Fair-Is-Wheel Fun

A Fifth/Sixth Grade Science Unit Focused Around Forces and Motion

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Introduction

Rationale

This unit was planned and designed around the idea of building with LEGO bricks. These childhood toys have come a long way in the past few years. LEGO Education has designed numerous kits for classrooms to get students thinking outside the box and assuming the roles of engineers.

The skills students will take away from this unit are building and programming with LEGO bricks and software, presenting in front of a panel of professionals and peers, and creating three-dimensional models of ideas from their imaginations. Students will do this by blueprinting an amusement park ride on paper with a small group. Then they will create their ride with LEGO bricks, making sure it moves directionally. Students will also program their ride using LEGO WeDo software. Finally, students present their final products in front of teachers and students, giving the effect of a real-live panel.

Fair-Is-Wheel Fun not only teaches students how to build with LEGO bricks and program them to move, but it also teaches them content knowledge. Students will learn about forces and motion all while engaging in an engineering experience. Throughout the course of the unit, students will understand what force is, examples of force, how it can be applied, and what strengthens and weakens a given force. Students will also learn how force affects the motion of an object. This will be shown through their LEGO rides. Other content related terms they will learn are inertia, centrifugal force, centripetal force, gravity, friction, and resistance. Content will be taught and learned through video clips, demonstrations, experiments, lecture, and group work.

The idea is that students will be able to place themselves in the role of an amusement part engineer. They will build a ride of their choice, get it to move by itself by programming it, and present to a panel/board as engineers who wish for their ride to be chosen. By putting them in the role of a park engineer, they are able to see what kinds of challenges people in this field face on a daily basis. This gives them a real-world experience on a smaller, more engaging scale all while teaching them content knowledge. By doing this, students ultimately understand the concept of invention and will learn how exploration is the key to uncovering or creating an invention of their own.

Differentiation for Gifted Learners

This entire unit is designed for gifted learners in a pullout setting. Below are the specific dimensions of differentiation from the unit, which are designed to meet the needs of gifted and talented students. You will find the features of differentiation in *italics* (complexity, challenge, depth, creativity, and acceleration).

CONTENT: The content presented uses expansive vocabulary and presents theories that gifted students would be able to understand and use. While fifth and sixth grade science

standards only require teaching force and motion on a basic level, this unit *dives deeper into these terms (depth)* by bringing in *Newton's Laws (acceleration)*. These theories are later taught in early high school courses.

PROCESS: The process of coming up with an amusement park ride requires *trial and error (this poses a challenge)*. Gifted students thrive from a challenge, which is exactly what they'll get in this unit! While their ride may work when pushed by their hand, it may not program. Students will have to work through why it doesn't program, where their problems are, and how they can fix them. The *programming streams* can get quite lengthy and difficult *(complexity - discovering why it doesn't work and how to fix it).* There will be no models, examples, or scaffolding available. They must use their group members and brains! Also, this unit begins with two lessons that are PBLs. This type of lesson speaks to gifted learners because they enjoy the challenge of researching the problem and discovering ways to fix it. This is a very complex way of learning suitable for gifted students.

PRODUCT: Their product requires *creativity*! This is an area most gifted students thrive in. They will not be allowed to simply copy a ride they found on the Internet. They must *blueprint and build something brand new*, name it, and give reasons why it is the best ride. These specifications are laid out in their performance task.

ENVIROMENT: For the majority of this unit, students are split into small groups. Rather than the teacher feeding them most of the information, they are walking themselves through videos, exploring ideas on the Internet, and crafting a ride solely from their imagination. Their small group peers are the main source of collaboration, ideas, and facts. This puts them in charge of their own learning, a style best suited for gifted students as it challenges them and activates deeper thinking.

All in all, this PLB and Questioning themed unit is right up a gifted student's alley. They will challenged in ways they've never experienced all while having fun playing and learning with LEGO bricks!

Gifted Population Intended

While this unit could be used with any group of gifted students, it is specifically designed for students in high socio-economic school systems. The reasoning behind this is due to the amount of resources needed to create the builds. Students should be in groups of 3-5 for this unit and each group will need one LEGO StoryStarter kit, one LEGO WeDo 3595 kit, and one LEGO WeDo 3590 kit. They will also need some sort of Laptop or device where the WeDo software can be installed and a simple USB cord can be attached to program the ride. This unit could also be used in Title IV schools or systems due to the fact they receive more money for supplies. The school where I currently teach is Title IV and those funds were allocated and used for the LEGO kits, software, and computers. All other supplies for the unit were purchased at WalMart for under $15. Those supplies are only necessary for the experiments in lesson two.

This unit is also designed for students with high creativity skills and good work ethic with other peers and group members. As stated above, the product requires a high level of

creativity with lots of areas where trial and error are necessary. Students are in groups most of the time during these lessons so it is vital they are social and work well with others.

Gender and race are not critical factors in the implementation of this unit. From personal experience, I had a mix of races as well as a perfect half and half ratio of males to females when this unit was first taught. Neither gender nor any race outshined or overdid the other. As long as students are eager to work together to solve the problem given on the performance task, the unit is great. While this unit is designed for fifth and sixth grade students, it could be used as low as fourth grade and as high as seventh grade. Late elementary to early middle school are the target age groups for the content presented.

Goals and Outcomes

Content Goals and Outcomes

Goal 1: To develop understating of force, motion, and the relationship between them.

Students will be able to…

A. Locate and explain the areas of force, motion, friction, and resistance in their builds with and without programming as well as in real life examples.
B. Compare and contrast the forces and motions of their rides with and without programming as well as examples in real life.
C. Examine the roles of engineers and how their job relates to the theories of force and motion as found in Newton's Laws.
D. Predict the effect of a given force or a change in mass on the motion of an object.

Process Goals and Outcomes

Goal 2: To develop problems solving skills with a tie in to science/engineering.

Students will be able to…

A. Collaborate with peers about ways to solve a given problem.
B. Make inferences based on evidence and definitions.
C. Formulate a plan and back it up with reasons, evidence, and facts.
D. Agree upon a structured and detailed plan as a group to solve a problem.
E. Implement the plan in a creative and inventive fashion.
F. Present a final product to a panel and peers in a professional manner.

Concept Goals and Outcomes

Goal 3: To understand the concept of invention.

Students will be able to…

A. Research and explore other inventions around the world to use as examples for their own.
B. Create their own invention that meets the requirements initially given.
C. Present their invention to a board, panel, and/or peers.
D. Explain how their invention is unique and creative.
E. Transfer their knowledge and understanding of exploration to their invention.

Assessment Plan

Along the course of the unit, the instructor will be asking a plethora of questions to check for understanding. One of the lesson plans, day three, is specifically designed around questioning. Questions in the lesson plans themselves check for understanding of vocabulary (force, motion, gravity, resistance, friction, centrifugal and centripetal force) as well as how the terms are related and intertwined. By the end of the unit, students should have a working, programmed ride. This will show understanding of the terms force, motion, gravity, mass, friction, and resistance, and also their understanding of the programming software and how their ride is engineered.

Below are other examples of formative and summative assessments used throughout the unit. They will check for understanding of content (terms, vocabulary), process (how they're coming along on their ride), product (their programmed, working ride), and concept (the relationship between the two overarching concepts).

Formative Assessments

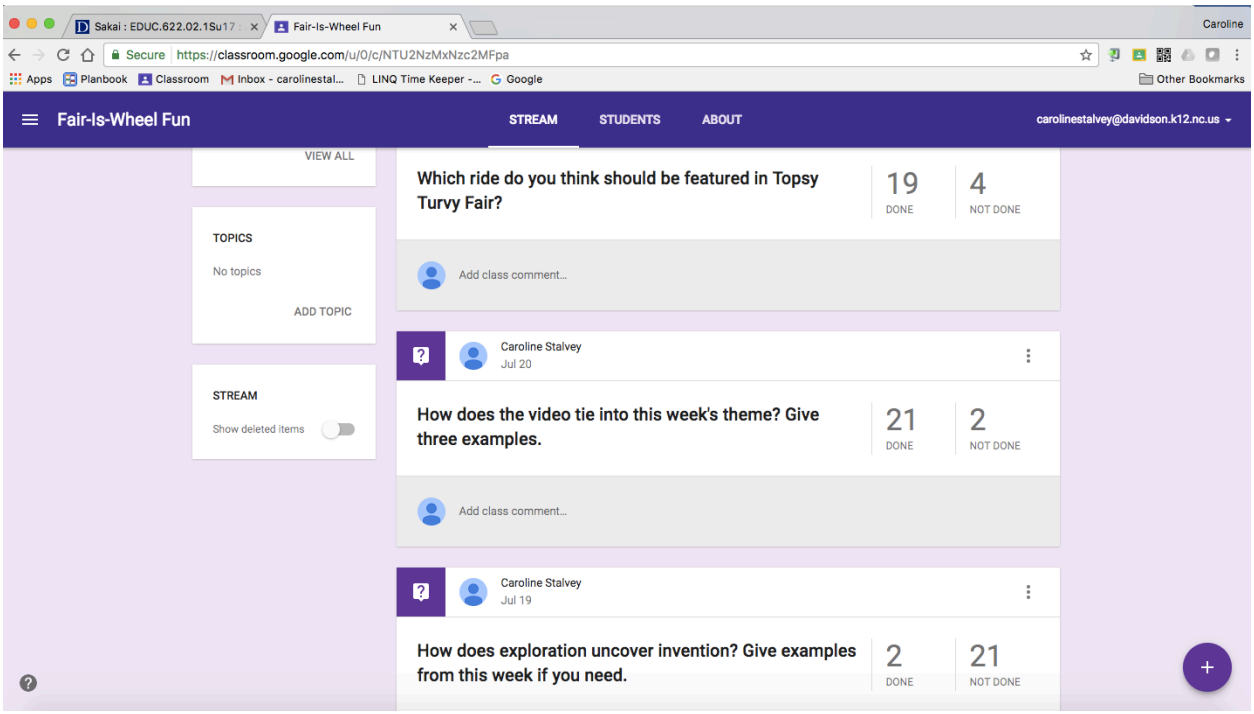
- Students will respond daily to questions on Google Classroom. Below are examples of questions asked:
    - *How does the video tie into this week's theme?*
    - *How does force affect motion?*
    - *Which ride was the most attractive and why?*
- Students will also be given vocabulary sheets that check for early understanding of the terms. Without this understanding, the rest of the unit is quite difficult. An example of a completed vocabulary-understanding sheet is on the next page.

