

Educator Guide



TYPHOON TOWER

Design Challenge



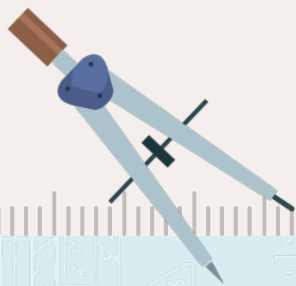
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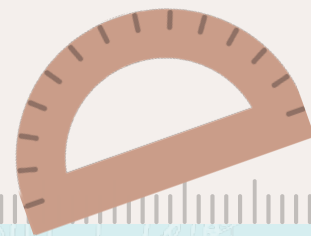
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TYPHOON TOWER

Design Challenge



Take *Build a Better World* to new heights with our *Day 11 Extension: Typhoon Tower Design Challenge*! This activity raises the stakes for 4th to 6th graders, inspiring them to reimagine and improve their original typhoon-resistant towers. Download the challenge to boost rigor and resilience as learners strengthen their understanding of the engineering design process.

Materials List

Challenge learners to revamp their typhoon towers from Day 11 of *Build a Better World*. Begin with groups' pre-built towers as the base of their design.

Built-in Tips for Classroom Management:

Option 1: Provide each group with a specified amount of the listed materials.

Option 2: Place more of every material in a centralized area where groups can send a teammate to retrieve supplies as needed.

What if my learners haven't built a typhoon tower yet?

Allow time for groups to use materials to construct a free-standing structure that holds a tennis ball at least 18 inches off the ground.

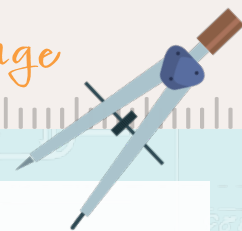
- Chenille stems/pipe cleaners
- Copy paper
- Craft sticks
- Index cards
- Masking tape
- Ruler
- Straws
- String
- Tennis ball
- Electric fan
- Scissors
- Spray bottle with water for testing



Objectives

1. Learners will build, measure and modify structures given specific design parameters.
2. Learners solve problems by actively applying growth mindset principles.

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STEAM Connections

- **Science:** Understanding the science behind refuge towers built in the path of typhoons.
- **Engineering:** Apply design thinking to develop effective solutions.
- **Art:** Constructing towers using assorted materials.
- **Math:** Measuring tower heights at various increments.

Aligned Standards

Common Core State Standards (CCSS):

- Solve problems involving measurement and conversion of measurements.

Next Generation Science Standards (NGSS):

- 3-5-ETS1-3. Engineering Design
- 4-ESS3-2. Natural Hazards

International Society for Technology in Education (ISTE) Standards for Students:

- Students use a variety of technologies within a design process to identify and solve problems by creating new, useful or imaginative solutions.

National Core Arts Standards (NCAS):

- Apply knowledge of available resources, tools, and technologies to investigate personal ideas through the art-making process.

21ST Century Skills:

- Creativity and Innovation
- Critical Thinking and Problem Solving
- Communication and Collaboration

Habits Of Mind:

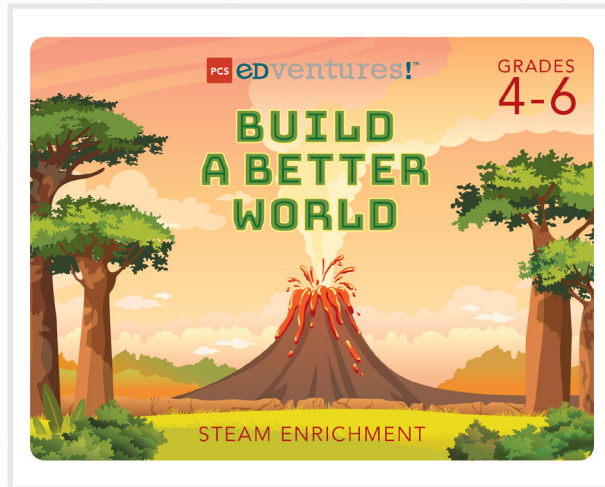
- Thinking interdependently
- Applying past knowledge to new situations
- Questioning and posing problems
- Creating, Imagining, Innovating

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BACKGROUND INFORMATION

Build Learners' STEAM Knowledge with a Typhoon Tower Design Challenge!



