



CAREER ACTIVITY

The Cup Stack Challenge

OBJECTIVES

Students will be able to:

- Apply the process of scientific thinking to solve a problem while working as a team.
- Work collaboratively to create the end product.
- Practice negotiating, problem-solving, critical thinking, and collaboration.

OVERVIEW

Research shows that collaborative problem-solving leads to better outcomes. People are more likely to take calculated risks that lead to innovation if they have the support of a team behind them. Working in a team encourages personal growth, increases confidence, and reduces stress. Teamwork creates a system to ensure that deadlines are met and that there is high-quality work. When one team member falls behind, there is another to pick up the pieces. When work is divided up among members of a team, it gets done faster, making the overall business operate more efficiently.

Students will engage in a team project called The Cup Stack Challenge, where they will work together to create a pyramid with limited resources and parameters on how to build. The challenge is to create the tallest pyramid by communicating efficiently and working together.

One of the core principles of the Toyota Production System is Kaizen. Kaizen is a quest for continuous improvement and is the single word that sums up Toyota's 'Always a Better Way' slogan. In the Toyota workplace, Kaizen is a way to bring a human element to production and encourage team members to identify areas of improvement and suggest solutions. Kaizen provides individuals with the opportunity to be continuous learners and grow as professionals. As students move through the Cup Stack Challenge, Kaizen can be used as a framework to help students as they are working together to build the tallest pyramid.

This activity connects to the work that Toyota Body Weld Pilot Project Manager, Pamela Bass, does every day. Pamela must problem-solve

and collaborate on new projects and implementations. In order to do her job effectively, she uses strong problem-solving and communication skills, excellent organization and time-management skills, and maintains keen attention to detail.

INQUIRY QUESTIONS

1. Why was teamwork so important in this activity?
2. What real-world situations have you been in where you needed to use good teamworking skills? How did you handle that situation?
3. What other skills did your group have to use to complete this activity?

NEXT GENERATION SCIENCE STANDARDS

K-2-ETS1-1: Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

MS-ETS1-3: Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

BACKGROUND

A team is defined as a working arrangement in which individuals work interdependently to achieve their goals; where they are collectively accountable for their work outcomes, and where they and others see them as an intact social identity. As a discipline, engineering is centered around innovation and creativity with the power of teamwork to bring an idea to fruition. In the manufacturing sector, work teams typically exist on a continuous basis to deal with day-to-day tasks and to make and implement suggestions to enhance performance. Organizations support the development of new ideas when they have mechanisms in place, such as teamwork. Teamwork brings different perspectives together, which can fertilize each other for creative ideas to emerge, and time and resources that allow new ideas to be explored. Learning to work as a team elevates innovation. In this challenge, students will explore the power of teamwork as they build and stack!

KEY VOCABULARY

- Problem-solving
- Communication
- Data
- Engineering

MATERIALS

- 6 plastic cups (or any cups you have available)
- 1 rubber band
- 4 pieces of string
- 1 timer for the group
- Video: [The Power of Teamwork](#)

TEACHER PREPARATION

- Print **Student Capture Sheet #1**: The Cup Stack Challenge
- Print **Student Capture Sheet #2**: Thinking About the Lab
- Prepare a demo area where space is clear and there is room for movement

PROCEDURE

Engage: *How Do We Work as a Team?*

1. Begin the lesson by engaging students' curiosity by showing the [The Power of Teamwork](#) video. To get students thinking about the topic of momentum, reaction, and mobility, introduce students to the *See, Think, Wonder* thinking routine that they can use to consider their own understanding.
 - **See:** *What do you see happening in the video? How does working as a team move the collective mission?*
 - **Think:** *What connections can you make to prior knowledge? What are you learning?*
 - **Wonder:** *What questions come to mind as you watch?*
2. As the video ends, give students a few minutes to finish their thoughts. You may choose to ask a few students to share their thoughts or gather them as a class-wide discussion.

Explore: *Collecting Data on Collaboration & Teamwork*

1. Explain to students that, as a class, they will be using problem-solving and working as a team to improve the process and final product. Using a baseline of time, students will use the time data to better understand how working together can improve production. Data is an integral part of science and how we apply and solve problems. Experimenting and collecting data provide the insights needed to make better decisions and further investigations.

Experiment:

1. Divide students into groups of three, provide each group with **Student Capture Sheet #1: The Cup Stack Challenge** and a stopwatch (or something similar), six solo cups, 1 rubber band, and 4 pieces of string.
2. Students will now engage in the experiment of doing their own trials of dropping the measuring stick. Have students record their data on the "Your Reaction Time" data sheet.
3. Guide students to the final part of the experiment where students use their data to *Design a Solution* that would provide an innovation to create less damage to the cars during impact.

Reflect: How Data Helps Us Reach Conclusions and Question

4. Hand each student a **Student Capture Sheet #2: Thinking About the Lab**. Students will use data collection, analysis, and design solutions from their experiment to consider larger questions around the concept of reaction and its application to life today.

Extend

1. Watch the [Toyota Career Video](#) featuring Pamela Bass.
2. Ask students how Pamela's career connects to the activity in which they participated.
3. Encourage students to try this activity at home, with their families, to share their learning experience.

THE CUP STACK CHALLENGE

STUDENT CAPTURE SHEET

One rule of the Challenge:

Participants cannot touch the cups with their hands or any other part of their body.

1. Create a grapppler tool with the string and rubber band (this will move the cups).
2. Place the cups in three stacks.
3. Start your timer. Move the cups by using the grapppler tool into a six-pyramid shape.
4. After the pyramid is complete, stop your timer and record your time in the chart.
5. Repeat the activity at least 3 times.



Data Collection: Pyramid Building Time

Trial	Time
1	
2	
3	
4 (optional)	

Calculate the following:

Average Time: _____

Max Time: _____

Min Time: _____

Class Average time: _____

1. How well did your team work together to move the cups?
2. At what point in the activity did you feel like everyone was working together?
3. Describe a moment when your team became frustrated. How did you work through this?
4. Tell how one of your team members exemplified collaboration or communication.
5. Why was collecting and analyzing data important?