Summative Assessments

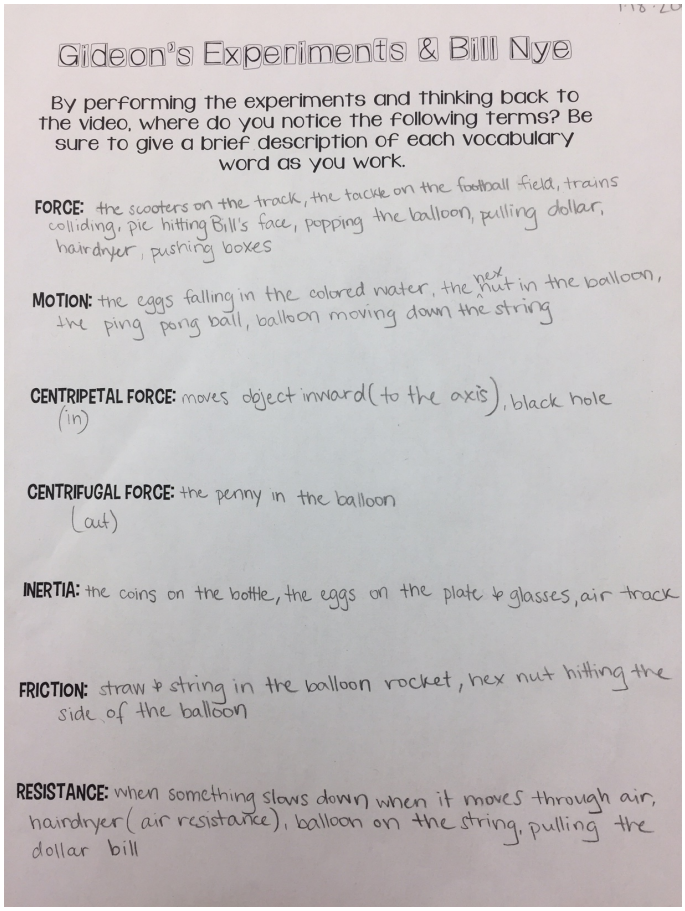
- Performance Task - students will be presented with a problem and be put in a real-world role. They will be asked to use the remainder of the week to work on their solution or product. Their product and presentation will show their ultimate understanding of the content and concept.
- Attraction Proposal Sheet - This sheet takes the whole week to work on and shows their understanding of how the vocabulary terms tie into their product. These will help them with their final presentation. You will find a completed proposal sheet on the following page.

Attached on the following pages are examples of the above formative and summative assessments from the Davidson County AIG Camp.

Google Classroom Questions



Vocabulary Sheet



Gideon's Experiments & Bill Nye

By performing the experiments and thinking back to the video, where do you notice the following terms? Be sure to give a brief description of each vocabulary word as you work.

FORCE: the scooters on the track, the tackle on the football field, trains colliding, pie hitting Bill's face, popping the balloon, pulling dollar, hairdryer, pushing boxes

MOTION: the eggs falling in the colored water, the hex nut in the balloon, the ping pong ball, balloon moving down the string

CENTRIPETAL FORCE: moves object inward (to the axis), black hole (in)

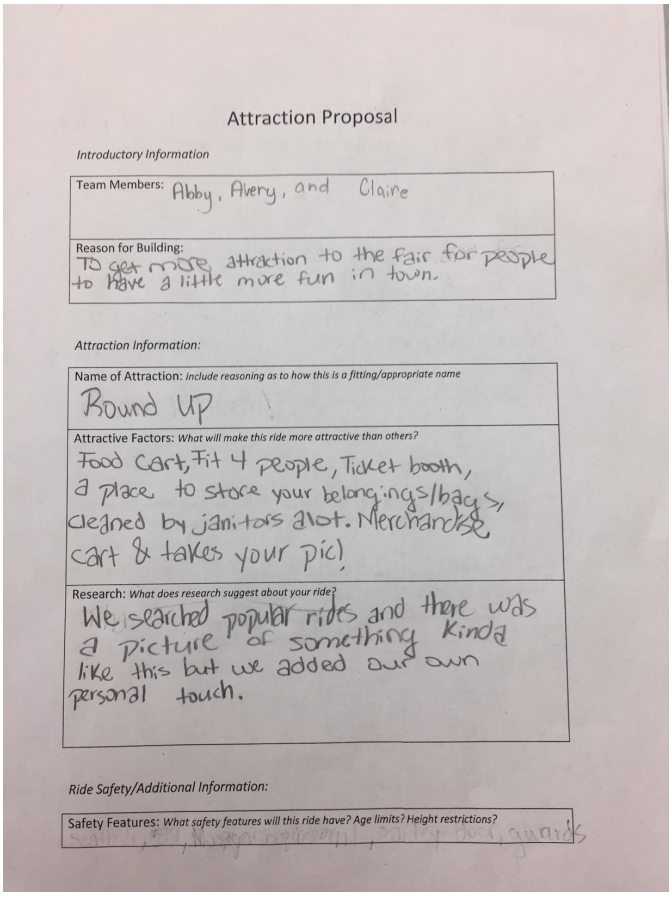
CENTRIFUGAL FORCE: the penny in the balloon (out)

INERTIA: the coins on the bottle, the eggs on the plate & glasses, air track

FRICTION: straw & string in the balloon rocket, hex nut hitting the side of the balloon

RESISTANCE: when something slows down when it moves through air, hairdryer (air resistance), balloon on the string, pulling the dollar bill

Attraction Proposal



Attraction Proposal

Introductory Information

Team Members: Abby, Avery, and Claire

Reason for Building: To get more attraction to the fair for people to have a little more fun in town.

Attraction Information:

Name of Attraction: *include reasoning as to how this is a fitting/appropriate name*
Round Up

Attractive Factors: *What will make this ride more attractive than others?*
Food cart, Fit 4 people, Ticket booth, a place to store your belongings/bags, cleaned by janitors alot. Merchandise cart & takes your pic)

Research: *What does research suggest about your ride?*
We searched popular rides and there was a picture of something kinda like this but we added our own personal touch.

Ride Safety/Additional Information:

Safety Features: *What safety features will this ride have? Age limits? Height restrictions?*

Lesson Plans

The four lesson plans attached are designed to be taught in four consecutive days. On the first day, students will be given an icebreaker challenged, which is written in for the purpose of students getting to know each other. If this lesson takes place in a classroom setting where students are already acquainted, this piece can be omitted. They will then get into the performance task and the planning of their attraction or ride.

The second day, students begin to experiment with the vocabulary words using basic, household items. Video links are attached to help students understand the terms and how the experiments work. Time for building is also set aside.

On day three, students begin to program their rides. This requires lots of trial and error as the programs they first try often don't work or they get ideas from seeing other groups. A neat idea I found was to appoint group captains that can go around and "steal" ideas from other groups. This gives struggling groups a chance to catch up as well as boosting the confidence of groups who have really interesting ideas.

Finally, day four is when students finish up their rides and present them to the class. Instructors can choose to present their own ride for scaffolding and modeling purposes or dive right into the students' presentations. Other options are passing out poster paper to give students the chance to make a visual or requiring them to have a "theme" with their ride (pirates, BMX, etc.). As a rule of thumb, allow at least 30-45 minutes for students to disassemble their rides and put the LEGO pieces back in the correct kits.

Below are the four lesson plans and all documents that are incorporated with each day. Work samples are all also attached as well as photographs of students' rides.

TEACHER NAME	Lesson #
Caroline Stalvey	1

MODEL	CONTENT AREA	GRADE LEVEL
Problem-Based Learning	**Science**	**5/6**

CONCEPTUAL LENS	LESSON TOPIC
Invention	**Forces and Motion**

LEARNING OBJECTIVES *(from State/Local Curriculum)*

Grade Five - Goal 1 (Forces and Motion)

- 5.P.1.1 Explain how factors such as gravity, friction, and change in mass affect the motion of objects.
- 5.P.1.2 Infer the motion of objects in terms of how far they travel in a certain amount of time and the direction in which they will travel.

