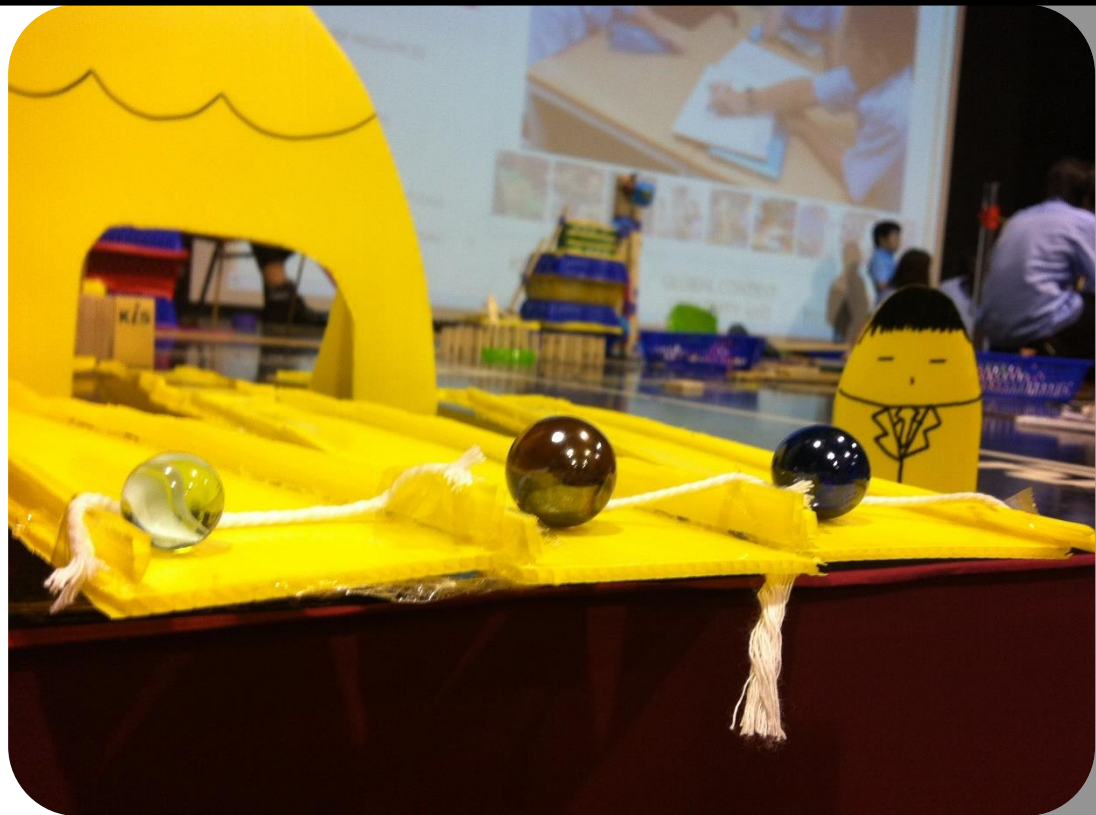


2013

Design Cycle Report: Team 21 “The Upper Class”



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KIS International School, 2013 Design Cycle
Challenge

11/15/2013

Introduction

Our group, the Upper Class, throughout the design cycle challenge, has become more and more connected to each other. We gather our heads together surpass difficult struggle we came across and fix them as a whole bonded team. Team 21 got one of the most challenging blocks in the entire event, we have to climb up the stage! We respectfully are given the object of inspiration of “iridescent drops of colors” as shown in the picture.



Inquiry and Analyzing: Design Brief

We have to build a machine that elevates from the auditorium floor onto the stage. For our process of working, we researched, looked, observed and thought of several ways we can develop our machine into something relevant to the object of inspiration and at the same time climbs up the stage. We followed simple steps of how to build a Rube Goldberg Machine from online help in Wikihow. After that, we got inspired both from our research and Youtube videos, we make some specifications and tests along with our own designs as we try out different possibilities.

