SEL 2016-2017
EDCP 331
Project Plan

# Marble Tracks (Force and Motion)

## Class Description

Our main classroom is a kindergarten class of 22 students hosting a diverse group of learners who vary in ethnicity, independency, emotional expression and energy level. There is an almost equal mix of girls and boys in the class. We had one student who would join in occasionally as they were in one of the resource rooms quite often. Our observation of the students throughout the first few lessons was critical in planning for our last ones. We discovered the importance of recognizing the introverted and extroverted equally. During circle time, the students who had extroverted personalities were frequently being called on to answer questions and offer their predictions for the experiments we carried out. Due to their outgoing nature, they were quick to raise their hands and were very excited to offer their answers, often bopping up and down and waving their arms enthusiastically. It was this visibility that prompted us to call on them first without waiting for the other students to foster enough "think time" to generate responses as well. We had to adjust our perception of the class and acknowledge that some students needed to be given a longer time to consider their answers and be given the opportunity to be called on to voice their thoughts.

It was also important for us as the classroom facilitators to recognize those who work well cooperatively and with which other students they are best suited to do so with. Due to class dynamics, we had to ensure that during the hands on experimentation, which usually took place in small group settings, students were grouped together methodically. The classroom teacher emphasized that they normally sit in specific group tables because of cooperative abilities with each other and it would be a more positive experience for us if we kept them similarly. It was interesting to note that the students who were purposefully set apart from each other were also the ones who differed greatly in their emotional expression and energy level. We had one girl in particular who would cry during most of our activities, more often than not due to a perceived unfairness or inability to take turns nicely. This was a similar occasion with another boy who would become quite angry when met with the same grievances. These students were often kept away from the boisterous ones who bubbled with energy and took charge of every situation. One in particular made himself known quite quickly. He vibrated start to finish and loved being the leader of his group and the activity. This type of energy, we noticed, was built quite quickly in other students and so we learned to emphasize calm bodies, walking feet, and deep breathing strategies very fast.

Finally, our classroom is made up of diverse ethnicity and culture. We have one ELL learner of Korean descent who speaks little English and would need very explicit instruction.

Our classroom teacher advised us to define or demonstrate words very clearly during our instructions or read aloud so she could understand them. We had students celebrating Diwali one Friday and came dressed in their traditional clothing, very excited to show them off and discuss their weekend plans of celebration. A few students were eager to share their Christmas wish lists to Santa and it was interesting to discover that the kindergarten class next door was learning about Hanukkah and the dreidel.

Our time spent in this dynamic and constantly moving kindergarten classroom was so full of wonder at what they were able to discover and create. The students were all incredibly curious, driven to learn new things, and were excited about all the tactile learning. We told them that we wanted them to act like scientists for our lessons, and scientists they became.

**Rationale**

We began our inquiry project by asking the kindergartens what they were really interested in learning more about. We noticed a trend in the answers we received. Many students asked to learn about trains, race cars, airplanes and we heard "the best things" a few too many times. The one answer that everyone in the class jumped on board with was their beloved centres activity, marble tracks. Due to the high interest in other moving objects, trains, planes and automobiles, we adapted our focus to force and motion in relation to marble tracks. We created a series of lessons that allowed the students to experiment with the three main forces apparent in the movement of marbles: friction, gravity and momentum. Our final lesson closed the series with the students designing their ideal marble track taking into consideration what kinds of structures would be needed to keep the marble going. We found our lessons to be very successful with the students because they were inquiring about scientific concepts that were directly related to their everyday play with peers.

**Objectives**

The BC Curriculum objectives we intended to cover were interconnected between science and socials studies. Our curriculum Big Idea was "the motion of objects depends on their properties." This was carried throughout our lesson series. We had a few Curriculum Competencies that drew the link between socials studies and science. These competencies focus on what we had the students doing in class and were what inspired our lessons to be experimental learning. The kindergarten social studies curriculum states that students should "use inquiry processes and skills to ask question; gather, interpret and analyze ideas; and communicate findings and decisions." It also encourages students to "ask questions, make inferences and draw conclusions about the content and features of different types of sources." We connected these inquiry focuses to the science competencies that asks the students to make "exploratory observations using their senses" and to "observe objects and events in familiar contexts." Finally, the concepts and content we wanted the kindergartens to know were the "properties of familiar materials" and "the effects of size, shape and materials on movement."

