This session is being recorded.

Systems Design Challenges
The Tech Interactive
San Jose, CA

We will be starting momentarily.
Welcome

Amy Bucher
The Bowers Institute
Professional Development Specialist

Allison Bault
The Bowers Institute
Program Manager

Goals:
• Introduce several systems design challenges and accompanying resources.
• Discuss how systems-based problem-solving can work across many subjects.
• Show how these techniques can empower learners to effect change within their own communities.
Professional Development

• Custom training available
• Hands-on workshops
• Based on the Design Challenge Learning framework

Contact Allison for more information abault@thetech.org
Share your experience

• What do you already know about systems design?
• What is your experience with design challenge learning?

Add your reflections to the chat

Raise your hand to share with audio/video
A Design Challenge is..

Design challenges use real-world problems to engage learners in an iterative design process.

Tech Tip: Innovation Design Process
(PDF / Video)
Key Features of Design Challenges

<table>
<thead>
<tr>
<th>Solvable by multiple solutions.</th>
<th>Provide opportunities for iteration. Students can test and improve designs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connect with participant interests.</td>
<td>Make explicit connections to real world problems and careers.</td>
</tr>
</tbody>
</table>
# Types of Design Challenges

<table>
<thead>
<tr>
<th>Engineering Design Challenge</th>
<th>Systems Design Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ex Problem:</strong> Create a vehicle that can transport a load.</td>
<td><strong>Ex Problem:</strong> How can we deliver life-saving medical supplies to remote hospitals?</td>
</tr>
<tr>
<td><strong>Test:</strong> Data from physical test or user feedback</td>
<td><strong>Test:</strong> Feedback from audience, users or experts. Research and additional info.</td>
</tr>
</tbody>
</table>

Zipline Design ([Activity Guide](#))

Medical Supply Availability (Zipline) ([Lesson, Videos](#))
Why Systems Design?

Addressing complex real-world problems builds students' problem-solving capacity, self-confidence, preparing them for careers of the future and empowering them to create change in the world.
Elements of Systems Design

Deconstruct a complex system and define a specific problem.

Research (background information, current events etc) and use this data to inform solutions.

Use ideation and brainstorming techniques to generate innovative solutions.

Think about solution in context of larger system.

Present solutions to audience and receive feedback.

Reflect on personal ability to create change and solve problems.
Sample Structure

Session 1: Frame the Challenge
This first session sets the stage for the challenge. Teams research the problem and begin brainstorming solutions.

Session 2: Develop Solutions
Teams develop solutions, give and receive feedback.

Session 3: Iterate
After reviewing examples of real-world solutions, teams refine their ideas and prepare to present them to others.

Session 4: Present
The project culminates as teams present their ideas.
Introduce the Challenge

Think about:
Why might vaccines be considered one of the greatest medical advancements?

https://youtu.be/8jS-JIPZ09Y

Vaccine Distribution (PATH) (Resources)

Updated version coming soon!
## Vaccine Distribution: Design Challenge

<table>
<thead>
<tr>
<th>Design Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>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 on who needs the vaccines most, where to distribute the vaccines and how to convince people to get vaccinated.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Presentation</th>
</tr>
</thead>
</table>
| Your pharmaceutical team will need to create a presentation, including:  
  • 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.) |
Share your ideas

• How do you think your learners would respond to this real-world problem?

• How would you adjust this framing/introduction for learners?

Add your reflections to the chat

Raise your hand to share with audio/video
## Materials

Start with: Paper and pencil

As needed add tools for:

<table>
<thead>
<tr>
<th>Research</th>
<th>Brainstorming</th>
<th>Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>• resources to connect to content or current events (articles, books, videos etc)</td>
<td>• sticky notes &amp; chart paper</td>
<td>• posters</td>
</tr>
<tr>
<td>• user feedback</td>
<td>• online tools: Jamboard, Mural, Slides etc</td>
<td>• slide decks</td>
</tr>
<tr>
<td>• guest speaker/ career connection</td>
<td>• templates/ games- mindmaps, mash-ups etc</td>
<td>• videos</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• online tool: document, web page, etc</td>
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<tr>
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<td>• accompanying prototypes (storyboards, 3D models, diagrams etc)</td>
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</table>
Research the Challenge: Cebu City

Designing a Solution with Cebu City, Philippines

The city of Cebu City has reached out to your pharmaceutical company for help with their current immunization crisis.