Inquiry and Analyzing: Design Specifications and Tests

No.	Specifications	Tests
1.	The machine must climb up the stage in order to trigger the next group’s machine.	Record a video of our machine climbing up the stage and successfully continue onto the next group’s machine for evidence.
2.	We will paint (red, blue and yellow) our machine for decoration and to match with our visual stimulus.	We will take pictures of the painted/decorated final machine for evidence.
3.	We will use three different types of actions in our machine.	We take pictures and record a video while the machine is running to prove that our machine used three different types of actions.
4.	There must be two different potential energies to trigger actions in our machine.	We will record a video and take pictures of the parts of the machine that both contain different potential energies for proof.
5.	We have to have one working KIS Rube Goldberg Machine.	Record a video proving our final machine works.

Inquiry and Analyzing: Research

Guiding questions	Research Summarized	Source
How to build a Rube Goldberg machine?	<p>There are simple 7 steps to build a homemade Rube Goldberg machine.</p> <ol style="list-style-type: none"> 1. Look at other machines for inspiration. 2. Choose simple machines we are going to work with coinciding with our initial ideas. 3. Connect each action to one another. 4. Assemble the machine. 5. Test repeatedly. 6. Decorate the machine. 	<p>http://www.wikihow.com/Build-a-Homemade-Rube-Goldberg-Machine</p>
What are other people doing?	<p>They mostly use dominos to start.</p> <ul style="list-style-type: none"> • Table tennis balls as an energy to trigger another action. • They make use of gravity. • They use ramps or slanted surface areas for rolling objects to move. 	<p>https://www.youtube.com/watch?v=WiHn5_RfKjE</p>
What are some successful machines that would inspire us?	<ul style="list-style-type: none"> • The Page Turner • Mythbusters Rube Goldberg Machine • Rube Goldberg Photobooth 	<p>http://coolmaterial.com/roundup/rube-goldberg-machines/</p>
What simple machines can we use in our Rube Goldberg machine?	<p>There are six type of simple machines that we can use:</p> <ol style="list-style-type: none"> 1. Levers – found in broom, spoon, spatula, ladle, baseball bat, scissors 2. Wedge – found in fork, knife, blade, potato peeler, thumbtack, ice skates 3. Screw – found in c-clamp, jar lid, light bulb, drill 4. Inclined plane – found in fan blades, ladder, stairs, ramp, roller coaster, bath tub 5. 5. Wheel and axle – found in tricycle, roller skate, wagon, bike, door knob, car, pencil sharpener, egg beater, fan, windmill 6. Pulley – found in window blinds, flagpole, clothesline, tow truck, crane 	<p>http://content.screencast.com/users/srossdavis/folders/Scratch/media/9d36f796-202f-4bcb-bfb1-311e1f94049f/sm.png</p>

<p>How do we continue the machine system up onto the stage?</p>	<p>We can use pulley to trigger something on the stage. Use string and have some weight inside the cup so that there's something to keep the pulley pulled. And then something will give weight to another side of the pulley in the cup so that the weighted cup is pulled upward.</p>	<p>Mr. Tim Grundhoefer</p>
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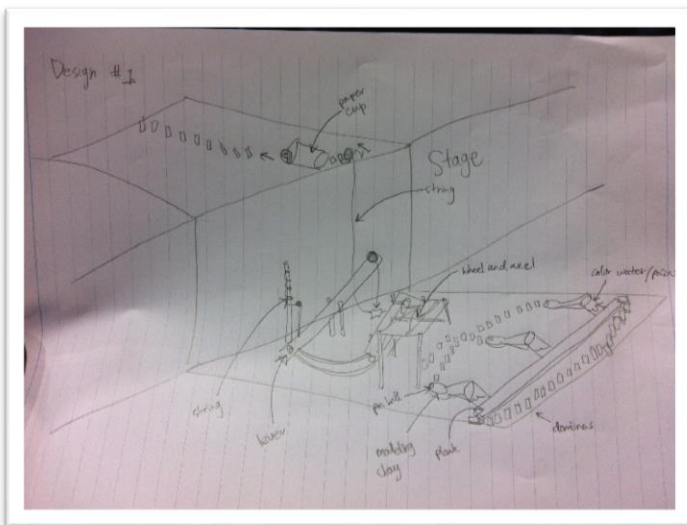
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Developing Ideas: Design Ideas