**Assessment**

Our assessment of the students was done observationally as the intention behind our lessons was to have the kindergartens learn about friction, gravity and momentum experimentally. We asked the students lots of questions during our guided lesson as a way to confirm their understanding of the concepts we introduced. We encouraged them to make their own discoveries during the experiments by asking leading questions like "why do you think that one went faster\slower?" "why does the ball drop when you stop blowing?" Students were also assessed during our review periods at the beginning of each class. We reminded them of key components to the concepts through descriptive words or demonstrations as a scaffold to help them remember the scientific terminology. Finally, our last lesson was built around providing students an outlet to make connections between force and motion and marble tracks by having them design their own ideal contraption. We encouraged them to think about shape, material and direction of the tracks to create a fast and efficient ride for the marble.

**Resource Critique**

*Sheep in a Jeep*, Nancy Shaw- We used *Sheep in a Jeep* to scaffold the students understanding of momentum. While it never explicitly uses the word momentum, it was easy to make the connection between the importance of momentum to keep the jeep moving. The book was entertaining for the kindergarten class and was fun to read aloud. Many of the students joined in the reading of the story as the dialogue was repetitive and simple.

"Gravity is Falling Down," Anonymous- We used the gravity song, sung to the tune of "London Bridge is Falling Down" to teach the language behind the concept of gravity. We also used it as a brain break and had the students follow along to our actions. Again, the song is repetitive so it was easy to have the students join in. It was apparent that this song was a success in teaching gravity because two Friday's later when we asked students what gravity was they said "gravity is falling down." Big hit!

*Roller Coaster*, Marla Frazee- *Roller Coaster* was used to create real world relevance to marble tracks. We explained that roller coasters can be considered a bigger marble tracks with people as the marbles. The book was fun to read and had many great moments when you could pause and ask the students to act situations out. Examples of this included buckling their seat belts, showing their best no-noise screaming face and feeling dizzy after the ride ended.

"Roller Coaster", Go Noodle- The interactive roller coaster was a huge hit with lots of fun, movement and acting silly. However, we made a small error in our first class that we fixed in our second. At one point in the video the characters tell you to scream while you are going down a big hill. We preloaded our second class with a demonstration of what "indoor screams" sound like and asked them to use those during the screaming moments. Good body break video, however, and was relevant to our teaching that day.

## Lesson Series

**1)**

**Title of Lesson or Unit:** Force and Motion (Friction) **Grade:** Kindergarten

**Big Ideas (what students will understand)**

The motion of objects depends on their properties (science).

| Curricular Competencies (what students will do): | Concepts and Content (what students will know) |
|---|---|
| -use inquiry processes and skills to ask questions; gather interpret and analyze ideas; and communicate findings and decisions (socials)<br>-ask questions, make inferences, and draw conclusions about the content and features of different types of sources (socials)<br>-make exploratory observations using their senses (science)<br>-observe objects and events in familiar contexts (science) | -properties of familiar materials (science)<br>-effects of size, shape and materials on movement (science) |

| Materials and Technologies | Pre-Class Preparation |
|---|---|
| - 6 pieces or cardboard with either one of these 5 materials glued on (one left blank):<br>-felt<br>-plastic/laminate<br>-tinfoil<br>-sandpaper<br>-waxpaper<br>- 2 racecars | -Precut pieces of cardboard and pieces of different material, (felt, tinfoil, plastic, etc.)<br>-Set up area in the classroom to do the experiment<br>-Come up with questions to ask prior about the student's hypothesis for the experiment.(Ask again in the middle and at the end of experiment) |

**Lesson (Teacher\Student Action)**

-students sit in a circle on the carpet facing the instructors
-instructors show the 6 different surfaces and explain they are going to be used as a "race track"
-explain to students that our overall objective in learning about marble tracks, is to develop a standard that will help us create the best or ideal marble tracks track.
-in this lesson, students will learn about friction by determining which surface will be faster (2 surfaces against each other 3 times)
-after the races are performed, the class will have a brain/body break
-instructors lead discussion about friction
-what is it?
-what happened to the cars that went down the scratchy/bumpy or soft/squishy surfaces?
-why are marble track tracks the surface that they are?
-students will then break off into groups with a single surface and have a chance to test out this surface with other objects (marbles if they wish to replicate it for the purpose of marble tracks)

-students can rotate through different surfaces for the remaining time.

