

NAME

Pinball

DESCRIPTION OF ACTIVITY

Use different materials and let your students create their own personal interactive pinball game. This is a deep learning activity where students will get to try out different ideas, work with conceptualization and build prototypes.

This example contains solutions and code adapted to Makey Makey and MicroBit but it is easily adapted to other platforms like Arduino or RaspberryPi.

To see an example of our MakeyMakey pinball machine, click [HERE](#)

LEARNING GOALS

- Trial and error construction
- Introduction to ideation, constructing circuits and switches
- Simple programming of input output systems
- Game design
- Exploration of physics

PRE-REQUISITE KNOWLEDGE/SKILL

Connecting hardware and uploading the program (modifying the code is optional)

MATERIALS NEEDED

Cardboard, Strawbees, straws, tape, rubberbands, conducted material, pencil, scissors and your choice of hardware.

CLASS DURATION

DURATION	ACTIVITY	TIPS
10 min	Introduction	Time for activity may vary from group to group.
20 min	Inclined plane	
20 min	Make walls	
30 min	Invent plunger + rubberband	
45 min	Invent bumpers	
45 min	Invent a switch	
20 min	Make scoreboard	
45 min	Program the hardware	

ADDITIONAL CHALLENGE

Depending on the skill level of the students it is really easy to add challenges. Look at classic pinball games and challenge yourselves into making more features, some examples follow.

High score system - Needs more programming skills

Moving parts - Add a motor and more interaction

Add flippers - Mechanical solutions

Sound design - Make cool sounds for the switches

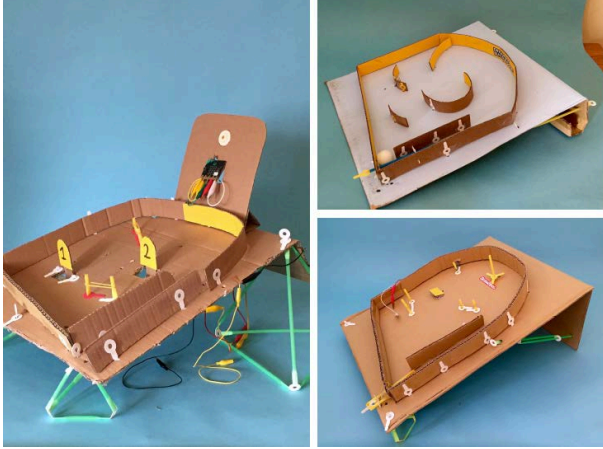
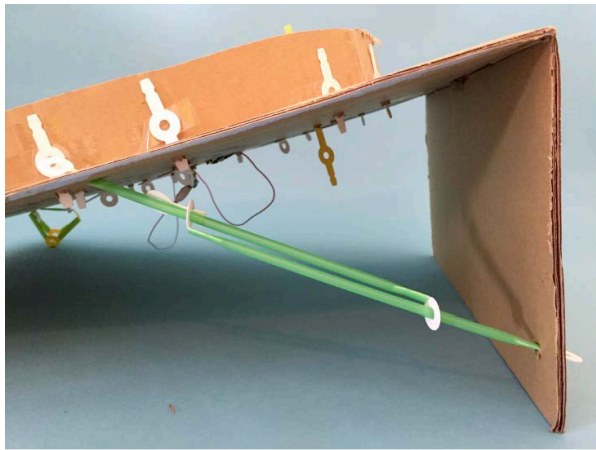
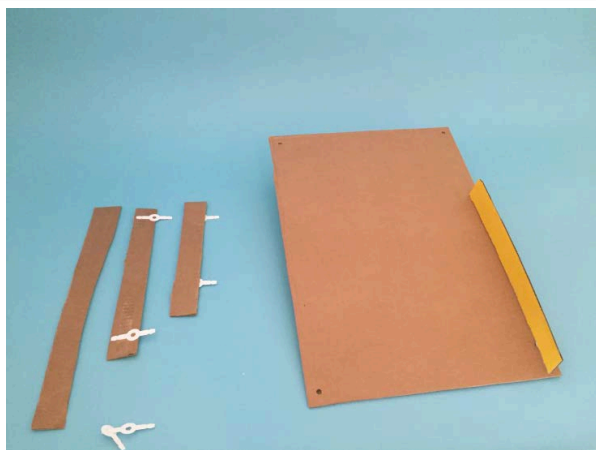
Build a railsection - Make the ball get up in the air.

Add lights - light up parts of the machine - easy with both MicroBit and MakeyMakey

Bonus points for certain events or sequences

Tilt - Minus points for tilting the machine.

