Team 1 Bangkok Titans

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Design Brief

As a team of Team 1, we will create a Rube Goldberg machine in the specific space by using the prepared materials that the school provided and the other materials that we have to bring it from our houses. Our Rube Goldberg machine has to be able to connect with the machine of Team 2 on the ground as Rube Goldberg machines of every group have to connect together. As the purpose of this Design Cycle Challenge is about being creative so a machine has to have systems that contain interacting or independent components of static or dynamic movement, which shows how much a Rube Goldberg machine can be complex.

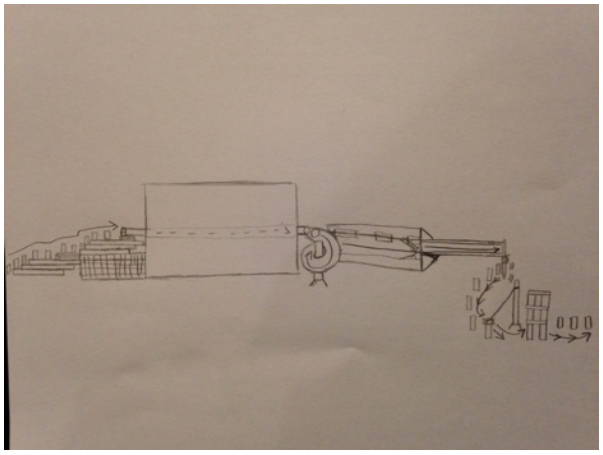
Design Specifications	Tests
The Rube Goldberg machine will contain three actions or more.	In the test on Friday, the final Rube Goldberg machine has to contain at least three actions by looking at each area of the machine.
The Rube Goldberg machine will have at least two potential energy sources. In the test on Friday the final Rube Goldberg machine has to contain at least two potential energy sources by finding the areas that provide energy.	In the test on Friday the final Rube Goldberg machine has to contain at least two potential energy sources by finding the areas that provide energy.
The Rube Goldberg machine will connect with the team's picture.	In the final design of Rube Goldberg machine, it has to have the color schemes of the picture that are red, orange and blue colors. And, the machine has to contain objects that represent love or romance because in the picture, there is a man and a woman walk together that can be show as love.
The Rube Goldberg machine will only need a push of domino by people in the beginning but after that it has to run by itself without any intervention of people during the machine runs.	When the Rube Goldberg machine is running in the final test, there will be no requirement or help from any person to make the machine continue running.
The Rube Goldberg machine will fit in the space that the school provided in the auditorium.	There is no any part of the Rube Goldberg machine that come out of the provided space in the final test.

Design Specifications	Tests
The Rube Goldberg machine will be able to connect with the machine of Team 2.	When our Rube Goldberg machine end, the machine of Team 2 has to run by the push of our dominoes to their dominoes.
The Rube Goldberg machine will run for at least 10 seconds to shows the complexity of the machine.	Use a stopwatch to time the Rube Goldberg machine from the start to the end point.

Design Ideas:

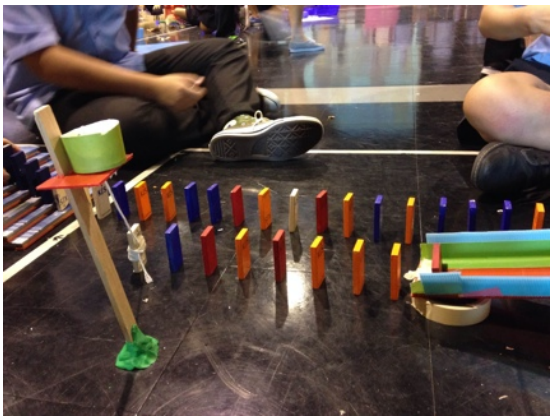
In the **first design**, the Rube Goldberg machine starts from the high level by placing dominoes on chair and let the dominoes to push a marble to inclined plane and the marble will run to a lever so the another side of the lever will go up and hit a cardboard with another marble on it. Then, the marble will run on the another inclined plane and go to a swirly slide to domino line that connect with Team 2's machine. There is only the pink color of the swirly slide reflects on the given visual stimulus as pink color symbolizes love, which is the feeling we feel from looking at the given picture.

