------|---|--|
| Presentation | <p>Your pharmaceutical team will need to create a presentation, including:</p> <ul style="list-style-type: none"> • The vaccination problem your team has addressed. • Your team’s solution for this problem. • Story of how your solution will impact one person in the city (a child, a parent, a healthcare worker, etc.) | |
|---------------------|---|--|

5. Set expectations for all team members to participate in the presentation.
6. Support teams in developing presentation materials, planning and practicing their presentations.



Extension

Have students continue their research and get involved in efforts to support real-world vaccine distribution.

Examples include:

- Raising money for [UNICEF’s immunization program](#)
- Sharing their ideas on social media
- Presenting to community leaders and organizations directly connected to their ideas

Set the Stage (5 min)

1. Make sure students have set up their presentations and have the resources they need to share their ideas.
2. Take a few minutes to review the process for presentations.
3. Review audience role. If there are additional audience members, introduce the teams and the overall challenge.
4. Review the positive feedback process and tools you will use during the presentations. Some examples include:
 - If the audience and students are rotating to see team posters, have them record feedback on sticky notes or notecards.
 - In a formal presentation, encourage a few individuals to share one thing they liked and a suggestion for improvement after each team presents.

| Session Four | 60 min total |
|---------------------|--------------|
| Set the Stage | 5 min |
| Presenting | 45 min |
| Debrief and Closing | 10 min |

Presenting (45 min)

1. Have teams present their solutions.
2. Keep track of time to ensure that all teams have a chance to present and receive feedback.
3. If time allows, have teams respond to additional questions.
4. In addition to any questions generated by the audience, you may want to provide a list of **Sharing Questions** as suggestions:
 - *What inspired you to develop this idea?*
 - *Why did you choose this particular solution?*
 - *What questions did you have as you worked on this project? What do you still want to learn about this problem?*
 - *What is one thing you changed about your idea as you worked on it?*
 - *What is something you would change or want to improve if you had more time?*

 **Tip:** Share student solutions, photos and videos with The Tech Interactive, #TheTechforGlobalGood.

Debrief and Closing (10 min)

1. Celebrate student work and reflect on the experience.
2. Debrief the project as a class. Discuss what students saw and learned from the process and each other's work.
3. **Debrief questions** can include:
 - *How did your understanding of the problem change throughout this project?*
 - *What part of the process did you like most?*
 - *What was most challenging?*
 - *What would you change?*
 - *How did this make you think about how you can impact the world?*

Standards Connections

In addition to the standards outlined below, see our [Tech for Global Good Standards Alignment](#) for details on additional content areas, standards and extensions.

Next Generation Science Standards

| Grades | Standard | Description |
|--------|-----------|--|
| 6-8 | MS-ETS1-1 | Defining a design problem that includes multiple criteria and constraints. |
| 6-8 | MS-ETS1-2 | Evaluating competing design solutions using a systematic process. |
| 9-12 | HS-ETS1-1 | Analyze a major global challenge using criteria and constraints that account for societal needs and wants. |
| 9-12 | HS-ETS1-2 | Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. |
| 9-12 | HS-ETS1-3 | Evaluate a solution to a complex problem based on prioritized trade-offs that take into account reliability, social, and cultural impacts. |

Common Core State Standards: English Language Arts

| Grades | Standard | Description |
|--------|-------------------------------|---|
| 7-10 | CCSS.ELA-LITERACY.SL.[7-10].1 | [Initiate <i>Grade 9-10</i>] Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on [<i>Grade 7-10</i>] topics, texts, and issues, building on others' ideas and expressing their own clearly [and persuasively <i>Grade 9-10</i>]. |
| 7-8 | CCSS.ELA-LITERACY.SL.[7-8].4 | Present claims and findings, emphasizing salient points in a focused, coherent manner: <ul style="list-style-type: none"> - [with pertinent descriptions, facts, details, and examples <i>Grade 7</i>] - [with relevant evidence, sound valid reasoning, and well-chosen details <i>Grade 8</i>] Use appropriate eye contact, adequate volume, and clear pronunciation. |
| 9-10 | CCSS.ELA-LITERACY.SL.9-10.4 | Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task. |

Resources and References

1. [The Tech for Global Good](#)
2. [Learning from smallpox: How to eradicate a disease - Julie Garon and Walter A. Orenstein, YouTube](#), uploaded by TED-Ed, Mar 10, 2015 (5:45 min).
3. [Visualizing Herd Immunity \(with 500 Mousetraps!\) \(feat. @The Slow Mo Guys\), YouTube](#), Feb 4, 2021 (15:36 min).
4. [Simulation: How Herd Immunity Works and What Stands in Its Way](#), National Public Radio, Thomas Wilburn and Richard Harris, February 18, 2021.
5. [Role of medical drones in global Covid vaccine campaign is growing](#), CNBC, Riley de León, February 4, 2021.
6. [On The Fence About COVID Vaccines? These Teens Want To Talk To You](#), CPR News, Jenny Brundin, February 4, 2021.