Western Sengineering Outreach

Paper Plate Pinball Challenge

Grades K-2





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https://www.eng.uwo.ca/mechanical/faculty/knopf_g/index.html

Learning Goal:

- Students move through the stages of the engineering design process as they create their paper plate maze.
- Curriculum Connections: Grade 1 Materials, Objects, and Everyday Structures; Grade 2 Movement

Materials Needed:

- 1 paper plate
- Scissors
- Construction paper
- Tape
- Markers
- 1 marble

- Straws
- Pipe cleaners
- Glue (hot glue if supervision)
- Popsicle sticks









Engineering and Science Connections:

What is the engineering design process?

The engineering design process is a set of steps that engineers use when they are designing, building, and testing their products. Following these steps helps engineers clearly understand the problem they are trying to solve and allows them to make their innovation or invention the best it can possible be.

What do you think are some important things to know before starting to design your product?

The Engineering Design Process

DEFINE THE PROBLEM

This step is important because as an engineer you need to know what the problem is that you are solving and what constraints there are that will impact your solution.

In the activity today, you will be building a paper plate pinball game. The constraints would be that it has to fit onto a paper plate and uses materials that you have available around the house.

DO YOUR RESEARCH

Ask yourself questions like what do you think you will need to solve this problem? Does anything else exist that deals with this problem? Learn as much as you can by researching.

For example, in today's activity you can consider what kind of obstacles other pinball games have.

DEVELOP POSSIBLE SOLUTIONS

This step is where you brainstorm as many possible solutions as you can think of. At this point it is important to remember to just think of as many solutions as you can - do not worry about how you would build them yet.

After you have brainstormed many possible solutions, you will need to pick one to continue working on. You want to pick one that solves your problem and is reasonable.

DESIGN YOUR SOLUTION

You will need to make a plan for how to build your solution. Here, you should make a design that shows how you intend to build your solution and what it will look like.

For this activity, you could draw out your plan for where certain obstacles will be located on your paper plate.

BUILD YOUR PROTOTYPE

Follow the plan you created and build your solution!

PAPER PLATE PINBALL CHALLENGE

In this case, you will be building your pinball game on the paper plate. The other material will be used to build your obstacles/features of your game. Using your design from the previous step, draw it onto the paper plate and then start creating your obstacles using your materials.

TEST IT

Now that you've built your design, it's time to test your solution to see how it performs. Does your design do what you want it to? Or do you need make adjustments?

EVALUATE

Do you want to improve your design? Are there any adjustments that would make it better? It is important to remember that even if your original design didn't work exactly how you expected it to, that's okay! Engineers almost always make multiple adjustments to their designs to perfect their product. Every time a prototype doesn't work exactly how you expected it to, creates an opportunity for learning and is all part of the process.

Do the steps of the engineering design process have to be done in order?

No! The engineering design process is an iterative process that is done many times to get the solution right. Often you will need to go back to previous steps and try things over again.

Video Recommendation: The Engineering Process: Crash Course Kids #12.2

https://www.youtube.com/watch?v=fxJWin195kU

Activity:

Before beginning, think about the following questions:

- What problem are we trying to solve/what are we trying to create?
- What materials are available for me to use?

Part 1: Exploring Ideas

Define the problem - Today you are going to build a pinball game on a paper plate. Your game will have various obstacles made out of different craft supplies.

Do your research - What do pinball machines look like? Research on the internet what pinball machines look like. What kind of obstacles do they have and how are they made? What materials can you use to make obstacles? Go through your supplies and discuss/think about what each material could be used for. For example, make an arch out

PAPER PLATE PINBALL CHALLENGE

of construction paper or use pipe cleaners to create a block that would change the direction of the marble. Other obstacles to consider could be ramps, curves, arches, angled barriers, etc.

Develop a possible solution and design your solution - Decide which obstacles you want to incorporate into your game. Draw your design on a piece of paper first, outlining which obstacles you want to include, their size, and where they will be located on the paper plate. Then, draw your design onto the paper plate.



Part 2: Let's Try It Out!

Build your prototype- Bring your design to life by using your materials to build your pinball game on a paper plate. Add ramps, curves, arches, or any other obstacles you included in your design.



Test it- Use your hands to tilt the paper plate to control the marble as it runs through the game.

Evaluate your solution - Ask yourself:

- What worked well?
- What didn't work well?
- Did any obstacles fail when you tested your prototype?
- What would you change about your prototype?
- Do you need to redesign a certain part or all of it?
- What would you do differently next time?

PAPER PLATE PINBALL CHALLENGE

Make any changes to your design and prototype and try it again! By testing your prototype, you were able to learn what works well and what needs to be improved. When you incorporate your changes, you are making your game better!

What Did You Learn?

- What is the engineering design process used for?
- What are the steps of the engineering design process?
- Why is it important to test your prototype and make changes to your design?

Future Learning

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- Try designing a pinball game on something larger than a paper plate e.g. the inside of a pizza box so that it already has edges.
- Design and build a manual plunger (the spring-loaded rod that sends the ball into the game) or flippers (the pair of bats at the bottoms of the table that can be manipulated to try and keep the ball in the game).
- Add score keeping to the game. Assign each obstacle a point value and as you play, have someone keep score of which obstacles are played in the game e.g. going through the arch with the marble is worth 2 points, hitting the pipecleaner obstacle is worth 1 point, etc.

We would love to see what you made. Email as at discover@uwo.ca or tag us on social media.

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Share your creations!

Thanks for discovering with us!