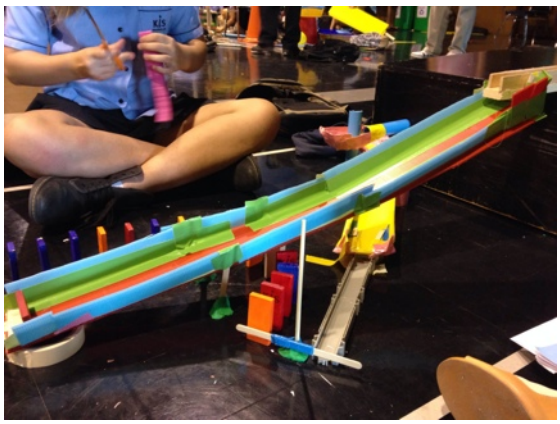
In the **second design**, we used books to place overlap each other like a staircase to put each domino in each step so the dominoes can lay down from the floor to higher position. Then, we came up with an idea to use a block that has holes in front through the back for put a water pipe in the holes so the marble can go through the pipe to another side. The second design started by push the first domino to make it lay down to the above dominoes, then the last domino will knock or push a marble that place



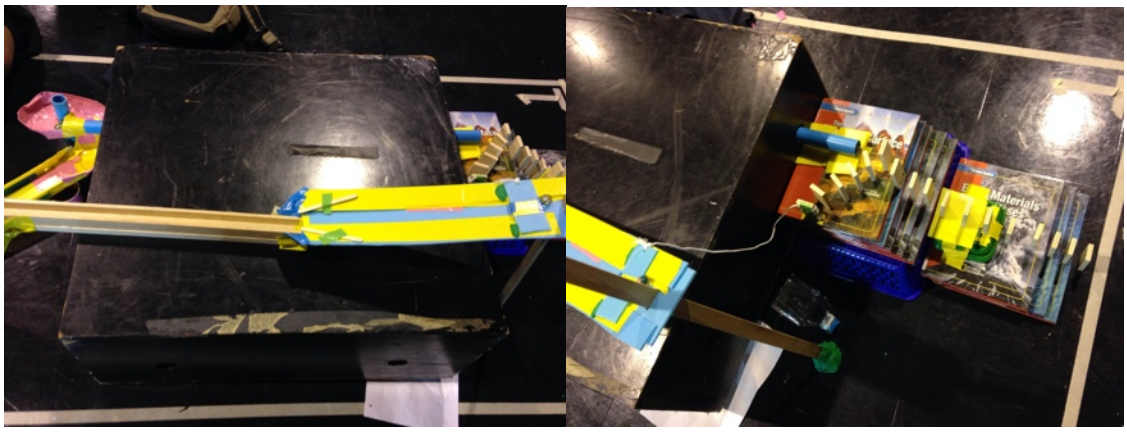
on the pipe so the marble will run to another of the pipe by putting two table tennis balls under one side of the block so the block is slope down and the marble can run by itself. When the marble runs to the other side, it will push larger marble that place on the swirly slide so the large marble run down to the another straight slide toward a route. In the end of the route, there is a popsicle sticks that connect together so when a marble push one popsicle stick, another popsicle stick will knock the domino that place next to it. After the marble hit the popsicle stick and knock the domino, then dominoes will lay down to form a curve line. The last domino of this line has a marble that connect with a rope on it so when that domino lay down, the marble will swing and hit the dominoes house to collapse to another dominoes line that connect with Team 2's machine. First thing that reflect on the assigned visual stimulus are the dominoes that lay down represent leaves that fall down in autumn like in the picture. Another one is the black block represents the dark sky in the right side of the picture, and the other areas represents the area that has light projects in the left side of the picture. The pink color tape of the swirly slide shows love or romance because in the given picture, there is a man and a woman walk together. The last thing that shows the visual stimulus is the long blue pipe as it shows peaceful water that flow.

The **third design** does not change a lot from the second design as we added another route or way to have two marbles run together. To make the two marbles run together, we created another slide that form an inclined plane on the block and put a piece of cardboard on the top of the slide to block the marble not to run down. From this to make the blocked marble run, we connect the cardboard that use for blocking connect with a domino by using a rope, and place that domino to the starter domino line as the domino will lay down as straight line at first and spread to two ways later. The marble that run down on the slide will run down to another two slides down to the dominoes that place at the end of the slide so when the marble reach the end, the domino will lay down form a line to the last domino that wrap with a rope that connect with a cup with a hole on the bottom. Therefore, when the last domino lay down, the cup that place on a cardboard that connect with a wood stick above will fall down and fake leaves in the cup will fall down either like leaves fall in autumn. The visual stimulus is the two marbles that run together represents two people walk together in the picture, which the two marbles release from different part that shows two people came from different places but come and walk together by love. Another visual stimulus is the end of the machine that two marbles do not run to the same place as they did not





meet each other in the end as in the assigned picture, one side is bright and one is dark that shows there are two ways for the man and woman to choose, which means they may choose the dark side so the dark side is they have to be parting like the marbles that run to different domino lines and way. The last visual stimulus is the leaves that fall down in the end shows the fall season that is autumn just like the given picture.



Final Machine Design

The final Rube Goldberg machine design of our group is the third design because in the third design there are many objects communicate the visual stimulus that are clear with deep meanings in the machine. The another reason that we choose the third design idea is there are many actions and there are two potential sources that are the marbles and dominoes. The actions that contain in the third design are the dominoes run up like a staircase, domino fall down to the ground and the block cardboard fall down so the marble run, marbles run through the pipe to the slides, dominoes lay down form lines, and domino fall and the cup fall that makes fake leaves fall down. Therefore, in the third design, there are more actions that work well than the other designs that shows complexity.