THE ESSENTIAL UNDERSTANDING *(What is the overarching idea students will understand as a result of this lesson?*	THE ESSENTIAL QUESTION *(What question will be asked to lead students to "uncover" the Essential Understanding)*
Exploration uncovers invention	***How does exploration uncover invention?***

CONTENT KNOWLEDGE (What factual information will students learn in this lesson?)	PROCESS SKILLS (What will students be able to do as a result of this lesson?)
• Invention is when someone creates something new or makes radical change to something old • Gravity is an invisible force that keeps objects grounded here on Earth • Force can be seen in multiple ways (weight, gravity, push, etc.) • Motion is the movement of an object • Ride popularity is based on the number of people who frequent the ride and wait times for the ride	• Solve a problem on their own • Collaborate with peers to solve a problem • Create a ride affected by force • Create a ride that has motion • Research or explore real-world rides/attractions • Identify areas and elements of force

GUIDING QUESTIONS

What questions will be asked to support instruction?
Include both "lesson plan level" questions as well as questions designed to guide students to the essential understanding

Pre-Lesson Questions:	During Lesson Questions:	Post Lesson Questions:
▪ What do you know about fairs or amusement parks? ▪ What makes a ride a "big hit?" ▪ What is gravity? ▪ How would you define gravity in your own words? ▪ What do you know about force and motion? ▪ How do people solve problems in today's society, especially scientists?	▪ What is going on in the slideshow? ▪ Why do you think failure is happening in those fairs? ▪ Where is the force in this ride? ▪ What would happen if the force were removed/added? ▪ What is the problem at large here? ▪ In what ways can you solve the problem? ▪ How would working as a team help you solve this problem? ▪ How would invention help us with this problem? ▪ What kind of ride are you planning to create?	▪ What did you learn about force? ▪ What did you learn about motion? ▪ What did you notice in your research or exploration of popular or "hit" rides? ▪ Why do you think your ride will be successful? ▪ Where would your ride have the most force applied and what would the factor of the force be? ▪ What do you think will make your ride more successful than others? ▪ How does exploration uncover invention?

DIFFERENTIATION *(Describe how the planned learning experience has been modified to meet the needs of gifted learners. Note: Modifications may be in one or more of the areas below. Only provide details for the area(s) that have been differentiated for this lesson.*			
Content	**Process**	**Product**	**Learning Environment**
	Students will be working together with one another to come up with an invention and ways to change it to solve our PBL problem.	**Students will be able to use creativity in their own inventions. They will use research to determine which types of rides were big hits and design their own ride (rather than being given a ride to make on their own). These are original works.**	

PLANNED LEARNING EXPERIENCES

(What will the teacher input? What will the students be asked to do? For clarity, please provide detailed instructions)

Engage and Connect - *This phase focuses on piquing students' interest and helping them access prior knowledge. This is the introduction to the lesson that motivates or hooks the students.*

- Icebreaker! Students will use the LEGO StoryStarter kits to build something that best describes them. They will have about 10 minutes to build and then we will quickly go around and present. Students are to say their name, their age/grade level, where they go to school, and what they built. They will be explaining how their build describes them as a student/person.
- I will briefly talk about the goals of this course and what fun activities we have in store.

Explore - *In this phase, the students have experiences with the concepts and ideas of the lesson. Students are encouraged to work together without direct instruction from the teacher. The teacher acts as a facilitator. Students observe, question, and investigate the concepts to develop fundamental awareness of the nature of the materials and ideas.*

- Students will see a silent slideshow of old, rundown, deserted, or failed fairs/amusement parks. They will be given three sticky notes. Students are to come up with three causes for the pictures they see. They will have about five minutes to do this and then we will share.

- Students will be presented with a problem/performance task that we will talk about together. This should get students in the mindset that they are inventors. They should be able to connect with the problem and start analyzing solutions while we discuss. I will hand out a flyer with the problem on it.

- Performance Task: *Topsy-Turvy Fair has been the ultimate thrill ride and family attraction for decades. However, recent years have shown a decline in ticket sales. Surveys have shown this is due to the same-old, boring rides. We need your help! Ferris Wheels, Merry-Go-Rounds, and Slides aren't enough to keep our business going. As new, up-and-coming inventors, create a new ride for our fair that will not only be a major hit among all thrill seekers, but will also raise our ticket sales.*
  Remember to work together with your team of inventors, create the moving and programed ride, and present it to the Executive Board of the fair for approval using an evaluation rubric and points system. You could be part of the team that saves Topsy-Turvy Fair!

- After reviewing the flyer and reading through the problem, students will be grouped based on their presentations from the ice-breaker (who seems like they will work best together/what they have in common) into groups of 3 to 4. They will begin researching popular rides and gathering ideas of a type of ride they want to build. Once they have an idea, they will draw up the plans (almost creating a blueprint or 2D model of what they will later build - this is a two day lesson to completely design and build).

Explain - *Students communicate what they have learned so far and figure out what it means. This phase also provides an opportunity for teachers to directly introduce a concept, process, or skill to guide students toward a deeper understanding.*

- I will show them some rides moving. Students will identify the motion of the ride as well as focus on the force(s). *Where is the largest amount of force on this ride? What would happen if the force were removed/added?*
- I will then show them a Brain Pop Jr. video that defines forces and motion. Students will talk about their experiences from class and we will tie in some real world examples. We will write the definitions on our vocabulary chart, as we will access these terms throughout the week.

Elaborate —*Allow students to use their new knowledge and continue to explore its implications. At this stage students expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them in new ways*

- Students will then share their blueprint ideas with the class. They will talk about their research findings and what they found to be popular rides. I will then ask them where force will be applied in their ride and how they think it will affect the motion. Other groups will be encouraged to ask them questions or give specific feedback.
- Students will make changes based on questions either I pose or they hear from their peers.

Evaluate: *This phase assesses both learning and teaching and can use a wide variety of informal and formal assessment strategies.*

- Students will fill out an attraction proposal form. They must give their ride a name, explain how it will move, give reasoning as to why it will be a success, and pinpoint where the majority of the force will be. I, as Fair Executor, will approve or deny their

proposals for tomorrow's building. All groups must have their proposals approved prior to building.

- Groups will be guided by these questions as they fill out their form:
  1. What is a catchy name that will attract thrill-seekers?
  2. Think of the definition of force. Where would your ride have the most force applied and what would the factor of the force be?
  3. What will make this ride more successful than others?
  4. Why do you think this ride will be approved?
  5. How did researching or exploring other rides and attractions help come up with your attraction?

- I will then ask the essential question we will use the last few minutes discussing: *Based on the exploration and research you've done today and the attractions you are planning, how does exploration uncover invention?*

Attraction Proposal

Introductory Information

Team Members:
Reason for Building:

Attraction Information:

Name of Attraction: *include reasoning as to how this is a fitting/appropriate name*
Attractive Factors: *What will make this ride more attractive than others?*
Research: *What does research suggest about your ride?*

Ride Safety/Additional Information:

Safety Features: *What safety features will this ride have? Age limits? Height restrictions?*
Other Pertinent Information: *What else does the panel need to know about your attraction?*

My signature shows my understanding of all information disclosed above. I attest that the information provided by the members of this team is accurate and true.

Member 1: _____
Member 2: _____
Member 3: _____
Member 4: _____

Performance Task

Help Wanted!

Topsy-Turvy Fair has been the ultimate thrill ride and family attraction for decades. However, recent years have shown a decline in ticket sales. Surveys have shown this is due to the same-old, boring rides. We need your help! Ferris Wheels, Merry-Go-Rounds, and Slides aren't enough to keep our business going. As new, up-and-coming inventors, create a new ride for our fair that will not only be a major hit among all thrill seekers, but will also raise our ticket sales.

Remember to work together with your team of inventors to create a moving and programed ride. By the end of the week be prepared to present it to the Executive Board of the fair for approval. You could be part of the team that saves Topsy-Turvy Fair!

Google Slides: Day 1

Welcome!

Find a seat and start thinking about things that best describe you. Just a hint, LEGO will be involved with these attributes so come up with things you could possibly build!

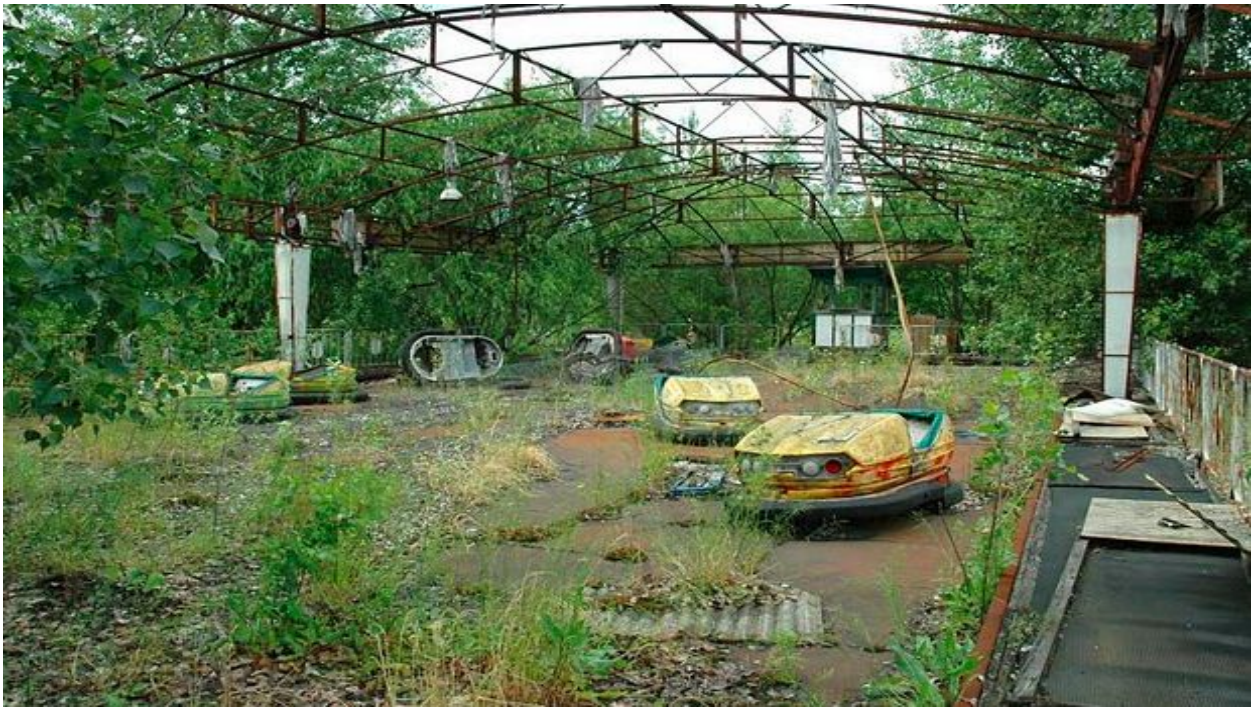
1. Name
2. School
3. LEGO build

As you view the following slides, think of a common, overall theme.