Engineers know that innovation takes shape when they reevaluate and refine their designs. That's why we've taken our *Build a Better World* program to the next level. With this exciting extension, learners are tasked with revamping their typhoon tower creations. Get ready to push the boundaries of what's possible!

Not part of the *Build a Better World* family yet? No problem!

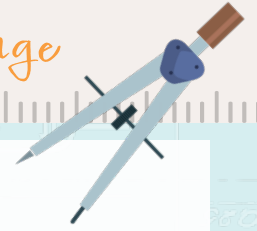
This extension can be used in all learning environments. Just be sure to preview the necessary materials and information you'll want to prepare before getting started.

Why You'll Love It:

- **Engaging and Interactive:** Sparks creativity through hands-on design challenges that actively involve learners.
- **Team-Based Challenges:** Encourages a collaborative learning environment where learners can work together to achieve a common goal.
- **Cultivates a Growth Mindset:** Fosters resilience by challenging learners to embrace mistakes, learn from them and rework their approach.

Unleash creativity, develop an engineering mindset and have fun with the Typhoon Tower Design Challenge. It's the perfect way to elevate your *Build a Better World* experience!

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LESSON 1: PUSHING THE LIMITS

(A Typhoon Tower Design Challenge Extension)

Directions for educators are in black. Discussion questions and examples are in blue for quick and simple implementation.

Estimated Runtime: 1 hour 30 minutes

***Estimated time based on learners having previously constructed 18-inch towers during Build a Better World, Day 11.*

Activity 1: Setting the Foundation

Whole Group Activity: 10 minutes

Begin by introducing the value of resilience.

What does it mean to be resilient? Think back to the typhoon towers we built. The most resilient towers were the ones that could handle the elements or bounce back quickly. Remember, hurricanes, also known as typhoons in some parts of the world, can be **STRONG**. Their high winds and powerful rain are often disastrous. You engineered towers that could persevere in the face of those challenges.

Ask: What challenges did your group face while building your first typhoon tower?

But resilience isn't only important for the structural design of our towers. As you shared, a lot of careful planning, creativity and problem-solving goes into constructing typhoon-resistant towers. Engineers need to be just as resilient as their designs, able to overcome setbacks and continue working toward their goals.

Remind learners that failure is part of the engineering design process. Just like towers must withstand the elements, engineers must embrace failures as opportunities to learn and improve their designs.

Today, we're putting our resilience to the test with a challenge that takes things to the next level! Let's see how taller towers stand up against hurricane winds.

Prep:

- Gather materials and be prepared to review how triangular builds, as opposed to squares, create a stronger, more typhoon-resistant design (see *Build a Better World*, Day 10 for more details).
- Refer to the background information provided in the Educator Guide for *Build a Better World*, Day 11. Otherwise, consider asking learners to research facts about typhoons (or hurricanes as they're called in some parts of the world) before the start of this extension lesson.

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Lesson 2: Typhoon Tower Challenge 2.0

Group Activity: 45-60 minutes

The Burj Khalifa in Dubai is a great example of how engineers can make even the tallest buildings withstand natural disasters and high winds. Standing 2,722 feet tall from base to tip, the skyscraper's stability is due to the engineers' decision to construct a Y-shaped base with a central hexagon core. This is known as a buttressed core system.

Point learners to the images of Burj Khalifa.

On Day 1 of Build a Better World, we learned that the Burj Khalifa in Dubai is the tallest building in the world! Let's take a closer look into the secrets behind its impressive structure.

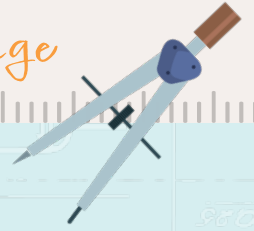
Think-Pair-Share: Take a look at these images of the Burj Khalifa (see page 8). What do you notice about the design that may contribute to the stability and safety of the world's tallest building?

