My Cup Overflows, Does Yours?
Part 2

<table>
<tr><th colspan="2">Introduction</th></tr>
<tr><td colspan="2">In this lesson set students will explore the concept of justice. The Justice Cup from China will be the artifact used as a provocation to the IB themed unit, How We Express Ourselves- an inquiry into the diversity of voice, perspectives, and expression. The second part of this lesson set students will analyze the function and design of the Justice Cup through a STEM activity on how siphons work.</td></tr>
<tr><td>Indiana Standards Connections:
Science:
3-5-ETS1-1: “Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.”

3-5-ETS1-3: “Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.”

Math:
3.M.1: “Estimate and measure the mass of objects in grams (g) and kilograms (kg) and the volume of objects in quarts (qt), gallons (gal), and liters (l). Add, subtract, multiply, or divide to solve one-step, real-world problems involving masses or volumes that are given in the same units or obtained through investigation.”</td><td>Compelling Question(s):

How do siphons work?</td></tr>
<tr><td colspan="2">Lesson Objectives:

Students will: Students will be able to work in a group to create a justice cup.</td></tr>
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Materials
Teacher Materials: • Video on Science behind the siphon (teacher background information): Pythagoras Cup • W2W featured video: How to Make a Pythagoras Cup Kids Science • Teaching how siphons work: The Siphon • Pythagoras Cup Tutorial • Anchor Chart Materials for each group of 3 students: • plastic cup (3) • push pin • Scissors • bendy straw • sticky tack • plastic cup lid (straw slotted) • water • food coloring (optional) Other student materials • Science Journal or writing paper for each student • pencil
Learning Plan
Activities Before the Lesson: • Teachers should watch videos on siphons and read the Britannica Kids article on siphons to gain understanding of how a siphon works. • Divide students up into groups of 3 or enter students' names into a random group generator and have it ready to go to use during the lesson. • Prepare the science materials. For Session 1 the teacher will be demonstrating a simple siphon using two cups and a straw. For session 2, materials will need to be prepped for the STEM challenge.

Session I

- Gather supplies needed for this session's lesson:

  Each student:
  - Science notebook
  - Pencil

  Each Group of 3:
  - 2 cups
  - 1 straw
  - Water

  Teacher:
  - Videos
  - Siphon supplies for demonstration

- Show W2W picture of the Justice Cup and the Pythagoras Cup (Resource 2) on the Windows to the World Website. Read the tags for both cups. Pose the question:

  "How can a cup spill out water if filled too much?"

- Lead a discussion with students, writing down their ideas on the board or anchor chart.
- After the discussion, introduce the word "siphon" to students. Read about siphons using the Britannica Kids-Siphon article.
- Have students summarize the article in their own words in their science notebooks or a piece of paper.
- Check responses for student understanding of siphons.
- Show the video, The Siphon
- After the video, ask students what they noticed about siphons. Ask what they are still wondering about. Then, pose the following question again: *"How can a cup spill out water if filled too much?"*
- Write down any new understandings on the board/chart paper.
- Using two cups and a straw, give a simple demonstration of a siphon. Mirror the siphon in the video.
- Have students get into their groups of three, give two cups and a straw to each group and let students explore how a siphon works. Check to see if all groups are able to get their siphon to work.
- Clean up and end the session.

Session II

- Before the session gather supplies:
    - Make copies of Justice Cup STEM Journal for each student
    - STEM Materials for each group:
        - plastic cup (3)
        - push pin
        - Scissors
        - bendy straw
        - sticky tack
        - plastic cup lid (straw slotted)
        - water
        - food coloring (optional)
        - 1 cup measuring cup filled with ½ cup water for testing.
- Decide how much time the STEM challenge should go for-but no less than a ½ hour. Normally, students need 45 minutes to an hour to design, think, plan, and build. This challenge can be done over a few days with no time limit as well. If it is decided to use time as a constraint, display a timer for students to see during the challenge.

