Brick by Brick 1 - Project 5
All units
Marble Run

Objectives and Learning Outcomes

- Learn hoe to add.
- Work with color and number codes.
- Explore the force of gravity.
- Do experiments with different kinds of slopes to make a marble change direction.
- Do experiments with deflectors to add a sudden change of direction.
- Collaborate and solve problems in pairs, teams, and as a class.
- Express likes and react to a fun experience.

Materials Needed

- Marbles.
- Masking tape - one roll per pair or group.
- Scissors.
- An abundance of toilet paper and paper towel tubes.
- Recyclable materials, such as polystyrene, cut off spouts of plastic bottles, paper boxes or cardboard.
- Shallow cardboard box or shoebox lid.
- Aluminum foil.
- Pool noodles with a hollow center, cut in half (optional).
- Toy car tracks (optional).
- Barbecue skewers with sharp points cut off (optional - for use with pool noodles and/or polystyrene).
- Toothpicks (optional - for use with pool noodles and/or polystyrene).
- Ice cream pop sticks (optional).
- Balloons with the end cut off.
- Cup or small container (that the balloon will be stretched onto).

Target Language

Colors: *blue, red, yellow, purple, green, orange,* etc. (review).
Numbers 1-10 (review).
Classroom items *desk, chair, etc.* (review)
School material: *book, eraser, pencil case,* etc. (review)
Activity: *marble, roll, drop, gravity, slope, fall, "drop it on the slope, see where it goes!" tape, tubes, change direction, deflector.*

Language for teamwork: *Don't give up, Let's try again, We're not finished, Let's…Sure. It's my turn. OK! Is this your…? Yes, Thank you. What should we use? Let's use this! Where should we put it? Let's put it here! What's next?*
Language for expression: *Cool! Wow, look at the…I love…Me, too! I don't.*

Timeline for the Project

Number of lessons: 3

Warm up: Lesson 1 – Review numbers and colors and explore gravity and slopes (15-25 minutes).
Development: Lesson 1 – Build a marble run to span the length of the classroom (20-30 minutes); Lesson 2 – Build a marble run with different slopes to change direction (25-35 minutes), demonstrate the marble runs and react to them (10-15 minutes); Lesson 3 – Create a number and color code to decorate a marble run (15-25 minutes).
Review/Conclusion: Lesson 3 – Add deflectors to dramatically change direction in the marble run (20-30 minutes); demonstrate and react to the marble runs (5-15 minutes).
Assessment: Students will be able to build different types of marble runs, experimenting with gravity, slopes, and deflectors. They will collaborate and solve problems together, working to persist through setbacks. They will work with number and color codes, and use language for collaboration and problem-solving.

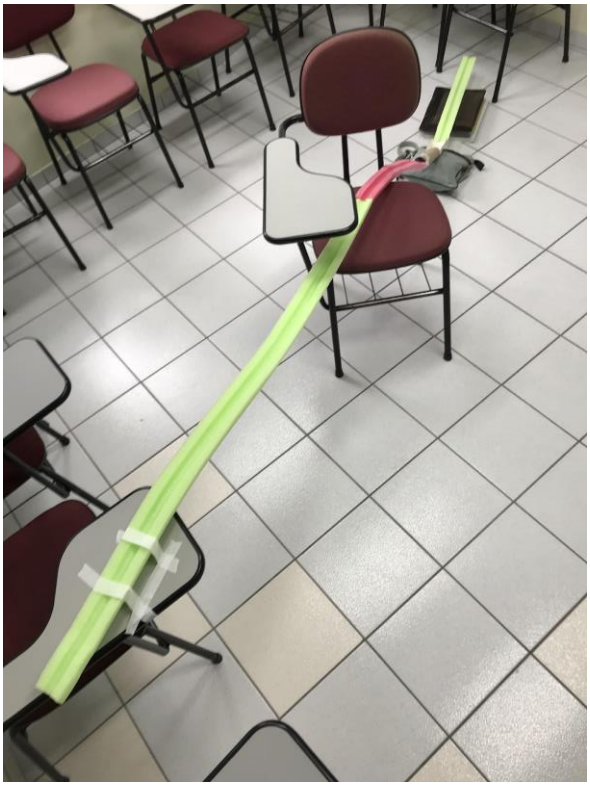
Lesson 1

Gather students for circle time. Show them a marble. What color is it? Teach the word, *marble*. What does it do? *It rolls*. Put the marble in a shallow cardboard box, or in a shoebox lid, and demonstrate. Teach the expression, *it rolls*. How many corners are there in the box? Count as a class to four, as you roll the marble from one corner to the next. Pass the box around, and let each student take a turn to choose a marble to roll in all four corners. Ask, “What color is it? What does it do?” Elicit the answers from the class, and, as the student rolls to each corner, count to four. Continue around the circle. Go around the circle a second time, this time, having students roll the marble to all four corners, but without touching the sides, counting as before. Review the vocabulary by asking, “What is it? What color is it? What does it do?”