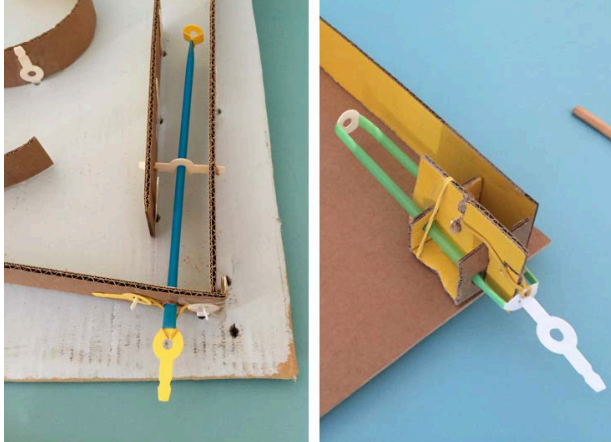
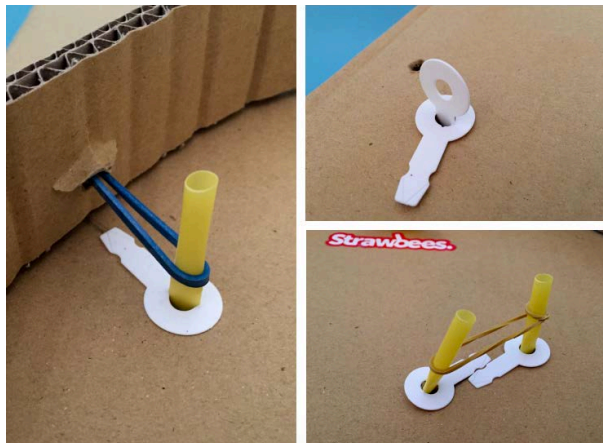
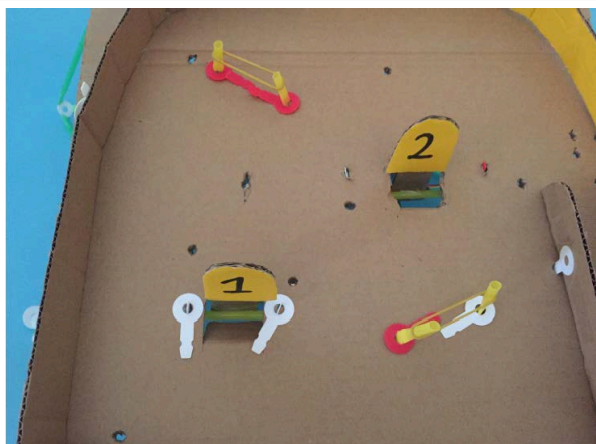

STEP - BY - STEP INSTRUCTIONS

IMAGES	NOTES
	<p>1. INTRODUCTION (10 min) Hold an introduction about pinball games and arcades and how this has developed into today's video games. Look at the general layout of Pinball games and talk about the parts we are going to make in this workshop, the case, a plunger, bumpers and some switches.</p> <p>An inspirational video about the anatomy of a pinball game can be found HERE</p> <p>Find a short video of our MicroBit pinball game HERE</p>
	<p>2. INCLINED PLANE (20 min) Let the students experiment with the inclination of the plane. Can they create a steady plane with cardboard and no glue? Can they invent a construction where they can adjust the inclination?</p> <p>Encourage multiple solutions, like tetrahedron bases or cardboard and straws or something else that we haven't thought of.</p> <p>An example video of adjustable planes can be found HERE</p>
	<p>3. CREATE WALLS (20 min) Show the students a simple way of making modular walls and how to attach them to the plane with Strawbees.</p> <p>Let the students cut out approximately 3cm cardboard walls out of cardboard. If they cut perpendicular to the channels in the cardboard they are much easier to bend to a nice curved shape.</p> <p>An example of how to attach the walls can be found HERE</p>



Note:
Feel free to include links to videos too!