Try to come up with one word answers here!


FLASH
DANCE
FLASH
DANCE


COOL ZONE



What words were you able to come up with? What did all the slides have in common?

TEACHER NAME	Lesson #
Caroline Stalvey	2

MODEL	CONTENT AREA	GRADE LEVEL
Problem Based Learning Continued from lesson 1	Science	5/6

CONCEPTUAL LENS	LESSON TOPIC
Invention	Forces and Motion

LEARNING OBJECTIVES *(from State/Local Curriculum)*

Grade Five - Goal 1 (Forces and Motion)

- 5.P.1.1 Explain how factors such as gravity, friction, and change in mass affect the motion of objects.
- 5.P.1.2 Infer the motion of objects in terms of how far they travel in a certain amount of time and the direction in which they will travel.

THE ESSENTIAL UNDERSTANDING *(What is the overarching idea students will understand as a result of this lesson?*	THE ESSENTIAL QUESTION *(What question will be asked to lead students to "uncover" the Essential Understanding)*
Exploration uncovers invention	***How does exploration uncover invention?***

CONTENT KNOWLEDGE (What factual information will students learn in this lesson?)	PROCESS SKILLS (What will students be able to do as a result of this lesson?)
• Gravity is Earth's pull and is an invisible force • Friction is the resistance that one object encounters when moving over another • Motion is movement • Inertia is a tendancy to do nothing or remain unchanged (exists in a state of rest or uniform motion)	Students will be able to... • Define force, motion, and inertia • Conduct experiements with force, motion, and inertia • Apply different forces to their builds • Explain the affects of those different forces • Use LEGO to understand how objects move • Support the idea that friction can slow motion or movement • Work together as a team

GUIDING QUESTIONS

What questions will be asked to support instruction?
Include both "lesson plan level" questions as well as questions designed to guide students to the essential understanding

Pre-Lesson Questions:	During Lesson Questions:	Post Lesson Questions:
▪ What is gravity? ▪ How you do define friction? ▪ What are some examples of friction? ▪ What would happen in this classroom if there was zero gravity? ▪ What is causing the motion of the ferris wheel?	▪ What do you think will happen to the coins when the dollar bill is removed? Where have I applied friction? ▪ How did the experiments help you better understand force, motion, and inertia? ▪ Why is having a building team important? ▪ What have you learned so far about invention?	▪ How beneficial and crucial was teamwork? ▪ What examples of force did you apply to your build? ▪ What was the result of the added force? ▪ Where did you notice friction in your attraction? ▪ What is the motion of your attraction? ▪ How does exploration uncover invention?

DIFFERENTIATION

(Describe how the planned learning experience has been modified to meet the needs of gifted learners. Note: Modifications may be in one or more of the areas below. Only provide details for the area(s) that have been differentiated for this lesson.

Content	Process	Product	Learning Environment
	The video shown in the lesson uses advanced vocabulary. The experiments and the building with LEGO requires methodical thinkers.		**Students will be working together in teams based on their interests (from the ice-breaker yesterday). This allows for better conversation and collaboration.**

PLANNED LEARNING EXPERIENCES

(What will the teacher input? What will the students be asked to do? For clarity, please provide detailed instructions)

Engage and Connect - *This phase focuses on piquing students' interest and helping them access prior knowledge. This is the introduction to the lesson that motivates or hooks the students.*

- To begin, students will gather around my build of the LEGO WeDo Ferris Wheel. I will move the Ferris Wheel with my hands showing them the motion of the attraction and how I'm applying force with my hands. We will quickly review our vocabulary from yesterday: *force, motion, and gravity.* I will explain to them that while by build is very attractive, they would not want to copy it or do something similar because it isn't original or creative. They need to think outside the box.

Explore - *In this phase, the students have experiences with the concepts and ideas of the lesson. Students are encouraged to work together without direct instruction from the teacher. The teacher acts as a facilitator. Students observe, question, and investigate the concepts to develop fundamental awareness of the nature of the materials and ideas.*

- Students will watch a short clip of Bill Nye the Science Guy that will briefly talk to them about force and motion. This will show them real world examples of force and motion. I will then introduce our new vocabulary word: inertia.
  https://www.youtube.com/watch?v=8iKhLGK7HGk

- Students will then perform some experiments where they discuss and see first-hand what force, motion, and inertia are. Students will watch Gideon's Experiments first to understand the vocabulary. Then they will try on their own. Each group will do one experiment and present to the class so we can get to our building faster.
  https://www.youtube.com/watch?v=ILhckx1zGXw
  1. Bottle with dollar bill on top and coins stacked - pull out dollar bill (talk about inertia)
  2. Hair dryer keeping a ping pong ball in the air
  3. Balloon with penny inside - centripetal force (can use hexnut as well)
  4. Balloon attached to straw sliding down ribbon
  5. Craft sticks in a line, pick up one (kinetic energy)

- As students investigate with these experiments, they will write down their observations, explaining what they notice about each of their vocabulary terms. *Was there a new term they noticed?* They will do a 3, 2, 1 sheet that they will present to the class (3 things they found interesting, 2 things they wish to share or personal experiences/connections, and 1 question for me or the class to answer).

- Then, students will look back at their plans from yesterday on their ride attraction. With their new knowledge of force, motion, gravity, and inertia, they will begin building their new fair attraction (after executive board approval). I will give them 5-10 minutes to collaborate with their group with their new findings from the video and experiments prior to working on plans and builds.

Explain - *Students communicate what they have learned so far and figure out what it means. This phase also provides an opportunity for teachers to directly introduce a concept, process, or skill to guide students toward a deeper understanding.*

- Students will read their approved building proposal aloud to the class. They will then show the class their attraction blueprint so far. They must explain why they chose to build that ride (based on the research), how it moves, why they think it will attract thrill-seekers, and what other plans they have for the ride. *Where is the most force? What is the motion of your ride? How did the experiments help you better understand force, motion, gravity, and inertia so you could build?*

- Groups will then have the chance to get feedback from their peers or constructive criticism. Their peers will use a feedback sheet to evaluate each group. The groups will then get the sheets back (all anonymous) to use for further planning. Once all feedback is given, students will spend the next 45-60 minutes building.

Elaborate —*Allow students to use their new knowledge and continue to explore its implications. At this stage students expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them in new ways*

- Students will then apply certain weights to their build/attraction: LEGO people, dice, coins, etc. They will explain as I walk around and converse with them how the weights or the force affected their attraction and its motion.
- *What examples of force did you apply to your build? How did this affect your ride and the motion of it? Did you notice any friction on your attraction due to the weights you added? If so, explain.*

Evaluate: *This phase assesses both learning and teaching and can use a wide variety of informal and formal assessment strategies.*

- Students will then continue working on their proposal form. Based on the experiments today and the conversations about force and where it's applied, they will answer the safety components today. They will need to explain the motion of this ride and possible age limits due to the motion (fast or slow). *Is there a weight requirement on your attraction and why?*
- I will ask the essential question to see if more depth was added from yesterday: *How does exploration uncover invention?*

Peer Feedback Form

Ride Name: *Is this a good name for the ride? Would you make any changes to it?*

Positive Feedback: *What do you think are the successes of the team thus far? What points really impressed you? What will make this ride popular?*

Constructive Feedback: *What do you think the team should work on? What areas need more work? What suggestions do you have for the team/ride?*

Gideon's Experiments & Bill Nye

By performing the experiments and thinking back to the video, where do you notice the following terms? Be sure to give a brief description of each vocabulary word as you work.

FORCE:

MOTION:

CENTRIPETAL FORCE:

CENTRIFUGAL FORCE:

INERTIA:

FRICTION:

RESISTANCE:

Google Slides: Day 2

Good morning!

Grab your invention but DO NOT mess with it. Leave it on your desk.

As you complete the experiment stations, write down where you notice the following words:

FORCE, MOTION, CENTRIPETAL FORCE, CENTRIFUGAL FORCE, INERTIA, FRICTION, RESISTANCE

We will review these at the end of our 20 minute rotation. Work diligently!

You may now use this time to work on your inventions. Remember NOT to mess with the motor.

If you finish early, you may work on your proposals!

TEACHER NAME	Lesson #
Caroline Stalvey	3

MODEL	CONTENT AREA	GRADE LEVEL
Questioning	Science	Fifth/Sixth

CONCEPTUAL LENS	LESSON TOPIC
Invention	Forces and Motion

LEARNING OBJECTIVES *(from State/Local Curriculum)*

Grade Five - Goal 1 (Forces and Motion)

- 5.P.1.1 Explain how factors such as gravity, friction, and change in mass affect the motion of objects.
- 5.P.1.2 Infer the motion of objects in terms of how far they travel in a certain amount of time and the direction in which they will travel.