Drop the marble on the floor, carefully, so that it doesn’t get lost. “What does it do?” *It falls.* Teach the expression. Ask, “Why does it fall?” Elicit the idea of *gravity* and teach the word. Gravity is a force that pulls an object to the center of the Earth. Put the marble back in the box. Ask, “Why does it roll?” Demonstrate the idea of a *slope* and teach the word. We can change the slope to make the ball roll where we want. Demonstrate this with a paper towel tube. Drop the ball inside the tube, and angle the slope so that the ball falls into the box, in the middle of the circle. Teach the word *drop.* Have the students chant: *Drop it on the slope, see where it goes!* Now, go around the circle once more, with students working in pairs. One partner holds the paper tube as a slope, aiming for the box. The other drops the marble. The partner holding the tube counts backward from three to one, and on one, the student holding the marble drops it. Each time, get the class to chant, *drop it on the slope, and see where it goes!* Go around the circle until everyone has played both roles.

Tell students that they are going to try to make a slope that can carry a marble across the length of the classroom. Show them the materials that can be used. If available, pool noodles with a hollow center, cut in half beforehand, are great for length. So are toy car tracks. Paper towel tubes, cut in half, are fine, as well, but save plenty of uncut ones for the next lesson. Aluminum foil and recycled paper can also be folded to make a marble track. Demonstrate this.

Model some language. *What should we use? Let's use this! Where should we put it? Let's put it here!* Choose the first piece together with the students. Help students choose a high enough place to start the marble run, in order to get enough speed. A desk may work well. Recycle vocabulary for the classroom as you plan your starting and ending points. Attach the second and third pieces as a group, asking the questions, "What should we use," and, "Where should we put it," encouraging students to respond with, "Let's use this! Let's put it here!" Help them attach the items with tape, making sure there is enough support on top of the desk, and then criss-crossing strips of tape. If using pool noodles, it's best to attach them to each other, or to other paper, with toothpicks, poked into the foam of each noodle, or taped to a paper object.



Put students in pairs and give them easy access to scissors and tape. Let pairs choose which material to assemble and add. Assign each pair an odd number or a color. They can draw one at random from the provided cutouts. Then write the following code on the board, leaving out some of the sequence:

red – 1– _____ – 3 – yellow – 5 – green – ___ – blue – 9 – _____

Ask students to name the missing items (*orange, 7, violet*—odd numbers and the colors of the rainbow). Tell them that this will be the order of who attaches their piece to the marble run. (You can adjust the sequence according to the number of students you have.) As each pair comes up to attach their piece, help them attach it with tape as needed. Place some classroom objects such as chairs, books, backpacks, or pencil cases under the marble track to elevate it as necessary. Recycle the language, "*What should we use?", "Let's use this!". "Where should we put it?", and "Let's put it here!"* Add the question, "*What's next?"*

Test the marble run with each addition, encouraging students to chant, *Drop it on the slope, and see where it goes!* There will be opportunities for problem-solving if the marble gets stuck somewhere or falls off the track. Students can solve problems by adjusting the elevation of some parts or reinforcing attachments with more tape, or re-attaching them completely. Sing, to the tune of "Mary's Little Lamb," *Don't give up, let's try again, try again, try again, Don't give up, let's try again, We're not finished!* Teach students to sing this song every time the marble does something unexpected. As students problem-solve, encourage them to make suggestions with *let's*.

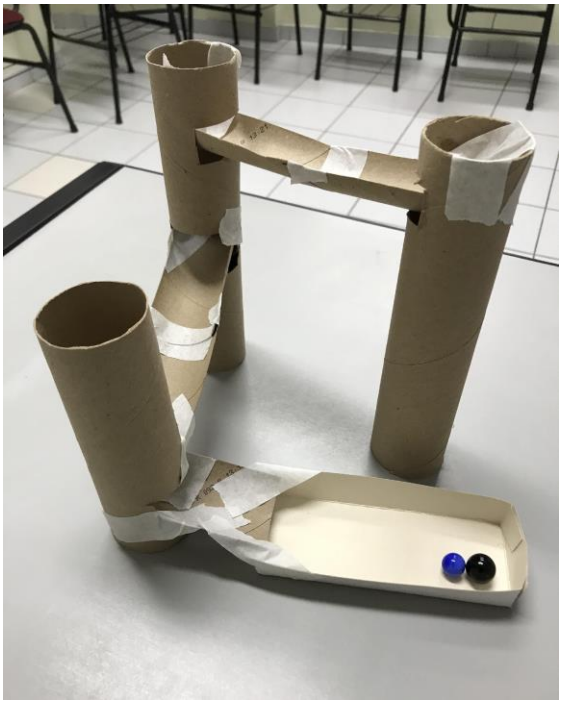
If you classroom is small and you have long pieces like pool noodles, try a zigzag shape. If your classroom is large, see how far you can get with the materials you have. Be sure to allow enough time for every student to run a marble down the finished marble run, experimenting with different size marbles. You might have each one draw a number or color again, going in numerical order and/or colors of the rainbow, or sticking to the same code as before. At the end, clean up and save the pieces to be assembled differently in the next lesson. Tell students they will do something different with slopes and marbles next time. Encourage students to help each other put away their belongings by saying things like, "*Is this your book/backpack/pencil case?" " Yes, thank you!"*

Lesson 2

Gather students together, and review vocabulary. Ask "What's this?" *(A marble.)* "What color is it? What does it do?" *(It rolls.)* Demonstrate it rolling on a piece of the tracks from last time, and elicit the word *slope.* Say, "The slope makes it roll this way, but can we make the marble *change direction*?" Motion the idea of a direction change, and elicit the use of another piece of the track placed under the first, pointed the other way.

