THE EDUCATION FUND

FOR EXCELLENCE IN MIAMI-DADE PUBLIC SCHOOLS

2022-2023

Ideas with IMPACT

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Science in Motion

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Goals and Objective

Behavioral Objective:

- Learn how to research and assimilate new information for practical use
- Develop creative-problem solving skills
- Improve ability to work collaboratively

Academic Objective:

- Students will build and redesign a working catapult
- Students will be able to identify the various energy transformation that occurs when launching a catapult (potential to kinetic and vice versa)
- Students will be able to identify energy transformation
- Students will be able to identify non contact and contact forces
- Students will be able to assess their precision, accuracy skills
- Students will be able to collect, graph and explain data.

Florida Standards

Elementary (3-5 grade)

Big Idea 10

SC.3.P.10- Energy exists in many forms and has the ability to do work or cause a change.

Big Idea 10

SC.4.P.10-Energy exists in many forms and has the ability to do work or cause a change.

Big Idea 12

SC.4.P.12- Motion is a key characteristic of all matter that can be observed, described, and measured.
The motion of objects can be changed by forces.

Big Idea 10

SC.5.P.10- Energy exists in many forms and has the ability to do work or cause a change.

Big Idea 13

SC.5.P.13- It takes energy to change the motion of objects.

Energy change is understood in terms of forces--pushes or pulls.

Some forces act through physical contact, while others act at a distance.

Florida Standards

Middle Grades

SC.6.P.11.1- Explore the Law of Conservation of Energy by differentiating between potential and kinetic energy. Identify situations where kinetic energy is transformed into potential energy and vice versa.

SC.6.P.13.1-Investigate and describe types of forces including contact forces and forces acting at a distance, such as electrical, magnetic, and gravitational.

SC.6.P.13.2-Explore the Law of Gravity by recognizing that every object exerts gravitational force on every other object and that the force depends on how much mass the objects have and how far apart they are.

SC.6.P.13.3- Investigate and describe that an unbalanced force acting on an object changes its speed, or direction of motion, or both

Big Idea 10

SC.7.P.10 Energy exists in many forms and has the ability to do work or cause a change.

Bid Idea 11

SC.7.P.11 The Law of Conservation of Energy: Energy is conserved as it transfers from one object to another and from one form to another.

Course Outline/ Overview

The STEAM Digital Literacy curriculum resource packet is appropriate for students taking science in the 3-7th grade in Florida. While this lesson can be applied to other subject areas, this packet will be focused exclusively on the sciences. Designing a catapult that can accurately shoot into a target allows the students to design and build a product that showcases some of the more abstract concepts like energy and motion. This activity can be done individually or with a partner. This curriculum packet will list suggestions on supplies to use, however, each teacher should use their discernment to pick supplies that are age appropriate for your studentS/grade level.

Lesson Plan

Vocabulary:

- Energy
- Potential Energy
- Kinetic Energy
- Gravity
- Energy Transfer
- Energy Transformation
- Accuracy
- Precision
- Repetition
- Newton's 3rd law of Motion

Materials

•• masking tape
• Straws or sticks
• Pipe cleaners
• Paper cups
• Paper towel rolls
• Plastic spoons
• Rubber bands
• Pencil
• hole puncher
• Card stock
• Ping pong ball
• toothpick
• Popsicle (craft) sticks

Budget: This activity on the lower end would cost about $75-85 and on the higher end, it will cost about $150

Background Information:

Newton's third Law of Motion states the following:

- an object at rest stays at rest until a force is applied
- an object will stay in motion until something creates an imbalance in the motion
- Every action causes a reaction.

Potential energy is stored energy. You store energy in a rubber band every time you stretch it out.Catapults store potential energy by stretching ropes and rubber bands, and even by bending and flexing the wooden lever. The more energy you pack in, the higher your ball will go.

When you pull down the lever arm all that potential energy gets stored up! Release it and that potential energy gradually changes over to kinetic energy. Gravity also does its part as it pulls the object back down to the ground. When using a catapult, there is an exchange of potential and kinetic energy. The energy stored in the rubber band or the lever of the catapult transfers to the ping pong ball. That transfer of energy is called Energy Transfer.

Challenge- Create a catapult that shoots a ping pong ball into a basket.

The challenge can be adjusted to suit the grade level. Other challenges can be

- Create a catapult that launches a ping pong ball into a basket from 6 feet away?
- Create a catapult that can make 10 baskets in 60 seconds?
- Create a catapult that launches a ping pong ball into a basket from the furthest distance?

Building the Catapult

There are so many ways to build a catapult. Depending on the challenge, students are able to build different catapults. If data is going to be collected and compared, then having students create the same catapult would be ideal.