On the first day of the design cycle, we came up with several different designs of our Rube Goldberg machine which imply the object of inspiration and research we have.

Design sketch number one:

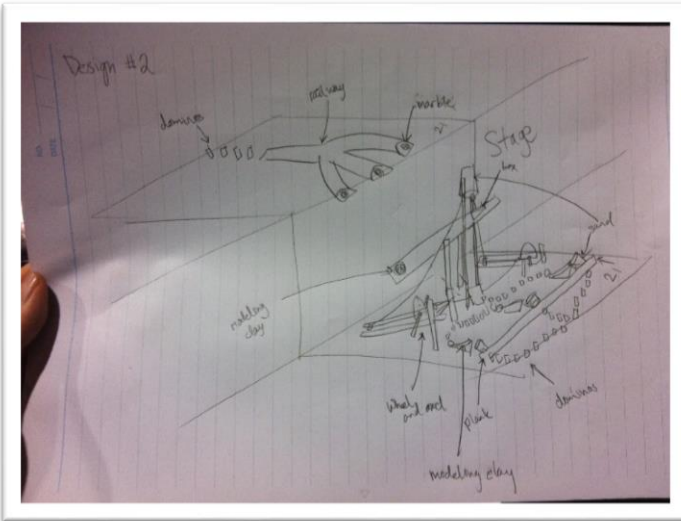


This design will start off with dominos. It separates into three paths knocking three cups with three different water color or paint on a plank (preferably red, yellow, and blue). As the water flows down into three sliders made from modelling clay (colored red yellow and blue) containing plastic pinballs, the rising pinballs then knock another set of dominos to activate another act. Wheel and axle on an inclined plane then starts rolling and knocks on another wheel and axle. This time the wheel and axle hits a ball to knock down a spiral tower made from string connected to a chopstick and a

marble. The spiral string twirls to knock a weighty object on a lever off. Then the weight misbalanced, making the seesaw fall on another end knocking a domino that is connected to a

marble on the stage that's connected to a set of dominos. Dominos fall simultaneously until the end.

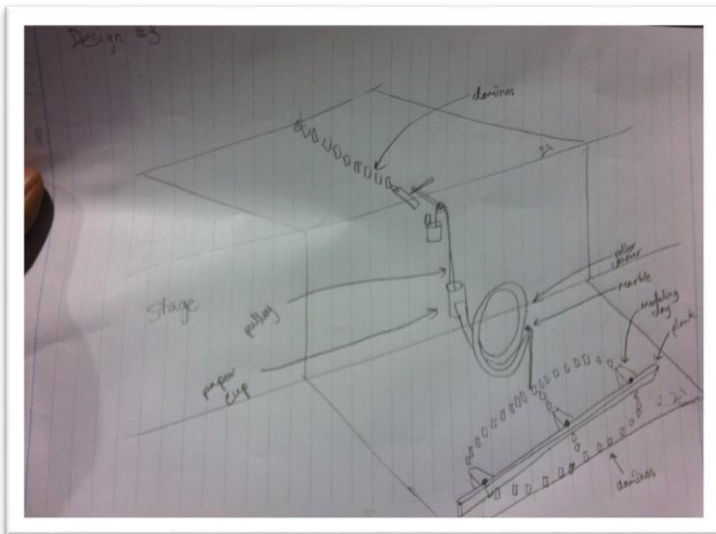
Design sketch number two:



This design starts similarly with the first design, we decided to use sand instead of liquid. The color components are the same. After the sand pushes the marbles out of a swallow, slanted well made from modelling clay knocking the dominos on the two sides. Then wheel and axle is activated. When both wheels and axles reach the end they knock pieces of dominos that is connected to plugs on a sand-containing cup by a string. As the plugs are pulled down, sand starts dripping into a container on a wooden seesaw. The seesaw then active, switches sides triggering the marbles on the stage that

will knock a set of dominos until the end of the machine.