Problem

Your pharmaceutical company has helped develop and ship 200,000 vaccines for measles to Cebu City, Philippines. Now your team needs a plan that keeps these vaccines the right temperature and gets them stored in the rural communities outside of Cebu City.

Your pharmaceutical team will need to create a presentation solution and how it will impact one person (a child, a parent, worker, etc.) in a community near Cebu City. The following information might be useful to your team while you build your presentation.

About Cebu City

Cebu City is a busy port town with a long history. Today there are 932,031 people living within the city limits. This is between the populations of San Juan (1 million) and San Francisco (800,000). Cebu City is the main domestic port in the Philippines with over 7 miles of the coast suitable for docking ships. This city is very busy with international and local loads dropping off and picking up goods. However, this is not the only way to get in and out of Cebu City. There is an international airport 30 miles away. Getting around the area can be achieved with buses, ferries, and jeeps.

In November 2013, Typhoon Haiyan hit the Philippines. It was one of the deadliest ever recorded in the region and took out electricity throughout the Philippines. In 2015, there are still electrical issues related to the damage from this storm. This includes rolling blackouts, which are times when part or all of the electricity in an area goes out for periods of time from a few minutes to a few hours.

Immunization Challenges:

- Large port
- Storms, earthquakes
- Brownouts and electrical issues
- Travel to city costly
- Vaccine needs to be stored at specific temperatures

When there are storms like Typhoon Haiyan that destroy buildings, ships, and the network and the need for vaccines and medicines increases. The damage to infrastructure like design, transportation, and clinics makes getting vaccinations in rural communities even harder. City and country governments often work with nonprofit and international agencies to develop plans to help these areas in cases of an emergency.

In cases like Cebu City, that there needs to be ways to store and transport the vaccines while keeping both intact at the correct temperatures. Given that the area has earthquakes, typhoons, and some brownouts, there needs to be a plan for storing and delivering vaccines where they are needed. To achieve this there can be a combination of approaches in protecting vaccine using:• Temperature monitoring vaccine carriers that can run 6 to 85 hours between electrical charges, but they can only hold a few boxes (200 vaccines).
• Backup generators at hospitals can be expensive to maintain, but can supply electricity during a power outage as long as there is enough fuel to keep them running.
• Solar-powered refrigerators used 3.5 kWh/middle of sunlight to power the freezer for 85 to 135 hours.

To use the vaccine the undiluted vaccine vial and the diluent need to be combined. The temperature of the vaccine must be between 29°F to 40°F to do this. It is recommended that the vaccine be used as soon as possible after combining the vials. The combined vaccine vial should be stored in a dark place at 29°F to 40°F and discarded if not used within 8 hours.

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Research the Challenge: Minneapolis

Immunization Challenges:

- Lack of culturally appropriate materials
- Misinformation
- Antivaxx campaign
- Outbreaks due to lack of vaccination in some communities
Brainstorm Solutions

- Encourage wild, creative ideas.
- Use a variety of different techniques from mind maps to mash-ups.

Jamboard Examples

Tech Tips: Brainstorming (PDF/Video)
## Connections to Content

<table>
<thead>
<tr>
<th>Science/Math</th>
<th>ELA/Social Science</th>
<th>Careers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Math</strong></td>
<td><strong>Language Development</strong></td>
<td>Examine the different careers and professionals who solve these problems.</td>
</tr>
<tr>
<td>Real-world application of mathematical problems.</td>
<td>Persuasive writing</td>
<td></td>
</tr>
<tr>
<td><strong>Science</strong></td>
<td><strong>Social Science</strong></td>
<td>Consider the tools and resources career professionals use.</td>
</tr>
<tr>
<td>Investigating problems based on scientific phenomena.</td>
<td>Using historical examples or context to inform solutions.</td>
<td></td>
</tr>
<tr>
<td><strong>Math</strong></td>
<td><strong>Language Development</strong></td>
<td>Share solutions and receive feedback from authentic audience of professionals.</td>
</tr>
<tr>
<td>Data analysis.</td>
<td>Interviews and user testing of ideas.</td>
<td></td>
</tr>
</tbody>
</table>
Share your ideas

• What are other techniques that you could use for research or brainstorming?