- During the Lesson:
    - Review with students session 1's lesson. What is a siphon? How does a siphon work? Tell students that today, they will try their hand at using a siphon to make a justice cup!
    - Pass out journals and introduce the STEM challenge students will tackle today:
        - "Using your knowledge of siphons, design a justice cup that will siphon out water when filled."
    - Go through the task and field any questions students may have.
    - Before students get into their groups, take 5 minutes for students to think of their own design. Students draw their design on the "my design" page of the STEM journal.
    - Once students complete their own design, have students get into their groups from yesterday and start the group design process. Students should first share their personal designs with each other before deciding on a group design. During this process students will discuss what they think will work/may not work, what elements they like out of each other's designs, and come up with a

design they agree upon. This may be a fusion of elements from each individual design, or it may be the group votes on one person's design to be built as a group. Teachers should be visiting each group, looking at designs, and troubleshooting with students.

- Once students have an agreed upon design, the teacher looks it over and approves it. After approval, students can start building their justice cup.
- During the build process, the teacher is available to talk through problems that may arise. Once cups are complete, students can test their cups with the water. If using food coloring, students may put a few drops in their water to color it.
- If the cup did not work, students should go back through the design process. What did not work? What tweaks to the design can be done to make it work?
- Students design and test until they are happy with their justice cup.
- Once groups are finished with their cups, and if time allows, students can demonstrate their cup to other groups.

****During the STEM challenge, if students are not grasping the idea of using a siphon to build a cup, show the video of one cup design linked on the W2W resource page for the Justice Cup.**

Assessment Suggestions

Session 1 assessments:

- Check for understanding of what a siphon is and how it works through the summary students write in their Science notebook.
- Check groups of 3 made a working siphon

Session 2 assessment:

- Working justice cup

Extensions

- Once students build a working cup-how can they improve it? Is there a way to hide the siphon from view?
- If a 3D printer is available to you, print a 3D Pythagorean Cup

_____'s

Justice Cup STEM Journal

NAME:_____

JUSTICE CUP STEM CHALLENGE

Problem: Using your knowledge of siphons, design a justice cup that will siphon out water when filled.

Constraints (limits on available resources and time):

1. Materials: You may use only materials provided to you.
2. Time: You must build your model within the time limit given to you.

Materials:

- plastic cup (3)
- push pin
- Scissors
- bendy straw
- sticky tack
- plastic cup lid (straw slotted)
- water
- food coloring (optional)

Name:_____

JUSTICE CUP STEM CHALLENGE

My Design:

Name:_____

JUSTICE CUP STEM CHALLENGE

My Group's design:

NAME:_____

JUSTICE CUP STEM CHALLENGE

How will you use your materials?

_____

_____

_____

How will you be sure that your cup will work?

_____

_____

_____

What possible problems could come up during construction?

_____

_____

_____

NAME:_____

JUSTICE CUP STEM CHALLENGE

What about your design worked well?

_____

_____

_____

If you were to do this STEM challenge again what would you do differently?

_____

_____

_____

How did you help the group? _____

_____

How did your group work together? (Well, not well?) Explain.

_____

_____

_____

Works Cited

Boundless Brilliance. *Pythagoras Cup | Easy Kitchen-Science Experiment for KIDS!* 2022. *Youtube*, Boundless Brilliance, https://www.youtube.com/watch?v=5wBwJXJXO04. Accessed 23 May 2024.

Britannica Kids. “siphon - Students.” *Britannica Kids*, Britannica Kids, https://kids.britannica.com/students/article/siphon/277075#. Accessed 23 May 2024.

KiwiCo. “Pythagoras Cup | DIY for Beginners.” *KiwiCo*, KiwiCo, https://www.kiwico.com/diy/stem/motion-mechanics/pythagoras-cup. Accessed 23 May 2024.

Kohlstedt, Kurt. “Pythagorean Cup: Practical Joke Chalice Overflows with Ancient Greek Humor.” *99% Invisible*, 23 December 2016, https://99percentinvisible.org/article/pythagorean-cup-practical-joke-chalice-overflows-ancient-greek-humor/. Accessed 23 May 2024.

ScienceOnline. *The Siphon*. Youtube video on how siphons work. https://www.youtube.com/watch?reload=9&app=desktop&v=CZmP0vsRBZ8&embeds_referring_euri=https%3A%2F%2Fwww.likvchina.com%2F&feature=emb_imp_woyt.