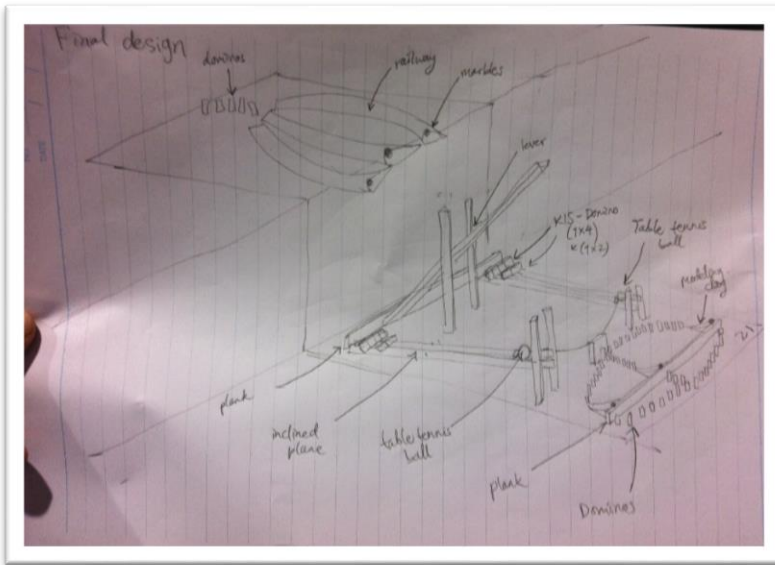
Design sketch number three:



For our thrid design, it starts slightly differently from the other designs. As required by the rule, it starts with dominos. Then knocks on to marbles sliding down modelling clay sliders (colors are the same). Then, again, knocks the dominos down. These dominos ended and knock over a marble holder making the marble fall into a roller coaster rail. The marble finally rolls into a cup connected to a pulley which, once one side of the pulley has more force, the net force is unbalanced. The side with more forces pulls and another cup with less force elevates up to push an

small protuded plank of wood from the edge of the stage. The wood trembles, then the dominos on top of the plank falls continuously until the end of the machine.

