Problem Description

Sarah Morrow a soldier of the Medieval area wants to build a catapult to throw marshmallow projectiles onto a wall of plastic cups. Her goal is to knock down the castle wall made up of

a ping pong ball as far as possible. Sarah does not know how to adjust the correct angle to reach the largest distance. Sarah needs help building the catapult and adjusting the correct angle.

Teacher preparation

- Read the activity teacher guide to be familiar with the concept of building the activity
- Build a sample of the activity
- Gather materials needed

Materials needed for this activity

- paper ball or Marshmallows
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Constraints

- Students are expected to finish activity within a 45-50 minute time frame.
- Every engineering design step has a specific time limit.

Learning outcomes - *The student must...*

- Show an understanding of the problem
- Show an understanding of the solution and the purpose of the solution
- Be able to plan/design the solution
- Be able to implement their plan to the solution with the materials provided at hand
- Be able to test the solution
- Be able to understand why the solution does/not work
- Show an understanding of the engineering design process steps

Introducing the activity

- Distribute materials to the students
- Introduce activity
- Proceed to the Engineering design process steps

Engineering Design process steps

- ***Step 1: Ask*** *(Duration = 10 minutes)*
    - Questions
        - What is the problem that Sarah is facing? ***(Learning outcome 1)***

- ***Step 2: Imagine and plan*** *(Duration =10 minutes)*
    - Question
        - What does Sarah need to be able to get to the ping pong ball the furthest distance possible ? Why does Sarah need a catapult to be built? ***(Learning outcome 2)***
        - How can we make/build a bridge? ***(Learning outcome 3)***
    - Task
        - Have the students draw out their designs of the catapult on paper

- ***Step 3: Create*** *(Duration = 20 minutes)*
    - Questions
        - Using the materials provided at hand, how will you make the catapult? ***(Learning outcome 4)***
    - Task
        - Show the students the possible designs diagram then let them create the catapult

- ***Step 4: Test*** *(duration of 5 minutes)*
    - *Questions*
        - To check if the catapult works, we should test if the ping pong ball reaches a distance of # when launched ***(Learning outcome 5)***
    - Task
        - Have the students test their catapult designs at the hallway by measuring a distance of #. Launch the ping pong ball , if it reaches the distance then the catapult is a success.

- *Step 5: Improve (Duration = 5 minutes)*
    - Debriefing through the following questions
        - For the catapults that did not reach a distance of # , Why so? How can we re-make the catapult to improve it? ***(Learning outcome 6)***

- What have you learned ? ***(Learning outcome 7)***

Adjusting difficulty (Optional)