THE ESSENTIAL UNDERSTANDING *(What is the overarching idea students will understand as a result of this lesson?*	THE ESSENTIAL QUESTION *(What question will be asked to lead students to "uncover" the Essential Understanding)*
Exploration uncovers invention	***How does exploration uncover invention?***

CONTENT KNOWLEDGE (What factual information will students learn in this lesson?)	PROCESS SKILLS (What will students be able to do as a result of this lesson?)
• Programs cause movement and motion; therefore, making the attraciton move in any direction and speed • Force applied can slow the motion of an object • Taking away force speeds up an attraction • Small weights of force have small impacts on motion • Larger weights of force have bigger impacts on motion	• Observe other groups and gain findings from their work • Program an attraction so it moves • Write a convincing proposal • Answer questions ranging in difficulty about exploration and invention • Ask questions about force and motion

GUIDING QUESTIONS

What questions will be asked to support instruction?

Include both "lesson plan level" questions as well as questions designed to guide students to the essential understanding

Pre-Lesson Questions:	During Lesson Questions:	Post Lesson Questions:
• What do you remember about gravity, force, motion, and inertia? • What do you notice is going on? • Why do you think it's moving by itself? • What do you think the program is used for? • How do you think the program will work? • What are you excited/nervous about with your attraction and the program?	• What about my Ferris wheel do you want to include in your ride? • How did viewing my Ferris wheel help you? • Why do you think I didn't show you my program? • What are you noticing about the real world rides/attractions? • What problems have you encountered so far? • What have you learned from your group? • What objects applied the most and the least force? • What happened to the motion of the object when the force was applied? • How did the force of the object affect the program you created? • What have you learned about exploration so far? • What have you learned about	• Do you think your attraction will pass? Why or why not? • What group did you learn the most from? What findings did you notice? • What changes did you end up making? • What did you notice about exploration in this activity? • Where is the most force applied in your attraction now that it's programmed? • Imagine you are an executive board member? Would you approve your attraction? Why or why not? • You are still a board member: what ride has stood out in your mind today that you observed and why? • How does exploration uncover invention?

	invention so far?	

DIFFERENTIATION

(Describe how the planned learning experience has been modified to meet the needs of gifted learners. Note: Modifications may be in one or more of the areas below. Only provide details for the area(s) that have been differentiated for this lesson.

Content	Process	Product	Learning Environment
	Students will be given the opportunity to walk aroud and observe/explore other groups working to gain ideas. They will grapple first and then learn how the program works (trial and error). Students will be asked questions ranging in rigor, starting with basic memorization and defining questions and working up to putting themselves in someone else's shoes.	Students will be creating a product of their own design. There will be parameters and guidelines, but overall, they are in charge of inventing something of their choice. They will also be creating their own program, not one that's been pre-designed.	

PLANNED LEARNING EXPERIENCES

(What will the teacher input? What will the students be asked to do? For clarity, please provide detailed instructions)

Engage and Connect - *This phase focuses on piquing students' interest and helping them access prior knowledge. This is the introduction to the lesson that motivates or hooks the students.*

- Yesterday students came in and the Ferris wheel had been assembled and I was turning it with my hands (leading into where I was applying force). Today, students will come in and the Ferris wheel will be moving on its own. I will have programmed it using the small computers provided. This is a drag and drop designed LEGO programming system. Students will have two sticky notes where they will write down two questions about what they see.
- They will then ask one of their questions and we will talk about it as a group.
- *What do you notice is going on? Why do you think it's moving by itself? What do you think the program is? How do you think the program will work? What are you excited/nervous about with your attraction and the program?*

Explore - *In this phase, the students have experiences with the concepts and ideas of the lesson. Students are encouraged to work together without direct instruction from the teacher. The teacher acts as a facilitator. Students observe, question, and investigate the concepts to develop fundamental awareness of the nature of the materials and ideas.*

- Students will go to the back of the room and grab their attractions they've been building. Since I have already shown them my Ferris wheel and how it was programmed to move, students will finish up their attractions/rides and then open the program on the computer. They will grapple with different motions to get their ride to move. Students will use trial and error. They must program it so it moves in a reasonable speed and continuously moves without stopping after so many rotations. They will be able to watch my Ferris wheel, but will not be able to see the program I made. While they are programming their rides, I will be showing clips on the screen of other rides/attractions moving. This will give them some ideas and show them how real world rides move.
- I will ask them questions as they are building and programming: *What about my Ferris wheel do you want to include in your ride? How did viewing my Ferris wheel help you? Why do you think I didn't show you my program? What are you noticing about the real world rides/attractions? What problems have you encountered so far? What have you learned from your group? What have you learned about exploration so far?*

Explain - *Students communicate what they have learned so far and figure out what it means. This phase also provides an opportunity for teachers to directly introduce a concept, process, or skill to guide students toward a deeper understanding.*

- Students will then have the opportunity to walk around one group at a time and observe other groups. They will talk to each group and watch their programs in action. They can offer feedback, ask questions, and gather some observational data to take back to their build. We will talk about how this is another form of exploration (going around to view other fairs, get ideas of what works and what doesn't). Students will fill out a Praise/Change sheet as they walk around for each group.
- I will then show them my program and walk them through how I chose the pieces I did to place in my program stream. This means the blocks they dragged and dropped onto the program to make their ride move and turn how they want. We will talk about the types of motions our rides/attractions need and which pieces would work the best. This is where we will review *force, motion, gravity, inertia, exploration,* and *invention*. Students can also ask questions at this time (why did you choose those programs, how many programs did it take you to find what you wanted, are there any changes you would make, etc.).
- I will then ask them if there are any changes they've found they want to make and why. *What have you found didn't work when you tried programming the first time? What changes are you going to make? What did you learn from observing other groups? Are you still happy with your attraction? Do you need any assistance?*

Elaborate —*Allow students to use their new knowledge and continue to explore its implications. At this stage students expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them in new ways*

- Students will then be given about 20-30 minutes to go back and fix their rides/re-program. They must make sure they are meeting the following criteria (they will be given an Attraction Safety and Success Standards Guide (like a rubric) so they can make sure they are following the guidelines for presentation to the board.
- I will also be walking around adding force to their attraction: coins, weights, LEGO people, etc. These are simulations.
- *What affect did the force have on the motion of the ride? How did the force affect the program? What happened when I removed the force? Which object applied the most force and had the biggest effect?*
- If they finish early, they can work on the final stages of their building proposal form to make sure it is ready for presenting to the Executive Board.

Evaluate: *This phase assesses both learning and teaching and can use a wide variety of informal and formal assessment strategies.*

- Students will begin preparing their presentations in their groups. I will walk around offering feedback and suggestions. Students will be asked a series of questions while working in their groups.
- *Do you think your attraction will pass? Why or why not? What changes did you end up making? What did you notice about exploration in this activity? Where is the most force applied in your attraction now that it's programmed?*
- At the end of class, students will have a final "closure question," or our essential question: *How does exploration uncover invention?* Their assessment will be a written paragraph explaining how our essential question has gotten more complex as the days have progressed.

PRAISES

CHANGES

Google Slides: Day 3

Welcome Back to Fair-Is-Wheel Fun!

Grab a sticky note and write down 3 things you like about my invention, 2 areas I could work on, and 1 question you have for me. Place it on the 3, 2, 1 board when you are done. Then grab your proposals ONLY!

Use the next 20-30 minutes to finish your unprogrammed rides. You will present these to the class!

STOP!!!

We are now going to present our rides to the class before we program. Now is the chance to give and get feedback.

For every constructive response you give, you must follow with a positive!

PRAISES	CHANGES

You have about 20 minutes to take the feedback you got and make any changes or tweaks.

This means minor changes!

Questions for Pondering...

- How do you think my Ferris Wheel is moving?
- What attachments do you see on my invention you need to add to yours?
- Are you going to have enough room to add these attachments? How do you know?
- Where will you place the attachments on your build?
- What changes do you still need to make?
- Is the force going to be so strong on your build that your ride will not move? If so, how will you fix it?
- What motion speed does your ride need to have?
- Looking at the programming sheet, what pieces of the program stream do you think you will need to make your ride move?
- What could make my ride's motion better?
- Once your ride is programmed, where will friction be (if any)?

Get back to your inventions, start programming your rides to move. Please be careful with the equipment! If it does not move, don't try to force it!! Look back at your ride and try to determine where the friction or resistance is coming from!

Things to keep in mind today...

- Your ride MUST be complete today. NO EXCEPTIONS!!!
- Your proposal MUST be complete today. NO EXCEPTIONS!!!
- Presentations are tomorrow so make sure your ride is programmed and will work for your presentation. You need to record your programming stream so you know how to program it quickly tomorrow!

Wrap up discussion....

How does exploration uncover invention?

TEACHER NAME	Lesson #
Caroline Stalvey	4

MODEL	CONTENT AREA	GRADE LEVEL
Socratic Seminar	Science	5/6

CONCEPTUAL LENS	LESSON TOPIC
Invention	Forces and Motion

LEARNING OBJECTIVES *(from State/Local Curriculum)*

Grade Five - Goal 1 (Forces and Motion)

- 5.P.1.1 Explain how factors such as gravity, friction, and change in mass affect the motion of objects.
- 5.P.1.2 Infer the motion of objects in terms of how far they travel in a certain amount of time and the direction in which they will travel.