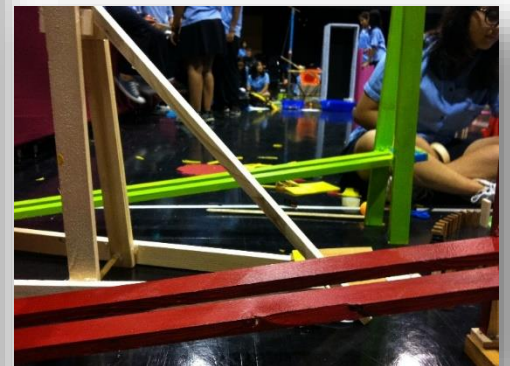
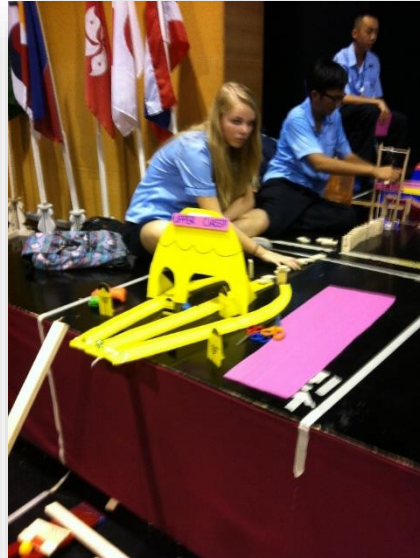
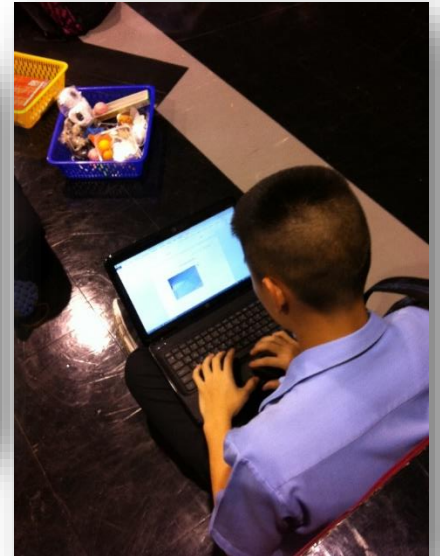
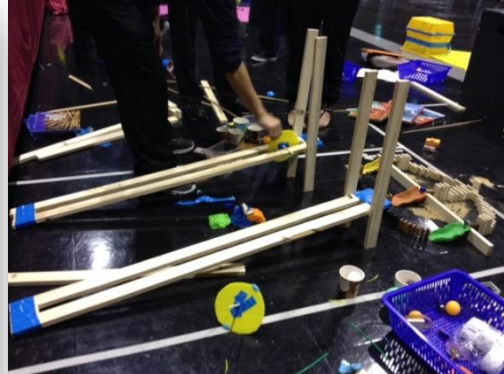
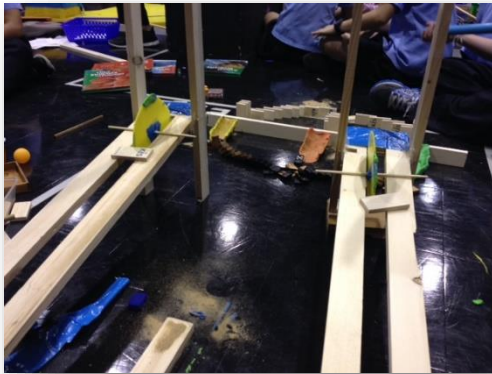
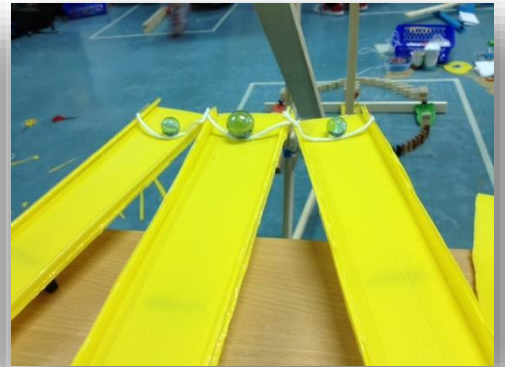
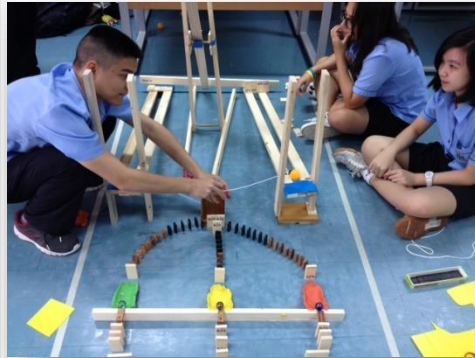
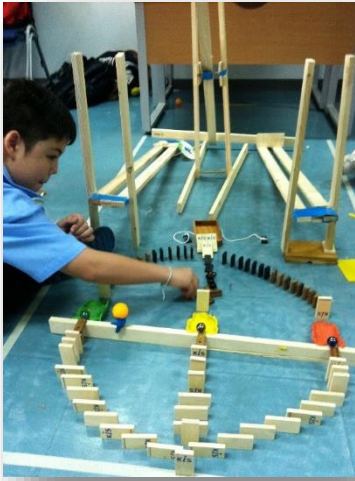
Final sketch design:

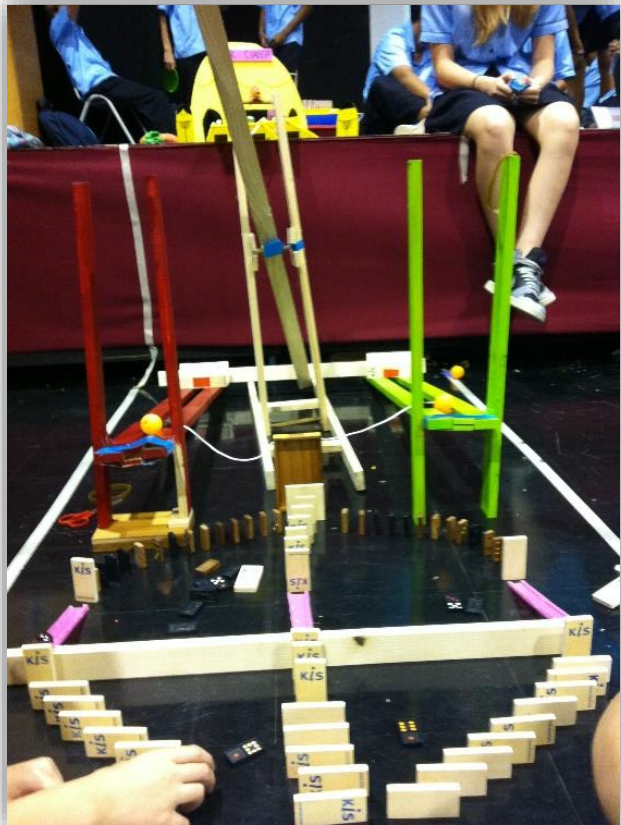
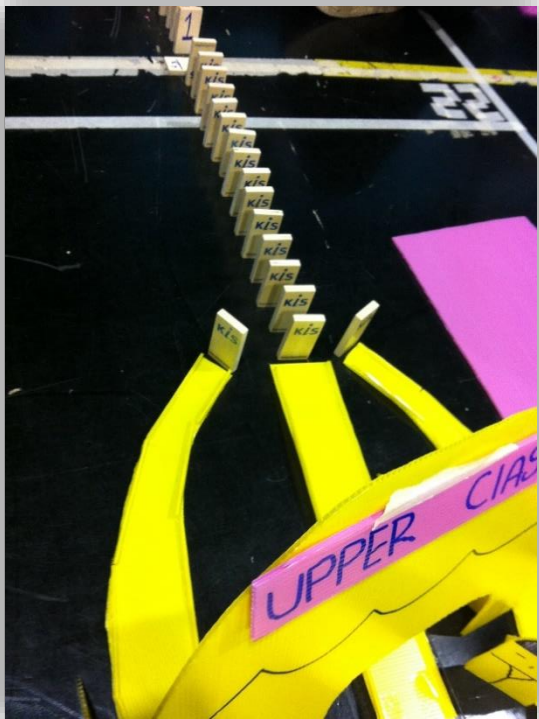


To sum up all of the designs together, this design is what we actually ended up using. In the beginning, as always, the machine initializes with a set of dominos that goes into three directions. Once again, color resemble is the same. The dominos knock the marbles off the planks onto modelling clay slider. Then the machine goes on to the dominos once again as shown in the diagram. At the end of the domino trail there is a big wooden domino piece that's connected to end of two dominos on each of the two inclined planes. Once the dominos are pulled off, table tennis

balls that were blocked by those pieces of dominos are now rolling. At the end of the inclined plane, there are some bigger pieces of dominos to knock over a long piece of wooden plank down activating the seesaw. Once the seesaw is activated (note that one side of the seesaw is intentionally made so that it weighs more than the other), the end of seesaw nearer to the stage triggers the marbles on the railways on the stage to roll. Those marbles then knocks over the dominos until the end of our machine.

