Designing a Design Challenge

The Tech Interactive
San Jose, CA
Webinar Resources

During this session we will be using the following resources:

Designing a Design Challenge
- Tech Tip
- Template
- Video

Download/print the Template to refer to throughout.
Tech Interactive- Intro Poll

We will be starting soon. In the meantime, please take our poll.

What is your experience with Design Challenges?

1- No experience
2- Just getting started
3- Still learning
4- Tried several times
5- Do them all the time!
Designing a Design Challenge

The Tech Interactive
San Jose, CA

The Bowers Institute
Welcome

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Bowers Institute
Professional Development Specialist

Session Goals:
• Get you inspired to design your own design challenges!
• Explore the steps and work along to begin the process.
• Brainstorm a design problem for your own setting (and get some feedback!).
Agenda

1. Overview of Design Challenge Learning
2. Process of Designing a Design Challenge
   • Introduce tools for planning
   • Share exemplars
   • Work time to develop your own idea
3. Informal Sharing of your Design Challenge Ideas
4. Q & A

Tech Tip: Designing a Design Challenge
(Tech Tip/ Video/ Template)
A Design Challenge is..

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

- Develops independent thinkers
- Empowers learners
- Guides learners to become creators and problem solvers
- Fosters collaboration, critical thinking, creativity, and informed exploration
Key Elements of Design Challenges

- Solvable by multiple solutions.
- Provide opportunities for iteration where students can test and improve designs (physical builds or systems solutions).
- Connect with participant interests or prior experiences.
- Make explicit connections to real-world problems and careers (at some point in the challenge).
Let’s CREATE a Design Challenge!

1. Developing Your Design Problem
2. Developing Criteria, Constraints and Testing Methods
3. Test Your Challenge
4. Lesson Flow and Preparation
5. Do the Challenge!

Tech Tip: Designing a Design Challenge
(Tech Tip/ Video/ Template)
1 Developing your Design Problem

Reflect on:
• your learners
• your setting
1. Developing your Design Problem

- Standards and Learning Goals
- Real-world problem

Design product

Design Problem Statement
Exemplar: Solve the Fall

Standards and Learning Goals: Forces, Gravity

Real-world problem: Mars exploration

Design product: Device to reduce forces

Design Problem Statement: Build a device that will keep the payload safe when dropped.
What ideas do you have for design problems? (standards, real world connections, design product)?
## Exemplars: Types of Design Challenges

<table>
<thead>
<tr>
<th>Engineering Design Challenges</th>
<th>Systems Design Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learners create and test a physical device.</td>
<td>Learners design a multifaceted solution to a complex problem (process, communication or logistics plan, device prototype, etc).</td>
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**Solve the Fall**  
(Lesson Plan)  

**Save the Species**  
(Lesson Plan)
# Types of Design Challenges

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**Type of Challenge affects:**

- Criteria and constraints
- Testing considerations

- Sharing process
- Additional resources
Criteria, Constraints

Consider:
- How to promote multiple solutions and iteration.
- How constraints can make your challenge easier or harder for different ages or levels of experience.
- How to involve learners in the development of the criteria and constraints.

Criteria:
Determine success of the solution.
Ex: stay standing for 5 seconds, meet the needs of this user

Constraints:
Provide limitations.
Ex: time limit, budget, device size
Exemplar: Solve the Fall

Design Problem:
Build a device that will keep the payload safe when dropped.

Criteria:
- Ball and device must stay together in one piece.
- Device must stay intact.
- Ball cannot bounce/light-up when it lands.

Constraints:
- 10 minutes to build and test.
- Ball must be visible (don’t completely cover it up).
- No tape or glue.
Criteria/Constraints

What are the criteria and constraints you would use for your design challenge?

Tech Tip: Designing a Design Challenge (Template)
2 Testing Methods

All Design Challenges include:
• Ways to test and iterate.
• Ways to collect feedback and/or data.
• Collaboration between teams: Learners can see other teams testing and solutions and give feedback.
• Ways to test early and often.

Check Alignment with the 4 key elements:

- Solvable by multiple solutions
- Opportunity for iteration
- Participant interest
- Real-world/career connections
## Testing continued

<table>
<thead>
<tr>
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<th><strong>Engineering Design Challenges</strong></th>
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<tbody>
<tr>
<td><strong>Testing method</strong></td>
<td>Test rig with physical tests of mechanisms.</td>
<td>Various options: surveys, focus groups, interviews, research, presentations, peer review, expert review/presentations.</td>
</tr>
<tr>
<td></td>
<td><em>May include: Safety concerns and risk mitigation</em></td>
<td></td>
</tr>
<tr>
<td><strong>Data collection process</strong></td>
<td>Qualitative: “It flew!” OR Quantitative: “It flew 5 feet!”</td>
<td>Qualitative: “What a cost-effective idea!” OR Quantitative: surveys, rating scale</td>
</tr>
<tr>
<td><strong>Feedback process</strong></td>
<td>Various options: informal peer sharing and gallery walks, formal presentations with authentic audience, community members or stakeholders.</td>
<td></td>
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Exemplar: Solve the Fall

Design Problem: Build a device that will keep the payload safe when dropped.

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Testing:
- Drop from 6 feet.
- Testing area visible to everyone.
- Formal time to share and informal time to test on own.
Reflect and Apply

Testing Methods

Think about:

- How would you apply this to your own design challenge?
  - Where and how will students test their solutions?
  - What data or feedback will they collect?

- What would the **testing methods/test rig** be for your challenge?