THE ESSENTIAL UNDERSTANDING *(What is the overarching idea students will understand as a result of this lesson?*	THE ESSENTIAL QUESTION *(What question will be asked to lead students to "uncover" the Essential Understanding)*
Exploration uncovers invention	***How does exploration uncover invention?***

CONTENT KNOWLEDGE (What factual information will students learn in this lesson?)	PROCESS SKILLS (What will students be able to do as a result of this lesson?)
• Programs cause movement and motion; therefore, making the attraciton move in any direction and speed • Force applied can slow the motion of an object • Taking away force speeds up an attraction • Small weights of force have small impacts on motion • Larger weights of force have bigger impacts on motion	• Observe presentations and gather factual information • Present findings and talk in front of a group • Write a convincing proposal • Answer questions ranging in difficulty about exploration and invention • Ask questions about force and motion

GUIDING QUESTIONS

What questions will be asked to support instruction?
Include both "lesson plan level" questions as well as questions designed to guide students to the essential understanding

Pre-Lesson Questions:	During Lesson Questions:	Post Lesson Questions:
• What have you learned about force and motion thus far? • Why do you think proposals are given before rides are built? • What would happen if project proposals or presentations weren't part of the process in real life? • What do you think happens during a proposal presentation?	• How did watching my presentation help you get ready for your presentation? • What changes do you think you need to make? • Would my invention make it as a successful ride? Why or why not? • How does invention yield to interest/attraction? • What elements of the ride would be crowd-pleasing? • What elements of the ride would not be crowd-pleasing? • What are the pros and cons?	• How has your Ferris Wheel project deepened your understanding of force and motion? • How are the two related? • How did working as a team help/hinder you? • What are the similarities and differences between your presentations and mine? • How does exploration uncover invention?

DIFFERENTIATION

(Describe how the planned learning experience has been modified to meet the needs of gifted learners. Note: Modifications may be in one or more of the areas below. Only provide details for the area(s) that have been differentiated for this lesson.

Content	Process	Product	Learning Environment
	Students will present in front of their peers for evaluation. Students will also put themselves in different roles throughout the presentation process.		Students will work and collaborate in groups, using only each other and their rubric to guide themselves for their presentation and product.

PLANNED LEARNING EXPERIENCES

(What will the teacher input? What will the students be asked to do? For clarity, please provide detailed instructions)

Engage and Connect - *This phase focuses on piquing students' interest and helping them access prior knowledge. This is the introduction to the lesson that motivates or hooks the students.*

- Students will be prompted to grab their Chrome Book and log into Google Classroom. I will then show them a short video clip of an amazing roller coaster and theme park that was created only of LEGO bricks. After watching the video, they will answer the question in Google Classroom: *How does the video tie into today's theme?* I will then hand everyone a packet that goes along with the presentations and voting process.

Explore - *In this phase, the students have experiences with the concepts and ideas of the lesson. Students are encouraged to work together without direct instruction from the teacher. The teacher acts as a facilitator. Students observe, question, and investigate the concepts to develop fundamental awareness of the nature of the materials and ideas.*

- I will review the documents in the packet and then go over what I will be doing as a presenter (so they will know for when it's their turn).
- Students will watch and listen as I present my Ferris wheel ride as an attraction and read through my proposal. Students will pretend they are members of the Fair Executive Board. They will be listening for what makes my ride a good, attracting ride and why it would make a great asset to the fair.
- They will be using/viewing the same rubric for my presentation that they will be evaluated on.

Explain - *Students communicate what they have learned so far and figure out what it means. This phase also provides an opportunity for teachers to directly introduce a concept, process, or skill to guide students toward a deeper understanding.*

- Students will be in a Socratic Seminar Circle where they will sit around as board members. They will be prompted with a question: *How does invention yield to interest/attraction?* Students will talk about how my invention will or will not produce ticket sales and give the fair the money/attraction it needs. They can use elements of the rubric as evidence. They will discuss and come up with a vote as to yes, the ride will be added to the fair or no, it will not. They must have reasons/evidence as to why the attraction will not be added to the fair.
- Questions will be placed on the board to help guide the group in their discussion: *What elements of the ride would sell? What elements of the ride would not sell? What are the pros and cons?*
- Before the seminar, students will be given instructions for how discussion is to flow: be considerate of others' comments and opinions, it is more of a conversation and not so much a debate, feed off of others' comments and questions, questions are allowed and encouraged.

Elaborate —*Allow students to use their new knowledge and continue to explore its implications. At this stage students expand on the concepts they have learned, make connections to other related concepts, and apply their understandings to the world around them in new ways*

- Once students are done with the seminar, students will go back in their groups, make any adjustments they need to tweak in their presentation, ride, or proposal, and then present to the class.
- If time allows, students will present one group at a time to me, the Executive Chairperson for the Board. If there is not enough time, students will get in groups and present to another group (group 1 presents to group 2, group 3 presents to group 4, group 5 presents to group 6 and then they will reverse). The group not presenting will act as the executive board.

Evaluate: *This phase assesses both learning and teaching and can use a wide variety of informal and formal assessment strategies.*

- If all groups have time to present, students will then pick the one ride in the class they feel would be the biggest success and defend why they think that.
- I will then ask the final essential question, *how does exploration uncover invention,* and we will talk about our answers from the first day to now (how the level of answers has deepened and gotten more complex).
- If time allows, students will take their builds apart and clear out the programs in the computer.
-

Scoring Rubric

	Needs Improvement (0 or 1 point)	Satisfactory (2 or 3 points)	Above and Beyond (4 or 5 points)
Presentation Skills and Persuasiveness	Presentation wasn't put together well. It was unclear what the group was trying to get across. Was not able to persuade to build ride. 0 or 1	Presentation was good. May have been missing a few components. It was clear what they were trying to get across. Group was able to persuade to build ride. 2 or 3	Presentation was very well put-together. Group made extremely clear what they were trying to get across. Points were clear and did a great job convincing to build ride. 4 or 5
Thrill Ride or Attractiveness	Ride is not going to be a thrill ride and will not attract many visitors to the fair. 0 or 1	Ride will be good but it is unclear as to if it will attract enough visitors to save the fair. 2 or 3	Ride will be a thrill ride. It is very attractive and will attract visitors of all kinds to the fair! 4 or 5
Comments:			

If ride does not meet criteria (at least 7 points), group must give reasons to support score:

_____

_____

_____

_____

_____

Pro and Cons Sheet

Please note the pros and the cons of the presentation. Note: when giving cons, please use this time to constructively give feedback - not just negative remarks.

**As a rule of thumb, give three positives to every constructive criticism you give.

PROs: *What did the group do that was great? What really stuck out to you?*

CONs: *What did the group do that needs work? What feedback could you give to them? What do you suggest they do differently?*

Voting Ballot

Ride Name:

YES or NO

Yes, the ride should be built or no, the ride should not be built.

Voting Ballot

Ride Name:

YES or NO

Yes, the ride should be built or no, the ride should not be built.

Voting Ballot

Ride Name:

YES or NO

Yes, the ride should be built or no, the ride should not be built.

Google Slides: Day 4

Good morning!

Welcome back to our last day of Fair-Is-Wheel Fun!

Watch the following video and tell me 3 ways it ties into this week's theme. Log into Google Classroom to complete this.

Take the next 30 minutes to program your ride, add any last minute details to it, and get it presentation ready. You are just working on the build, NOT the presentation!

Remember, we are looking for safety features, aesthetically pleasing elements, and something that sets it apart from all the other rides.

STOP!!!

You now have 20 minutes to get your presentation ready. You must use the poster paper to layout the most important aspects of your ride. Use the space wisely!

Remember to talk about...

1. Introductions
2. Ride name
3. Explain your ride
4. Safety first!
5. What sets it apart?
6. Any other cool features?

Now we need to sadly take the rides apart and get the pieces back in the correct kit. Sort the white kits if at all possible!!

Now log onto Google Classroom and complete the final two questions.

While you are doing this, we will review the results of the presentations and announce the winner!

Unit Resources

Below are the resources used to create this four-day unit and its corresponding materials. Listed below each resource is a short description of each.

Beyond the Brick. (2017, February 12). 125,000 LEGO Pieces! Jurassic Park Roller Coaster Dinosaur Amusement Park. Retrieved July 17, 2017, from https://www.youtube.com/watch?v=KrgqKrfdBlY
This video was used to hook students into the last lesson. It shows students other LEGO amusement park rides so they can compare their builds.

Daniel, J. (2013, September 04). When the carousel stops: Haunting photographs reveal abandoned New Orleans amusement park left to become overgrown wasteland. Retrieved July 16, 2017, from http://www.dailymail.co.uk/news/article-2410912/When-carousel-stops-Haunting-photographs-reveal-abandoned-New-Orleans-amusement-park-left-overgrown-wasteland.html
This website was used for its picture of the Screw Coaster for my day one slide show.

Early, M. (2014, April 24). Force and Motion - Bill Nye Clip. Retrieved July 17, 2017, from https://www.youtube.com/watch?v=8iKhLGK7HGk
Students viewed this video on day two. This was to teach them basic vocabulary terms so they could begin their experiments.

Ferris wheel. (2017, July 28). Retrieved July 01, 2017, from https://en.wikipedia.org/wiki/Ferris_wheel
I used this picture for the image on my performance task. This is a black and white picture of a ferris wheel.

Gideon's World. (2017, March 06). FORCE and MOTION | Cool Science Experiments for KIDS | Gideon's World of Science. Retrieved July 17, 2017, from https://www.youtube.com/watch?v=ILhckx1zGXw
On day two, students viewed this video for clarification of vocabulary terms and to see which experiments they would be conducting.