Today's objective is for groups of two or three to work together to make a marble run where the marble changes directions a few times. There are different ways to do this. Pool noodles or paper tubes can be taped to the wall in a zigzag pattern.

Another option is cutting slots in paper tubes standing upright, with a paper tube cut in half, inserted into each slot and reinforced by tape. Students will likely require some assistance in cutting the slots.
Provide students with plenty of toilet paper and paper towel tubes, as well as scissors and one a roll of masking tape per pair.



Another option, if there is not enough wall space, and if the challenge of a 3-D standing marble run is too much, is to simply create one similar to that of the first lesson, but in a smaller scale, and with more changes of direction, using backpacks, books, and pencil cases for elevation.

Write the following code on the board and have students figure out the missing items.

10 – violet – _____ – blue – 8 – _____ – 7 – yellow – 6 – _____ – 5 – red – _____

This time, the sequence is backwards, starting from 10 and violet. The missing items are *9, green, orange, 4*. Have student pairs draw a number or color again, but remove 1-3 from the mix. Following the sequence, one member of the pair gets to come choose an item to add to the slope. Depending on availability of materials, go through the sequence once again, letting the other member of the pair chose something the second time, continuing until all the materials (at least the ones students would probably like the best, like pool noodles) have been chosen.

Before students start, sing the "Don't Give Up" song again, and model the language for cooperation: *What should we use? Let's use this! Where should we put it? Let's put it here! It's my turn. Sure! What's next?* Make this into a chant. Clap three times while saying each expression, from "*What should we use?"* to *"It's my turn".* Then, clap once for the expression, "*Sure!"* And, for the last one, raise the intonation and stretch out the time on the first word, chanting, "*Whaaaat's next,"* with two claps. Repeat this with the students several times before they get to work.

Walk around the room and help students problem-solve. As time allows at the end, let each group demonstrate their marble run to the class. Model, *Wow, look at the marble run!* Encourage students to react similarly to each one. At the end of the lesson, keep the marble runs in a safe place until next time. If any students weren't completely satisfied with theirs, they will have a chance to make adjustments in the next lesson.

Lesson 3

As students come in, have them draw one of the number and color cut-outs. Put the following code on the board, and have students figure out the missing parts.

violet – 10 – 9 – blue – 8 – ___ – green – 6 – 5 – ___ – ___ – 3 – orange – ___ – 1 – ___
(7 – yellow, 4, 2, red)

Have students come, in that order, and take **worksheet**. The person next to them in the sequence will be their partner. (For example, violet and 10 are partners. 9 and blue are partners, 8 and 7 are partners, green and 6 are

partners, and so on.) Students add and solve the codes on the worksheet, then make their own code, indicating what colors they would like the marble run to be. They then exchange worksheets with a partner, who colors the other one's worksheet according to the code that person made.

Review with students different ways they can change the direction of a marble, reflecting on their experiences from last time. Ask them if the marble run reminds them of something from a playground. *(A slide.*) Demonstrate how a balloon with the spout cut off can be stretched over a cup or small container. What playground piece does this look like? *(a trampoline)* Invite a student to drop a marble on top to see how it bounces off. Now, take a small piece of marble track and place it at the end of and just below a larger piece, perpendicular to it. Next, place a pencil under the smaller piece to make a lever. Ask the students to identify the playground piece. *(A seesaw.)* Invite a student to roll the marble off the larger piece, so that everyone can watch which way it bounces off the seesaw. Finally, if there are some cut-off spouts of water bottles available, have a student run the marble off the larger piece, into the spout, to see how it moves. Tell students that these are called *deflectors*—they make the marble *change direction.*

Tell students that their goal is to add at least one deflector to their marble run. They will likely have to make adjustments, and perhaps re-build some of it, to incorporate the deflector. (If the playground that students made in Project 2 is still in the classroom, students might try incorporating some of those pieces into the marble run as deflectors.) Sing and chant the following: *Don't give up, let's try again, we're not finished; What should we use? Let's use this! Where should we put it? Let's put it here? What's next?*

Let students get to work and assist as necessary. Model, *Wow, look at the seesaw/trampoline/deflector!* To wrap up, have student groups demonstrate their marble run to the others, and encourage spectators to express themselves with, *Cool! Look at the marble! I like the deflector!*

Students should understand the basic principle of gravity, working with slopes and deflectors to make a marble go where they want. They should be able to collaborate and problem solve, using the expressions in the song and chant, and naming items in the classroom. They should be able to solve codes and create their own, using vocabulary for numbers and colors.

In the end, students may either keep their marble runs, or they may be disassembled and saved for other activities.

Photo credits: Danielle Hersey