**Tech Tip: Designing a Design Challenge** *(Template)*
Choose materials that promote iteration.

Use a variety:
- Everyday/recycled objects
- New to your learners
- Whimsical objects
- Science/building tools & materials

Group by categories of type or function.
## Exemplar: Solve the Fall

<table>
<thead>
<tr>
<th>All purpose materials</th>
<th>Connectors</th>
<th>Net or basket-like materials</th>
<th>Cushioning materials</th>
<th>Tools (per group)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Cardboard</td>
<td>• Twist ties</td>
<td>• Fruit baskets</td>
<td>• Foam</td>
<td>• Scissors</td>
</tr>
<tr>
<td>• Straws</td>
<td>• Pipe cleaners</td>
<td>• Paper cups/bowls</td>
<td>• Bubble wrap</td>
<td>• Hole punch</td>
</tr>
<tr>
<td>• Paper towel/toilet paper rolls</td>
<td>• Rubber bands</td>
<td>• Fabric scraps</td>
<td>• Tissue paper</td>
<td>• Masking tape (optional)</td>
</tr>
<tr>
<td>• Chopsticks</td>
<td>• String</td>
<td>• Coffee filters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Craft sticks</td>
<td>• Paper/binder clips</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Clothes pins</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Paper fasteners</td>
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</table>

Payload = Light-up bouncy ball. Or ball of any kind: rubber, ping pong, tennis ball etc.
Materials: Systems Design Challenge

Consider how students will research, develop and visually present their ideas.

Ex: paper, online tools (brainstorming, sharing), whiteboards, charts, physical prototypes

Consider additional resources needed: readings, videos, experts, sample users, research tools, etc.
Reflect and Apply

2 Materials

- What would the materials be for your challenge?

Tech Tip: Designing a Design Challenge (Template)
How do you this in a virtual setting? What do you need to consider?
Virtual Settings

- Plan what you can do **asynchronous** and **synchronously**.
  - Try out offline resources and tools - ex journals, asynchronous builds, family/community connections.
- Consider how students will get **access** - printed materials, devices, connectivity.
- Consider which **materials** are essential and which can be adjusted for at home creating -recycling, materials kits.
- Opportunity for **special resources** - guest speakers or career connections.
3 Test Your Challenge!

Try to find a group of sample participants or other educators! Create your own solution.

Check for:
- Clear design problem
- Multiple solutions and iteration
- Appropriate difficulty
- Generates useful data
- Accessibility
- Length of time
- Engagement
- Questions/Concerns

Check Alignment with the 4 key elements

- Solvable by multiple solutions
- Opportunity for iteration
- Participant interest
- Real-world/career connections
Testing lets you

- Anticipate issues
- Iterate and revise
- Target learner needs
- Develop exemplars and resources
- Use the design process
Lesson Flow and Preparation

1. **Introduce the Challenge**
   - Frame: Real world scenario, video, guiding questions
   - Define the Problem
   - Criteria and Constraints

2. **Do the Challenge**
   - Brainstorm
   - Prototype: Create, Test and Reflect, Iterate

3. **Share Solutions:** Share, Feedback, Debrief

**Assessment:** Formative & Summative
4 Longer Units

1. Introduce the Challenge
2. Do the Challenge
3. Share Solutions
4. Content Connections
5. Reframe the Challenge - adjust criteria and constraints based on content
6. Do the Challenge Part 2
7. Share Solutions

Assessment: Formative & Summative
# Exemplar: Solve the Fall

**Design Problem:**
Build a device that will keep the payload safe when dropped.

<table>
<thead>
<tr>
<th>Outline</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduce the problem: Guiding Questions, Real world Scenario</td>
<td>7 min</td>
</tr>
<tr>
<td>Frame the Challenge: Problem, Criteria, Constraints</td>
<td>3 min</td>
</tr>
<tr>
<td>Brainstorm</td>
<td>5 min</td>
</tr>
<tr>
<td>Prototype: Build, Test, Iterate</td>
<td>20 min</td>
</tr>
<tr>
<td>Share Solutions</td>
<td>15 min</td>
</tr>
</tbody>
</table>

**Lesson Plans and Resources**
- [Lesson Plan](#)
- [Educator Video](#)
- [Tech at Home Guide](#)
Preparation and Environment

Designing Engineering Challenges for Inclusion

Environment that fosters:
- Everyday objects used in novel ways
- Whimsical objects
- Novel objects
- Real tools and equipment

Inspiration
- Playful and inspirational designs and imagery
- Deliberate color choices
- Language reinforced
- Scene-setting

Facilitation
- Supports STEM identity
- Process over product
- Provides additional scaffolding
- Introduces vocabulary

Materials
- Rooted in a real-world STEM problem
- Open enough to be learner-driven

Narrative
- Story that invites imagination

Risk-taking
- Iteration

Collaboration
- Empathy
Do the Challenge!

Reflect on what you did.

- What worked as expected?
- What went unexpectedly?
- What would you change?
- How can your students give feedback?
- How can you share with others and get more feedback?
Remind Yourself:
You are learning and iterating too!

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

Think about: What will you try next?
Do you have the seed of an idea you'd like to share and get feedback on?

Yes

No

Maybe
Break out rooms
Share your Design Problem

- What was your idea?
- Where did you get stuck?

Feedback Time
Q & A

The Bowers Institute
Resources

• Educator Resources: thetech.org/resources

• Parent Guides and Videos: thetech.org/athomé

• Spanish Guides and Videos: thetech.org/en-casa
Exit Survey
We need your feedback!

Bit.ly/DCL527
Thank you!

Stay in touch!
BowersInstitute@thetech.org