Hickman, M. (2017, May 31). 8 eerie, abandoned amusement parks. Retrieved July 15, 2017, from https://www.mnn.com/lifestyle/eco-tourism/photos/8-eerie-abandoned-amusement-parks/take-a-ride-or-not
I used a picture of an abandoned roller coaster on this website for the slide show shown on day one.

MailOnline, C. D. (2014, October 03). A crumbling castle, empty rollercoasters and rides at a standstill: Inside the abandoned Japanese 'Disneyland' built in the Sixties. Retrieved July 16, 2017, from http://www.dailymail.co.uk/travel/travel_news/article-2777757/Inside-abandoned-Japanese-Nara-Dreamland-Theme-Park-built-Sixties.html
This website was used for its picture of an abandoned Japanese theme park ride. This was used in my slide show on day one.

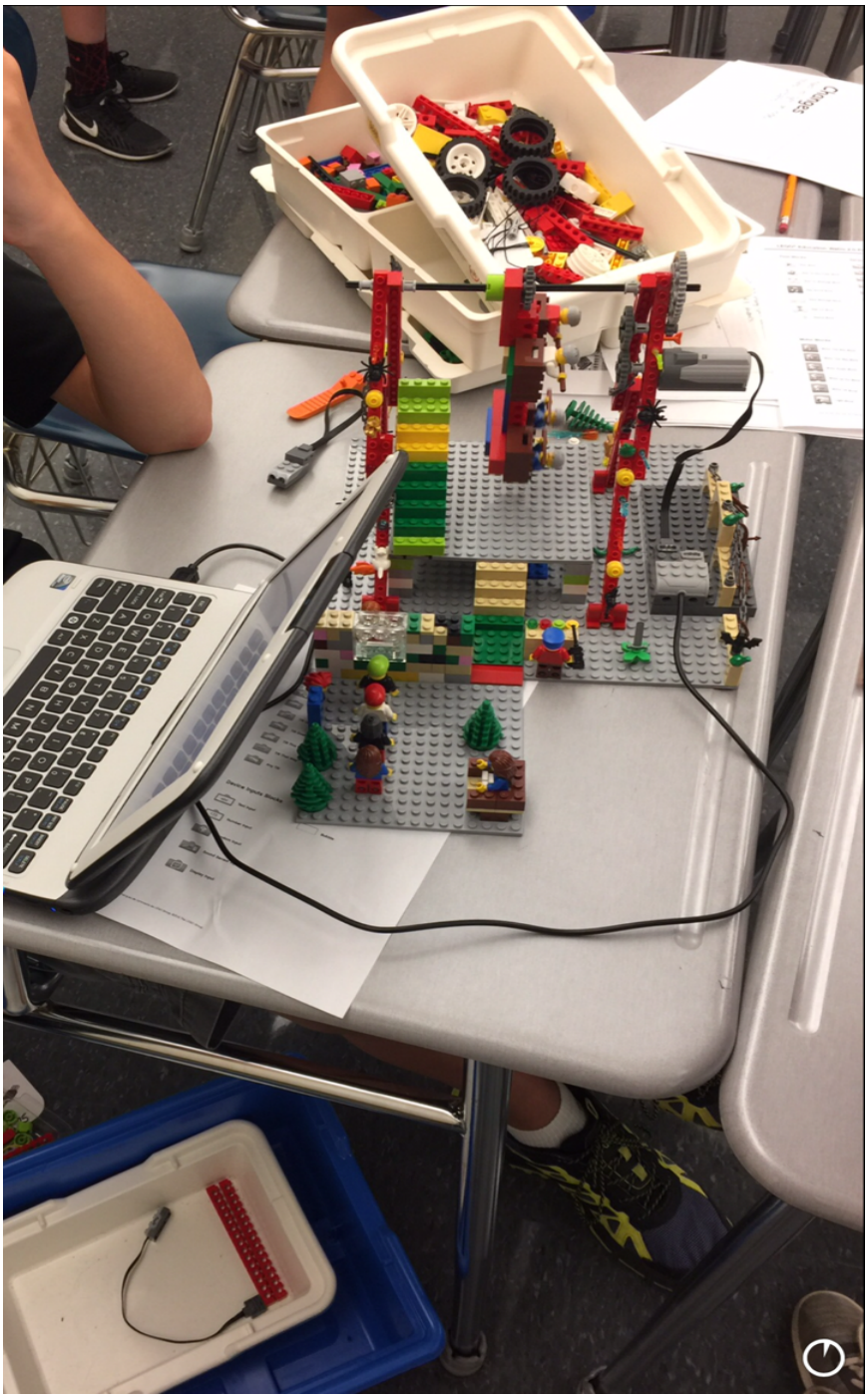
T. (2013, October 20). Lego World Utrecht 2013: Circus and fun fair. Retrieved July 25, 2017, from https://www.youtube.com/watch?v=bLyS2cPP1Tw
I was able to screen shot a picture of this video to use on the front cover of my unit.

21 creepiest abandoned amusement parks. (n.d.). Retrieved July 16, 2017, from http://www.latimes.com/travel/themeparks/la-trb-21-creepiest-abandoned-amusement-parks-20140225-htmlstory.html
I used three photographs of old abandoned amusement parks for my slide show on day one.

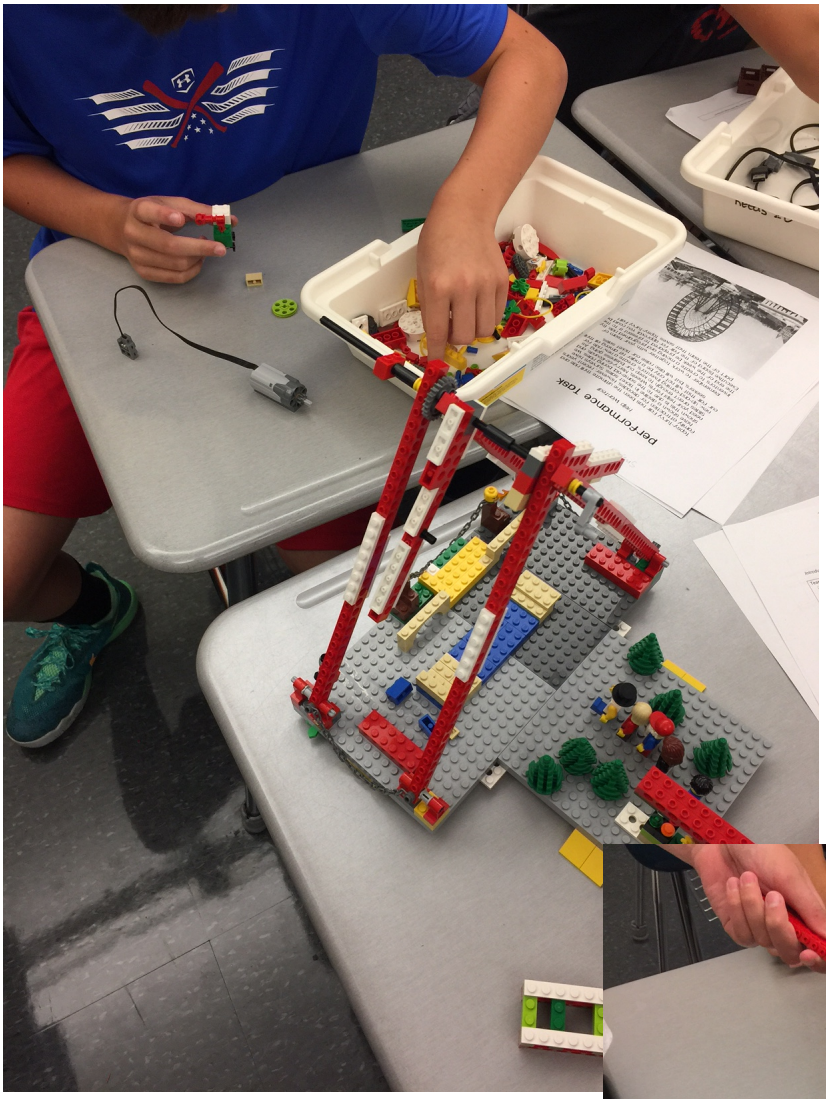
All other photographs were taken from my practicum experience on my iPhone and uploaded.