| **Assessment\Evaluation** | **Adaptations\Modifications** |
|---|---|
| -at the end of the lesson, ask questions during circle time about what happened in the experiment and why?<br>-ask them about new words/terms they learned today when experimenting<br>-students will have demonstrated an understanding of the concept of friction when they can describe why marble tracks goes faster on a surface like plastic versus bumpy like sandpaper. | -have the students test the car (or other objects) themselves in small groups<br>-Have materials laid out in the classroom for the students to experiment themselves without teacher having prompts, later in the class teacher can ask what different materials were out and what they learned about why some materials were better to use than others. |

**Extensions/Possible Cross-Curricular Connections**

-Applied Design, Skills and Technology
-Math: Objects have attributes that can be described, measured and compared
-Language Arts: Curiosity and wonder lead us new discoveries about ourselves and the world around us

**Statement of Enactivism**

Enactivism is embedded in our lesson through the inclusion of student driven and hands on learning and the exploration of different friction-inducing materials. The students can determine which materials are affected by the property of friction and the different surfaces that can slow down or speed up movement. It is socially interactive, connected to their daily play (marble tracks) and is relevant to their active interactions in the world. By allowing the students to make predictions and determine the results for themselves, they are learning through inquiry as well.

**2)**

**Title of Lesson or Unit:** Force and Motion (Gravity) **Grade:** Kindergarten

**Big Ideas (what students will understand)**

The motion of objects depends on their properties (science).

| **Curricular Competencies (what students will do):** | **Concepts and Content (what students will know)** |
|---|---|
| -use inquiry processes and skills to ask questions; gather interpret and analyze ideas; and communicate findings and decisions (socials)<br>-ask questions, make inferences, and draw conclusions about the content and features of different types of sources (socials)<br>-make exploratory observations using their senses (science)<br>-observe objects and events in familiar contexts (science) | -properties of familiar materials (science)<br>-effects of size, shape and materials on movement (science) |

| **Materials and Technologies** | **Pre-Class Preparation** |
|---|---|
| -"Gravity is Falling Down" song lyrics<br>-Straws<br>-Pre-cut paper circles<br>-Ping pong balls or pom-poms or tin foil balls<br>-Tape | -Gather all materials and technologies<br>-Place materials needed for building the blowers out on tables so they are ready to go (or have them easily distributable)<br>-Have circles cut out before class |

**Lesson (Teacher\Student Action)**

-students sit in a circle on the carpet facing the instructors
-instructors begin by briefly reminding students what they learned about last time (friction)
 -"What did we do to experiment or test friction?"
 -"Can anyone remember what they learned?"
-instructors then explain that they are going to learn about a new marble tracks motion
 -before defining or using the word gravity, instructors can "act out" gravity by providing examples (dropping a ball, jumping up and down) etc and then ask the students to think about what is being demonstrated
 -"what do you notice is the same about these movements?"
 -"what direction are we\the ball moving?"
 -provide a simple definition of gravity: "Gravity is a force that pulls objects toward the ground...it keeps us and everything around us stuck to Earth so we don't go floating off into space."
 -could go on to tell the popular story of how Sir Isaac Newton (maybe have a printed off picture of him) sitting underneath an apple tree.
 -ask the class, "what do you think happened to him while he was sitting underneath the apple tree?" (talk to your neighbour?)
 -when an apple fell and bonked him on the head, he decided to learn more about why the apple fell straight down and hit him instead of falling up or sideways.
 -this lead to the discovery of gravity and many experiments about it
-tell class that before they perform their own gravity experiments, we are going to sing a song! (also meant to be a body break)
 -have students stand up and follow along with the instructors (actions will be simple enough to mirror) (introduction and teaching approx. 15 minutes)
-following the song, students will be asked to move to their table spots where the two instructors will split themselves up so that they each have approximately half the students to manage during the experiment (can be adjusted to better suit classroom space etc)

