Ping Pong Bowling Engineering Design Challenge

AUTHOR
Unknown

GRADE LEVEL
6
7
8

CONTENT TOPICS
Engineering
Engineering Design
Science

DESCRIPTION
This instructional resource provides an overview for a Ping-Pong Bowling activity. Students are asked to design a ball thruster for a ping pong bowling game that will fit a variety of provided specifications. A student worksheet includes a data collecting table to use during testing. An Excel spreadsheet matrix is provided to help students calculate their design's performance on each of the engineering specifications.

SUGGESTED STANDARDS CONNECTIONS

NGSS	MS-ETS1 Engineering Design

Ping-Pong Bowling

Scenario: Customer wants to have a ball thruster for a ping pong bowling game that will fit the following requirements:

- Easy to use
- Thrust a ping pong ball accurately every time
- Must be able to knock down a stack of cups
- Must be able to thrust the ping-pong a distance of 10 feet
- Durable
- Easy to make
- Thrust must only come from the launcher (no body parts or throwing)
- Must use stored energy
- Ping-pong ball cannot roll out by itself

<u>Engineering specifications (with units):</u>

- Number of steps to make (#)
- Number of pieces to make (#)
- Time to make (minutes)
- Time to launch (seconds)
- Number of steps to launch (#)
- Time between launches (seconds)
- Effort or force to launch (newtons)
- Average distance from target (cm)
- Number of launches before it breaks (#)
- Average number of cups knocked down (#)
- Average distance from launcher to ping-pong ball (cm)
- Average distance launcher moved when launching ping-pong ball (cm)

Materials:

Rubber bands
Tubing
Cups
Tape
Ping-pong balls

Procedures:

1. Divide class into groups (2 students per group)
2. Present customer requirements
3. Shown materials
4. Generate a QFD matrix with the students using the customer's requirements
5. Each group will draw a design for a ball thruster (includes measurements)
6. The students will build (collecting data) and try out their prototype (collecting data)
7. The students will improve their design based on their test results and QFD
8. The students will retest and make design modification as many times as needed

Things Students need to consider when they are designing:

Length of each tube
How many rubber bands

Handouts:

Data collection sheet
Design sheet
Matrix Blank (Double-sided)

Teacher things:

Laminated paper for matrix with customer requirements (one for each group—60)
Return labels with engineering specifications printed twice (one for each group – 60)
A projected slide with customer requirements and engineering specifications to tally group thoughts
A projected slide with design worksheet to demonstrate how to draw and log in measurements
Design worksheet for students
Data Collection sheet for students with engineering specifications
Matrix blank so students can log in or stick in final engineering specifications
Excel matrix
Tubing we would need (12 groups per class; 70 tubes of each size)

Names _____ Date _____ Period ___

Table # _____

Data Collection Sheet

Number of steps to make:

Number of pieces to make:

Time to make (minutes):

Force prior to launch (Newtons):

Number to steps to launch:

Amount of time it takes to launch (seconds):

Amount of time it takes between launches (seconds):

Distances for each launch (measure from launcher to wherever the ball stops) (cm):

Average distance:

Number of cups knocked down for each launch:

Average number of cups knocked down:

Amount of times the ball comes out of the launcher before launching:

Percent of time the ball comes out before launching:

Distance the launcher moves when launching ping-pong ball (cm):

Average distance the launcher moves when launching ping-pong ball (cm):