Popsicle Stick Catapult

1. Make a stack of popsicle sticks and rubber band them together on each end. (You can adjust the amount of sticks you stack up. Most common is stacking 7 sticks together)

2. Take two additional popsicle sticks and stack them together. Rubberband them together on just one end.

3. Pull the two popsicle sticks slightly apart and place the larger stack of popsicle sticks in between them.

4. Rubber band the stack of popsicle sticks to just the upper popsicle stick. Next,rubber band a spoon to the upper popsicle stick.

6. Place the ping pong ball on the spoon. Your catapult is ready to launch.

Below you will find a handheld catapult and does not require a flat surface to launch.

1. Take a paper cup and cut off ¼ of the side, leaving the base intact. (see picture)

2. Now, using a hole puncher, punch a hole on each side of the cup. Make one hole near the base of the cup (see picture)

3. Now, take a toothpick and put it through a rubber band. Pull it through the hole at the base of the cup tightly. (see pictures)

4. Put the pencil through the 2 holes on the side as shown in the picture

5. Pull the rubber band around the pencil. The put the spoon through the rubber band as shown in the picture

6. Place the ping pong ball on the spoon. You are now ready to launch. (orange ping pong balls are found online. I had students draw lines similar to the that of an

actual basketball)

***Optional- Take a piece of masking tape and form a U around the spoon.Pinch the masking tape so it forms a ledge so the ping pong ball can have a place to rest on the spoon.

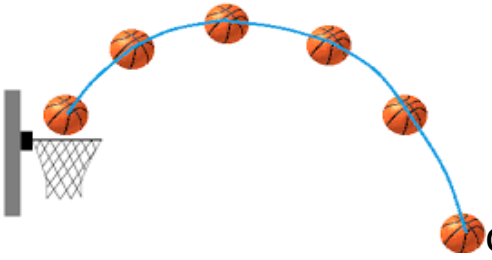
Once the catapult is designed, teachers can choose how the catapult will be tested based on the challenge. At this point students should put a piece of tape on the wall to act like a target and practice launching their catapult. They should try and hit the target at least 5 times in a row.

If students are unable to hit the target, students should adjust their catapult. They can adjust the spoon, how high or how low it is or they can adjust how they are shooting the catapult. Based on the challenge you have selected, your student can be put into teams or compete individually. Creating a score sheet or a data table to keep track of points, distances etc. sample data table can be found below:

Players Name	# of made baskets	Distance basket made	Points

Reflection Questions:

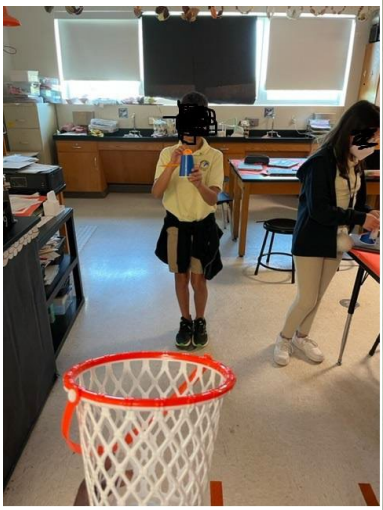
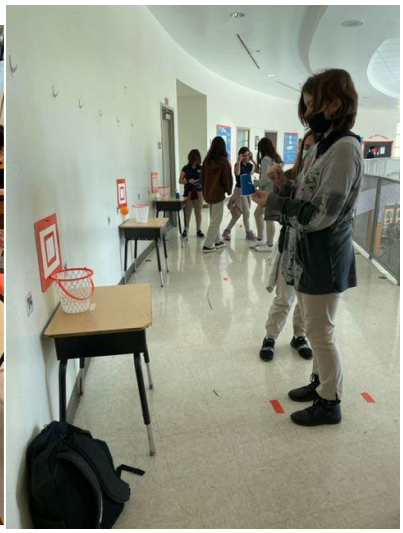
Using the picture below, answer the following questions using your experience with the catapult



1. Identify the point where the ball has the lowest potential energy?
2. Identify the point where the ball has the highest potential energy?
3. Identify the point where the ball has the lowest kinetic energy?
4. Identify the point where the ball has the highest kinetic energy?
5. What no contact force is being applied to the ball ?
6. Explain the energy transfer that occurs from when you launch the catapult to the basket.

Optional: To add to this activity, creating a space that is inviting really helps. Using Dollar Tree items, you can create a low budget classroom transformation. Hanging up tablecloths or using butcher paper to make a basketball court really adds to the experience.

Pictures of Activity


Resource List

Ping Pong balls:https://a.co/d/4ZIkck4
Basketball Basket:https://a.co/d/jkykMBr

Paper cups: https://a.co/d/g5jQWNf
Newtons' Laws Video:https://youtu.be/eU3ULRgS8V

All other supplies that are not linked can be found at stores such as Dollar Tree, Walmart, Amazon or Target. You may also already have many of these supplies in your classroom.