Tests

The first test was the consistency test. We had to try run through our machine 5 times and see if the machine runs every time. Our machine needed some help to hit down the dominoes because our dominoes weren't laid well. The machine worked 2 times and failed 3 times. Which will equal to 40% pasts. After the results came out we tried to solve the problems. So we figured out spots to place our dominoes and marked the positions with tape. Last we tested our machine with all the dominoes marked it was better our machine went through well most times.

Research:

What is potential energy and kinetic energy?

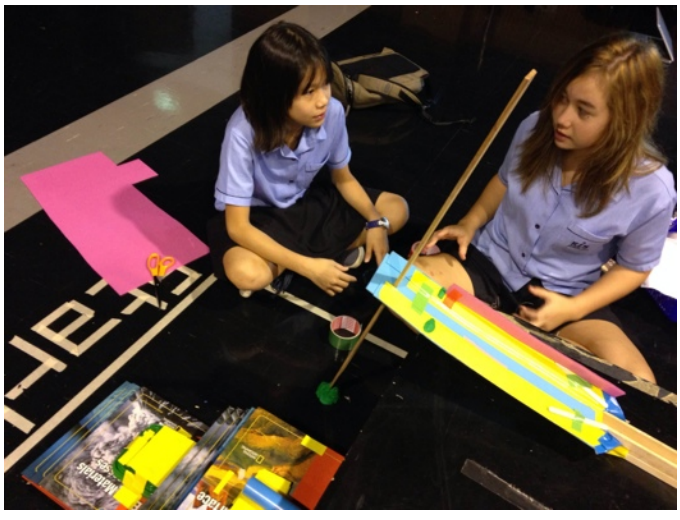
Potential energy is the energy that form by its position as potential energy is the energy that keep inside of an object as it does not use the energy yet. The potential energy create by the position as the gravity of the earth. The kinetic energy is the energy that being use or come out from the object by its motion, which means if an object stays without moving it has potential energy but when it moves the kinetic energy will occur.

What are the simple machines?

The simple machines are pulley, wheel and axle, lever, inclined plane, gear, screw, and wedge. Pulley is a machine that has a rope wrap around a wheel, which each side of the rope will has something ties with it so when one side of the rope is heavy that side will move down and another side will move up as it is lighter. Wheel and axle is put an axle or pipe inside of the hole of a wheel so when there is a force both of them will move. There are two types of lever; one of them is one side connect with something that cannot move and another side does not connect with anything as when something fall down to that side or push that side that object will fly up high, another one is one side has a heavy object on it so it will lounge to that side but when there is something that is heavier fall down or push to another side, the side that already has something on it will jump up. Inclined plane is using a flat surface to incline to move things over distances. Gear uses for moving objects to another place by using two or more gears. Screw is a metal machine that move in rotational motion to linear motion that use to hold objects together, which the more threads, the stronger the hold is. Lastly, wedge is two inclined plane that has sharp edge so when the wedge go down to an object, it will go through the object by its sharpness.

Evaluation:

The tests of the last day of DCC week shows that our Rube Goldberg machine achieves the goal of design specifications quite well with only one specification that did not achieve perfectly. The first specification is about having at least three actions in the machine, which the final machine has four big actions that are dominoes stair, marble slide down to places, dominoes line, and fake leaves fall down. The second specification is about having two potential energy sources in the machine, which there are three sources in the final machine that are marbles, dominoes, and popsicle stick that use marble to push it and it knock dominoes down after. The machine has to connect with the assigned visual stimulus is also one of the specification, which the machine achieves it because the dominoes are red, orange, and blue colors, and the marbles that run together and pink color of swirly slide represent love. Our Rube Goldberg machine was fitted in the



given space in auditorium properly, it can connect with the machine of Team 2 very well, and it runs for 16 seconds that is longer than the time that we set as minimum. However, the machine did not run by itself every time because when we push the first domino to start the machine, the machine need one help to make it run in every test.

There are changes made throughout the design cycle process. The first one is in the first design as after we understood about the rules of the design cycle challenge and research more on the Rube Goldberg machine so we change our idea a lot to the second design. For example, the beginning that use dominoes to run up. The another change that made during the process is the position of each dominoes as we have to mark the position for each dominoes to make they run as what we expect and can push marbles or other objects properly. We also change the slides that we use in the machine to have protection along the sides so the marbles would not go out of the slides. We had try many ways to end the Rube Goldberg machine, such as swing marble to knock the dominoes house. The last change that we made is the way to make the fake leaves fall from the cup when the domino lay down, which we cut the leaves to three times smaller and cut the bottom of the cup to create a hole so the leaves can fall down easier.

The further improvement of our Rube Goldberg machine is making the machine work every time that the machine run or start so the machine can be a good one that work well, which shows the consistently of the machine. The another improvement is adding more actions to it so it can be more complex and creative.

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