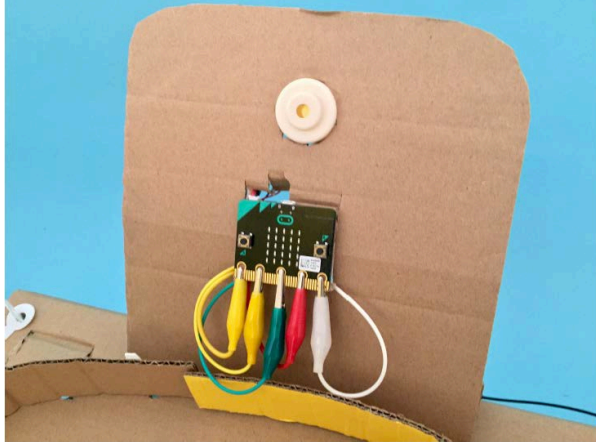
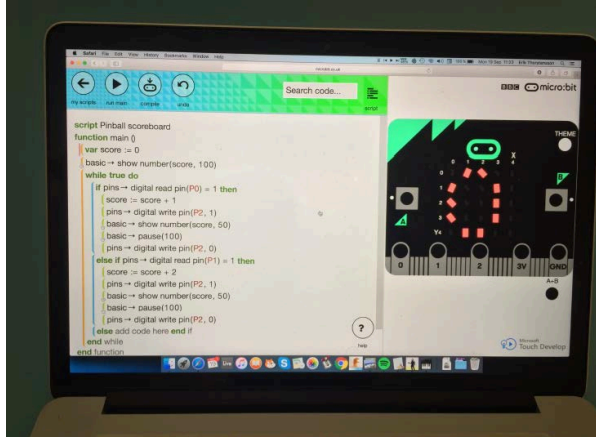
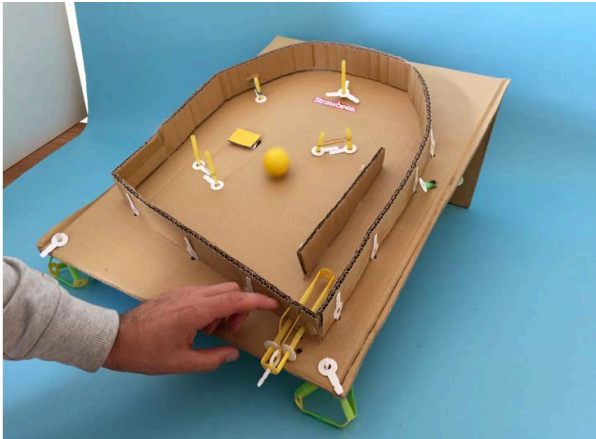
STEP - BY - STEP INSTRUCTIONS

IMAGES	NOTES
	<p>4. INVENT RUBBERBAND POWERED PLUNGER (30min) Option 1: Let the students trial and error their way into making a plunger. It's great if they get to try many solutions and fail a bit before you can hint towards what needs to be done to make the plunger move straight and with low friction. This is a bit tricky so prepare to help out and guide the students through this. Bonus point if they can make a modular easy to attach/detach plunger.</p> <p>Option 2: Show a solution that is easy to vary and let the students investigate this concept, invent improve or just replicate. This is good for younger students.</p> <p>Some examples of plunger constructions can be found HERE</p>
	<p>5. INVENT BUMPERS (45 min) Show a couple of bumper solutions and let them invent versions of these or something completely different. It's wonderful to see everything from crazy inventions to simple solutions pop out of the class room.</p> <p>Can you predict the balls trajectory somehow, let them research this for a while. Before adding the bumpers, figure out when they want the bumpers to affect the ball? Introduce predictability and chance and how to utilize this in the game. Talk about the physics involved. If you pull the plunger to the exact same length does it launch it with the same trajectory?</p> <p>Examples of different bumpers can be found HERE</p>
	<p>6. INVENT A SWITCH (45 min) Talk about circuits. Show the MakeyMakey and demo different circuits and switches.</p> <p></p> <p>To build a switch you need conductive material and crocodile clips. Investigate how to make a mechanical switch, how do you make it open after it's been closed? Use springs, rubberbands, foam etc. Leverage is important.</p> <p>Code for circuit testing with MakeyMakey can be found HERE Code for circuit testing with MicroBit can be found under additional resources. Circuit schematics can also be found under additional resources.</p> <p>To see examples of switch designs, click HERE</p>



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STEP - BY - STEP INSTRUCTIONS

IMAGES	NOTES
	<p>7. MAKE SCOREBOARD (20 min) Build a holder for your hardware that works as a display and scoreboard for MicroBit. It also helps collecting your cables. Use crocodile clips to secure the hardware to the scoreboard, or let the students invent another smart way of attaching the hardware so it's easy to attach and detach.</p> <p>Example of scoreboards can be found HERE</p>
	<p>8. PROGRAMMING (45 min) Use Scratch for MakeyMakey or your choice of platform for Microbit and program your hardware to count points and make sounds when you hit a switch on the pinball machine.</p> <p>How do you program so sensor input gets converted into points?</p> <p>Example code in Scratch for MakeyMakey can be found HERE Example code for MicroBit can be found under additional resources.</p>
	<p>9. TIME TO PLAY! Play it and make it a game! How well does it work? What works, what doesn't? Add, subtract and modify it or take the best part of each others machines and make a collaboration.</p> <p>It's play time! Who will get the highest score?</p>



Note:
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