-instructors will show the students what they are going to be making
-before explaining how it works, ask the students to think about what will happen when they blow through the straw, and what will happen when they stop
  -could ask for volunteers to offer what they think will happen
-then students will begin making their own blower step by step with their group (also modeled with the instructor creating a new one):
  -first, wrap the paper circles around so they become a funnel
  -then, attach a piece of tape to secure the shape
  -poke a small hole at the tip of the funnel and insert the straw on the short end
  -secure the straw with tape
  -place ball inside the funnel and blow through the other end of the straw
-students will have the remaining class period to experiment with their blowers (experiment 25 mins)
-class will end with a return to the carpet as a transition for the classroom teacher to take over

| **Assessment\Evaluation** | **Adaptations\Modifications** |
|---|---|
| -Observational assessment: students will have a good understanding of gravity when they can demonstrate how gravity works either by answering questions, showing what happens when you stop blowing through the straw, or by making other connections to gravity in our world (what happens in space? etc) | -Adaptations could include extra instructor support creating the students' gravity blowers |

**Extensions/Possible Cross-Curricular Connections**

-Applied Design, Skills and Technology
-Math: Objects have attributes that can be described, measured and compared
-Language Arts: Curiosity and wonder lead us new discoveries about ourselves and the world around us

**Statement of Enactivism**

Enactivism is embedded in our lesson through the inclusion of student driven and hands on learning and the exploration of how blowing through the straw acts as anti-gravity. The students can determine that when they blow the ball stays afloat but as soon as they stop it falls back down into their net. This demonstrates to them how gravity is natural and needs to be worked against to stop. It is socially interactive, connected to their daily play (marble tracks) and is relevant to their active interactions in the world. By allowing the students to make predictions and determine the results for themselves, they are learning through inquiry as well.

**3)**

**Title of Lesson or Unit:** Force and Motion (Momentum) **Grade:** Kindergarten

**Big Ideas (what students will understand)**

The motion of objects depends on their properties (science).

| **Curricular Competencies (what students will do):** | **Concepts and Content (what students will know)** |
|---|---|
| -use inquiry processes and skills to ask questions; gather interpret and analyze ideas; and communicate findings and decisions (socials)<br>-ask questions, make inferences, and draw conclusions about the content and features of different types of sources (socials)<br>-make exploratory observations using their senses (science)<br>-observe objects and events in familiar contexts (science) | -properties of familiar materials (science)<br>-effects of size, shape and materials on movement (science) |

| **Materials and Technologies** | **Pre-Class Preparation** |
|---|---|
| -Rulers, marbles, textbooks and cards<br>-Tape or sticky notes to mark movement<br>- Storybook | -Gather all materials and technologies |

**Lesson (Teacher\Student Action)**

(Students will begin by sitting in a circle)

**1)Introduction: Momentum activity (5-7 mins)**

-Review of who we are

-Tell the students to all stand up (in a circle) and have them all hold hands

-Do demo of arms going up and down while still holding your neighbor's hands (reminder to be gentle, and calm in the circle and with neighbor)

-Begin exercise and have students continue to move their arms up and down (start slow, and add speed) to imitate momentum

-Afterwards, have students sit back on their spots in a circle to begin the lesson (Listening ears on, and hands in lap)

**2) Lesson on Momentum: Read Aloud (10 mins)**

-Let students know that we will be learning about Momentum

-Have students repeat the word (momentum), and also give thinking time about what they think momentum may be? What kind of connections can they make from the exercise done and momentum?

- Have students raise hands to answer the questions

- Begin read aloud if applicable

- give definition of momentum: "momentum is mass in motion....we can see it everyday when we watch things move! We can increase the momentum of an object by either increasing its weight, or its speed. We need momentum in marble tracks to keep the marble moving."

**3) Brain Break: Electricity (5 mins)**

- everyone is in a circle and holds hands, a student/or teacher starts a pulse by gently squeezing their neighbor's hand, and when the neighbors feels the pulse, they also squeeze their neighbor's hand. The objective of the game is to see how fast we can get the pulse around the circle.

**4) Experiment time: Multiple exploration tables/centers (15 mins)**

**Rulers and marble**

- Before having students begin experimenting, demo what the activity will look like first:
- Have a marble sit on top of the ruler and in the middle
- To begin, place one end of ruler on 1 textbook and let the marble roll down until it pushes the card
- Place a sticky\tape to mark how far the card was pushed forward.
-Tell students that they can continue to stack books one at a time to notice if having a steeper hill (and therefore more speed) will push the card back further
- Split students up based on their table groups and have one instructor help facilitate each group\table