Photographs from Practicum Experience

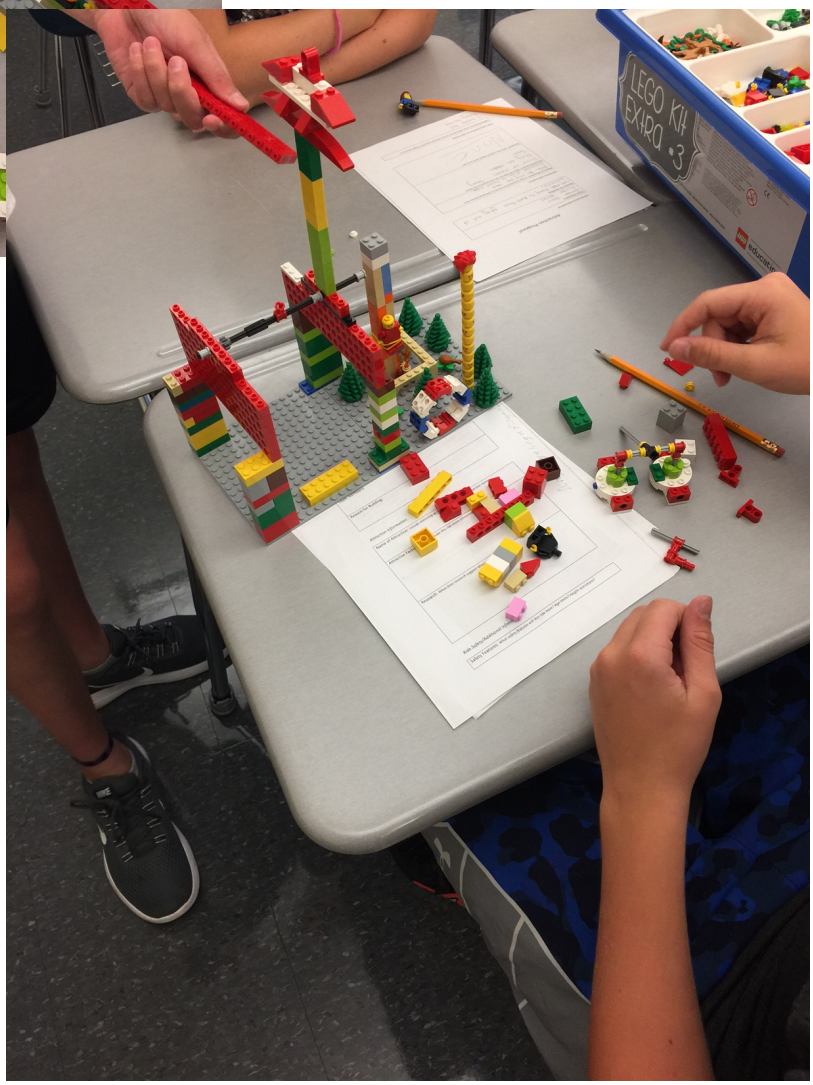
Below are some photographs from my practicum experience. They are rides the students made and presentations from day four.



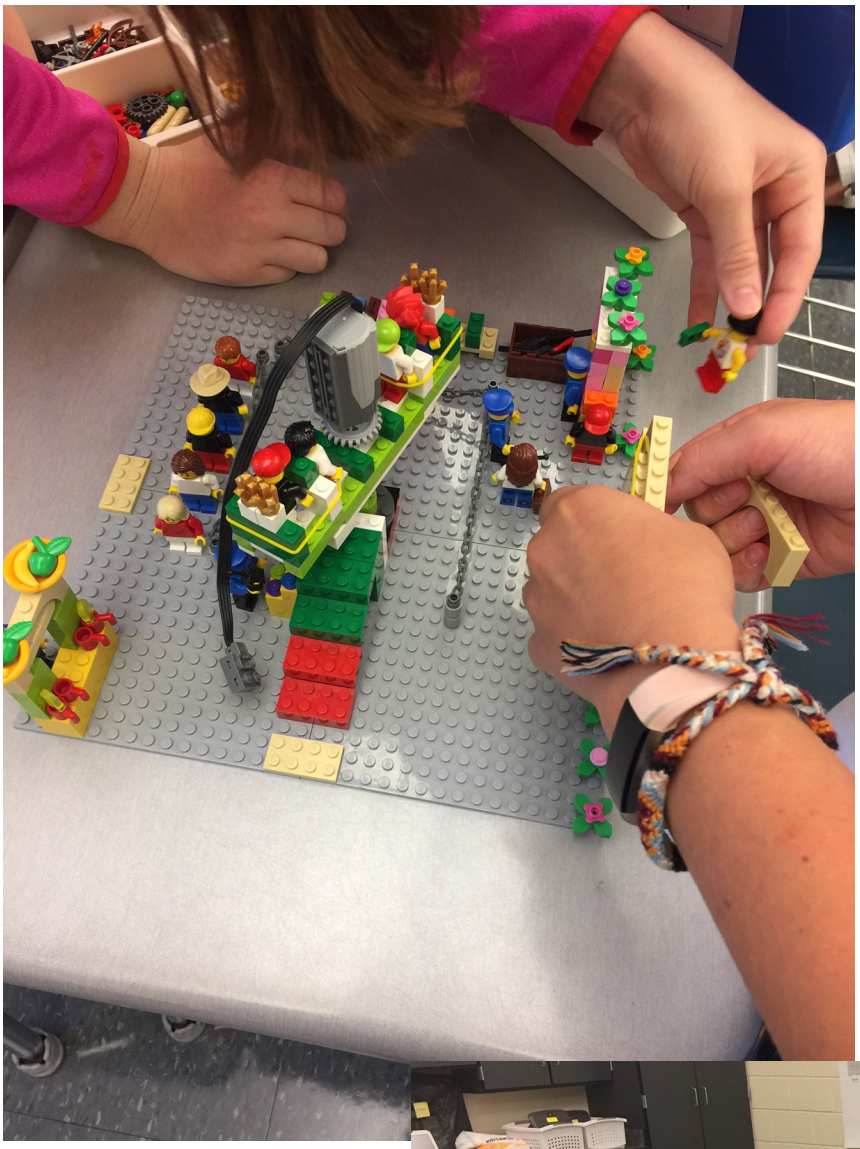
These students were in the process of programming their ride. The programs required them to drag and drop movement and speed bricks to create a stream. When the play button was pressed, the stream would commence, thus starting the ride. This was a tricky part of the PBL and students found the only way to conquer this was through trial and error. They often went around assisting other teams when they found a stream that worked well for them.



This group of boys was in the midst of turning their pirate ship themed ride into a BMX themed attraction. They chose to change last minute because they found three other groups doing pirate or sea themed rides. It was exciting to see their passion for challenge and being the best.

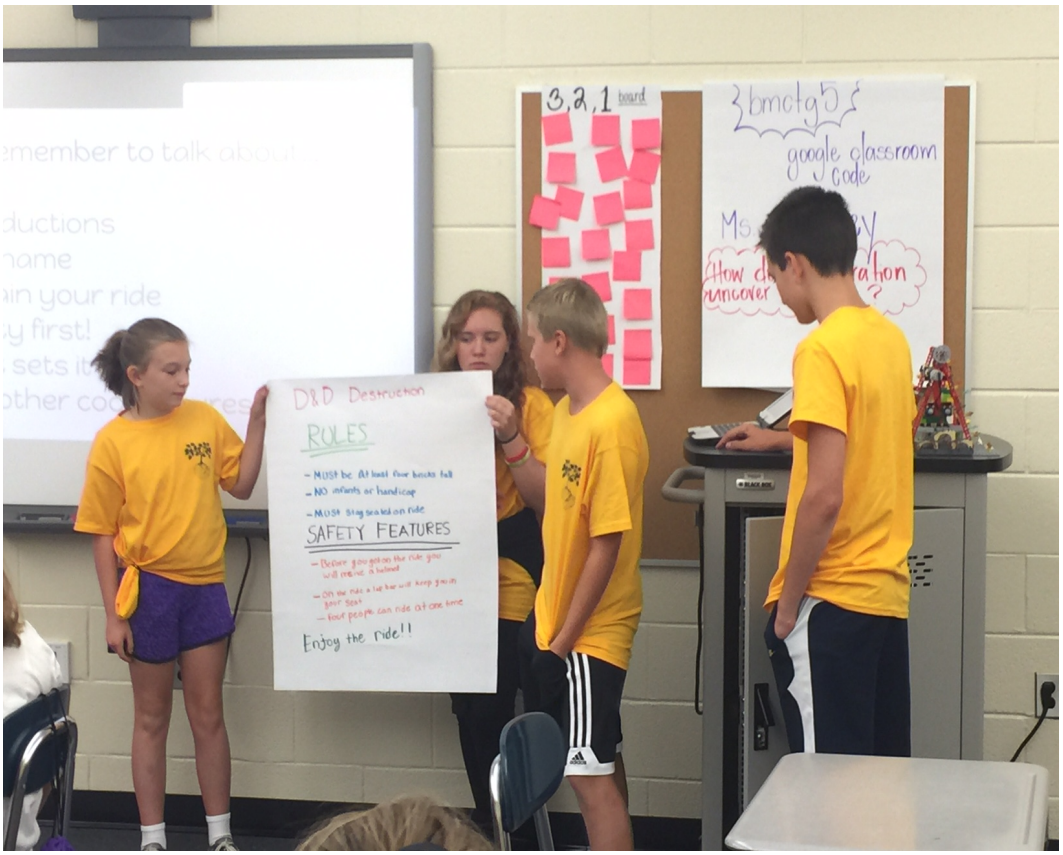


This group began the week thinking they weren't going to win. They goofed off most of the week, but towards the end found their competitive edge. They ended up winning the competition due to popular class vote. Their ride went upside down and turned in circles.



This was an all girls group who ended up having the most unique ride. All other groups made their rides go upside down, but these girls decided to tie in centripetal and centrifugal force and made their ride turn horizontally. They won the "Teacher's Choice" but came in second place in the class/popular vote. Their ride was called "Round Up."

Excitement poured from this group since the second they stepped into the classroom. They made a Pirate ship ride and ended up having a five and half minute presentation, the longest in the class. They were so excited about the project and couldn't tell us enough!



Our first presentation! This group is showing off their visual poster, which explain the safety features and what set their attraction apart from all the others. This was a gutsy group who decided to move their ride to the front of the room and present rather than keeping it at their seats.

This group began their presentation with tears. Their ride fell apart and they just couldn't recover. I gave them ten minutes in the hallway where they worked quickly to get to back together. By the end of the presentations, they had their ride rebuilt and programmed. The two boys shown presented the ride to the class and ended up coming in third place. True example of perseverance!