Encourage learners to consider the benefits of the buttressed core design as they sketch their design plans in their Student Activity Booklet.



What other design choices have shaped today's architecture? Discover more structural and artistic techniques with *BrickLAB Famous Architecture*! This hands-on program includes 12 reusable, one-hour lessons that reveal the engineering secrets behind some of the world's most iconic structures.

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Lesson 2: Typhoon Tower Challenge 2.0 (continued)

Introduce the Challenge:

Modify your existing typhoon tower to reach new heights while maintaining its stability during a simulated hurricane.

Start by challenging learners to raise their towers 24 inches off the ground. As groups meet the challenge, continue to set incremental height goals for the towers (e.g., 30 inches, 36 inches, etc.).

Facilitators may also choose to turn the challenge into a friendly competition! See which group can build the tallest tower, supporting the tennis ball while withstanding the simulated hurricane.

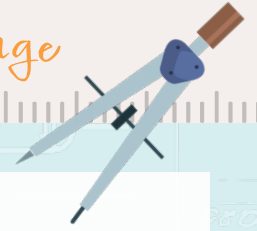
- 1. Design and Build:** Allow groups time to brainstorm plans in their Student Activity Booklet. Next, encourage them to build their modified towers using the materials provided. Remind them to consider the principles of strong shapes and wind resistance.
- 2. Testing:** Have learners test their towers using the electric fan to simulate hurricane winds. If desired, use a spray bottle to simulate rain. Record any observations and modification plans in the Student Activity Booklets.
- 3. Evaluation and Redesign:** After each test, have learners evaluate their tower's performance and make any necessary modifications to improve its stability. Remind groups to measure the tower's height each time to confirm their modified builds meet the challenge parameters.

Build Up Resilience

Consider using the following questions to guide learners as they work toward their goals:

- What is going well? What parts of the tower aren't turning out the way you planned?
- What did we find out from the parts of the design that are not working? How can that inform the changes we make?
- What part of your plan are you most confident about? How can we use that idea as inspiration to help solve the problem?

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Activity 3: Setting the Foundation

Whole Group Activity: 10-15 minutes

When time is up, bring groups together for a discussion.

Sample Discussion Prompts:

- Share an example of a problem you faced and how you worked through it.
- What did you do to stay positive and persevere through challenging moments?
- How did working as a team help you solve problems and build resilience?
- What did you learn about your own strengths and how you handle challenges?
- How has your understanding of engineering design and natural disasters evolved throughout this experience?



RESOURCES

Structural details of Burj Khalifa – concrete grade and foundations. (2017, December 12). theconstructor.org.

https://theconstructor.org/structures/structural-details-burj-khalifa-concrete-grade-foundations/20512/#google_vignette

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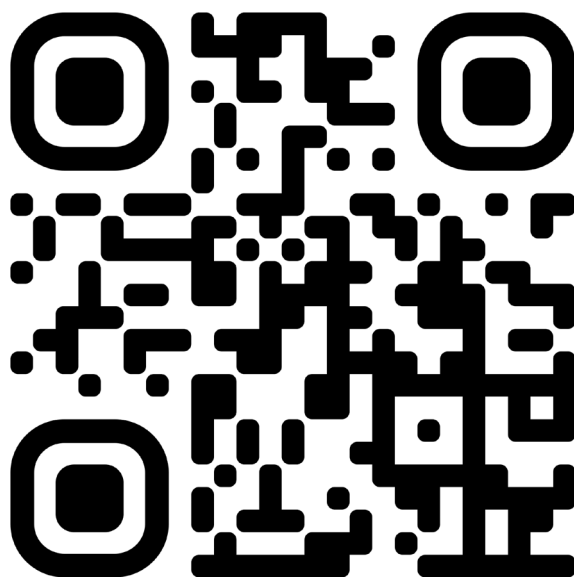
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