**5) Clean up: ( 5 mins)**

-Have students stop what they are doing and gain attention, to tell students it's time to clean up, tell students they must be calm and focused during clean up time. Once, done they can sit on the mat.
-Once seated in a circle, have students show by using thumbs if they liked the experiment
-Ask them to think about how momentum is useful for marble tracks...if we want the marble to move faster are we going to have flat surfaces or steep ones? Should we have one "drop" or lots throughout?
-Have them quiet down for the teacher to take over

| **Assessment\Evaluation** | **Adaptations\Modifications** |
|---|---|
| -Observational assessment: students will have a good understanding of momentum if they can demonstrate with their own bodies or other materials what momentum looks like. They should be able to consider or answer questions about momentum and connect it to other parts of their life. | |

**Extensions/Possible Cross-Curricular Connections**

-Applied Design, Skills and Technology
-Math: Objects have attributes that can be described, measured and compared
-Language Arts: Curiosity and wonder lead us new discoveries about ourselves and the world around us

**Statement of Enactivism**:

Enactivism is embedded in our momentum lesson through the inclusions of student experimentation and exploration in a social and play based setting. They have the opportunity to participate in a trial and error experience allowing for authentic and student-driven conclusions and ideas of what momentum is. This setting facilitates students' ability to make relevant and thoughtful connections to their everyday play experience with marble tracks. We have added a kinetic portion to our lesson in order for the learners to physically create momentum by using their hands to connect with their peers.

**4)**

**Title of Lesson or Unit:** Force and Motion (Marble Tracks) **Grade:** Kindergarten

**Big Ideas (what students will understand)**

The motion of objects depends on their properties (science).

| **Curricular Competencies (what students will do):** | **Concepts and Content (what students will know)** |
|---|---|
| -use inquiry processes and skills to ask questions; gather interpret and analyze ideas; and communicate findings and decisions (socials)<br>-ask questions, make inferences, and draw conclusions about the content and features of different types of sources (socials)<br>-make exploratory observations using their senses (science)<br>-observe objects and events in familiar contexts (science) | -properties of familiar materials (science)<br>-effects of size, shape and materials on movement (science) |

| **Materials and Technologies** | **Pre-Class Preparation** |
|---|---|
| -*Roller Coaster* by Marla Frazee<br>-Go Noodle Roller Coaster<br>-Sheets of paper (11 x 17 OR 8.5 x 14)<br>-Pencils, pencil crayons and crayons<br>-Pictures/samples of roller coasters | -Gather all materials |

**Lesson (Teacher\Student Action)**

(students will begin by sitting in a circle)

**Introduction (3 mins)**

-Review the three forces we have learned about in relation to marble tracks
-Tell students that for their final marble tracks lesson, they will be designing their own marble tracks
-First, going to talk about another real life example of marble tracks, roller coasters

**Read Aloud Activity (10 mins)**

-Have students sit in rows (remind them to listen carefully and look at the different roller coaster designs, make sure to keep our bodies to ourselves)

**Go Noodle Body Break (5 mins)**

-Play roller coaster go noodle (koo koo kangaroo)
-Will need to do a deep breathing or other calm activity after as the video is very high energy

**Activity: Create your own Marble Tracks (17 mins)**

-Give each student their own blank sheet of paper, pencil crayons, and crayons
-Student works independently drawing their own marble track on the paper

**Clean up time (5 mins)**

-Have students stop what they are doing and gain attention, to tell students it's time to clean up, tell students they must be calm and focused during clean up time. Once, done they can sit on the mat.
-Once seated in a circle, have students show by using thumbs if they liked drawing out their own roller coaster

| **Assessment\Evaluation** | **Adaptations\Modifications** |
|---|---|
| -Observational assessment: students will have a good understanding of friction, gravity, and momentum by being able to apply those words and consider the three forces while making their own roller coaster. They will be able identify marble tracks and roller coasters and have a connection. | |

**Extensions/Possible Cross-Curricular Connections**

-Applied Design, Skills and Technology
-Math: Objects have attributes that can be described, measured and compared
-Language Arts: Curiosity and wonder lead us new discoveries about ourselves and the world around us

**Statement of Enactivism**

Enactivism is embedded in our lesson through the creating of the students' own ideal marble tracks. Our lessons prior have been constructed around this final idea and were designed to offer the students the tools (force and motion) needed to create a great marble track. We chose to relate marble tracks to a larger scale model, the roller coaster, as a way to connect their learning to the outside world and add more relevancy. Their marble tracks creations are student designed and crafted (drawn) and are based off of their own individual learning, imagination and wonder.