• What are some other strategies to connect to content?
Focus on one problem and one solution.
Remember design product can take on multiple formats depending on this focus. 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.
What do these projects look like?
Share your experience

• What are some other types design products students could create?
• How would you adjust this to your setting?

Add your reflections to the chat

Raise your hand to share with audio/video
Iterate: Based on Feedback

- “Test” ideas with feedback from peers, users or experts
- This can happen multiple times throughout the challenge and be both formal and informal.

**Listen and Help**

<table>
<thead>
<tr>
<th>时间</th>
<th>团队展示</th>
<th>观众</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 min</td>
<td>呈现他们的设计解决方案。</td>
<td>沉默倾听。记录笔记。</td>
</tr>
<tr>
<td>3 min</td>
<td>回应澄清问题。</td>
<td>提问澄清问题。</td>
</tr>
<tr>
<td>2 min</td>
<td>沉默倾听。记录笔记。</td>
<td>提供反馈。</td>
</tr>
</tbody>
</table>

**Tech Tip: Sharing Solutions** ([PDF/Video](#))
Iterate: Based on Research

Introduce New Information:
“Test” ideas against additional research, background information, real-world examples or current events.

https://youtu.be/ShkzZvSbkv8
Consider the following when planning formal sharing:

<table>
<thead>
<tr>
<th>Product Format</th>
<th>Process</th>
<th>Audience</th>
</tr>
</thead>
<tbody>
<tr>
<td>• posters</td>
<td>• Gallery Walk</td>
<td>• classmates</td>
</tr>
<tr>
<td>• slide decks</td>
<td>• Class Presentations</td>
<td>• another group of learners</td>
</tr>
<tr>
<td>• videos</td>
<td>• Panel</td>
<td>• family and friends</td>
</tr>
<tr>
<td>• online tool: document, web page, etc</td>
<td>• Asynchronous</td>
<td>• professionals or community stakeholders</td>
</tr>
<tr>
<td>• accompanying prototypes (storyboards, 3D models, diagrams etc)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Share your ideas

• What are some other examples of presentation tools or formats?
• What mindsets do these experiences build?

Add your reflections to the chat

Raise your hand to share with audio/video
Have learners reflect on how they can personally affect change and solve problems.

Tech Tip: Innovator Mindsets
(PDF / Video)
## Distance Learning Adaptations

<table>
<thead>
<tr>
<th>Asynchronous</th>
<th>Synchronous</th>
</tr>
</thead>
<tbody>
<tr>
<td>● Introduce challenge</td>
<td>● Team brainstorming</td>
</tr>
<tr>
<td>● Research and background information</td>
<td>● Develop solutions</td>
</tr>
<tr>
<td>● Individual brainstorming</td>
<td>● Prepare presentations</td>
</tr>
<tr>
<td>● Surveys</td>
<td>● Share solutions</td>
</tr>
</tbody>
</table>

**Tips for Distance Learning**
*(Educator, Parent)*
Share your experience

• How are you feeling about systems design challenges?

• What aspects of these types of challenges do you still have questions about?

Add your reflections to the chat

Raise your hand to share with audio/video
Remind Yourself:
You are learning and iterating too!

- Be flexible.
- Vary your strategies.
- Test and reflect.
- Share your creations!

Think about: What will you try next?
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.

Resources
- Vaccine Distribution Challenge (Update coming soon)
- Save the Species Challenge
- Coming Soon: Data Challenge
- Tech for Tomorrow, Discovery Education Design Challenges
  - Zipline (Med. Supply Availability)
  - AI4All (AI Inclusiveness)
  - Solvatten (World Water)
  - Amandla Mobi (Organizing Activism)
The Solve For Earth exhibition at The Tech Interactive explores the connections between technology and living sustainably on Earth.

Resources coming soon:
- Scientists Stories Lesson Plan
- Emerging Technologies Unit Plan
- Connections Wall Lesson Plan

Website
Additional Resources

• Educator Resources: thetech.org/resources
  
  Browse our library of Virtual Professional Development

• Parent Guides and Videos: thetech.org/athome thetech.org/encasa
Exit Survey

We need your feedback!

Bit.ly/DCL2122
Q & A
Thank you!

Stay in touch!
BowersInstitute@thetech.org