Creating the Solution: Photographic Evidence





Creating the Solution: Reflection on the Principles of Visual Stimulus



As mentioned in the introduction, we received a visual of three drops of neon red, yellow and blue liquid. We interpreted the image as iridescent colorful theme for our machine. The liquid splashing on the group symbolizes liveliness, so for our machine we painted the inclined planes into red and blue (there was no time to paint the seesaw in the middle blue.) We also decorated our machine’s appearance with eye catching figures and cartoons to symbolize the liveliness portrayed through the image and also to relate with our team’s name, “the Upper Class.” We try to use various colors as much as possible in our machine.

Evaluation: Critical Evaluation

On Thursday we had run-through trials in the morning for a score keeping from 5 trials. Our group successfully runs through the machine only once. From the videos we took for each trials, when mistakes are found we evaluated and fixed them as we go along. For instance, there was one time where the marbles won’t slip down the plank onto modelling clay sliders. We found out that the marbles were stuck on the modelling clay because be placed them too hard. The dominos’ force along wasn’t enough to knock the marbles down, so we fix the problem by changing from modelling clay sliders to featured board sliders.

Specifications:	Tests:	Evaluation:
The machine must pass up the stage in order to trigger the next group’s machine.	Record a video of our machine climbing up the stage and successfully continue onto the next group’s machine for evidence.	We successfully transfer energy from the starting point onto the stage and trigger the next group’s machine. We have a video recording evidence embedded in our Thursday’s video journal.
We will paint (red, blue and yellow) our machine for decoration and to match with our visual stimulus.	We will take pictures of the painted/decorated final machine for evidence.	We took some pictures of the inclined planes we painted. We failed this specification because we didn’t have time to paint the seesaw blue.
We will use three different types of actions in our machine.	We take pictures and record a video while the machine is running to prove that our machine used three different types of actions.	We used dominos, marbles, and seesaw as our different types of actions. The recorded proof is embedded in Thursday’s video journal.

<p>There must be two different potential energies to trigger actions in our machine.</p>	<p>We will record a video and take pictures of the parts of the machine that both contain different potential energies for proof.</p>	<p>We used two different potentials energies: inclined planes and seesaw. Potential energy from the table tennis ball releases its energy into kinetic energy by gravity force, after the domino that blocks the balls is taken off. For our seesaw, we intentionally construct it so that a side of seesaw is heavier than another. We hold the lighter side of the seesaw with a plank. Once the plank is taken off, the heavier side of the seesaw is pulled down by gravity force making the lighter side elevate off the ground.</p>
<p>We have to have one working KIS Rube Goldberg Machine.</p>	<p>Record a video proving our final machine works.</p>	<p>Proof is given in Thursday's video journal.</p>

Evaluation: Changes

We cannot do roller coaster or wheel and axle because our potential energy wasn't enough for these to work. We didn't have time to think of more complex machines to energize more potential energy into kinetic energy. And since liquid is not allowed and sand doesn't work once we tried it out, we ended up with using good ol' marbles. On another note, while we were observing other groups, seesaw option has rarely been used, so we decided to go for it. For creativity, we color the incline planes to make them match with our object of inspiration: "iridescent drops of colors." In the end we decorated the machine with featured board and we decided to go with featured board at slider in the beginning instead of modelling clay due to difficulty in making the marbles falling off the plank.

Evaluation: Improvements

If there is anything to change for our machine to work for efficiently, it would be to make our woodcrafts more firm and stronger. For example, the bases of our seesaw are not strong, thus they are even wobbly. The two inclined planes on the two ends were not accurately equal in height, so as a result, the table tennis balls don't simultaneously knock down the plank at the same time to trigger the next action. Lastly, we wish we could have more time to paint our machine into our theme so that it looks nice and relevant to our visual stimulus.