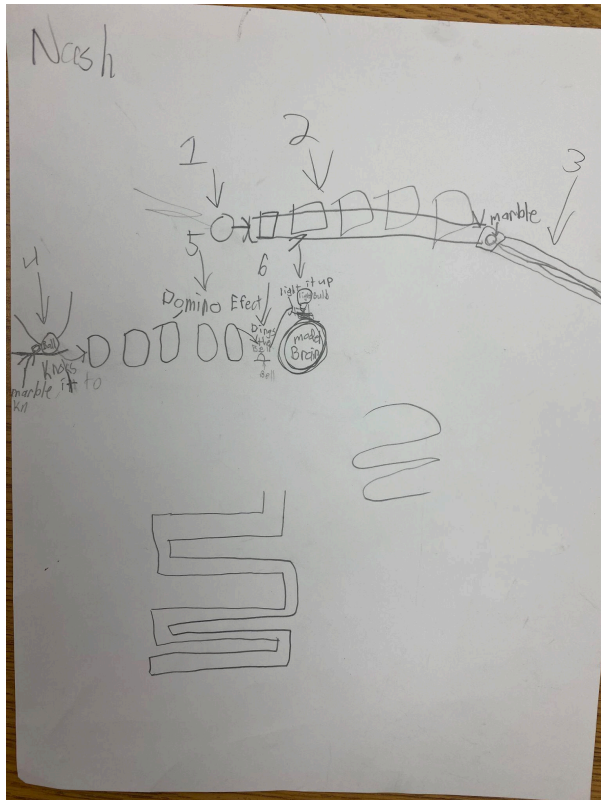
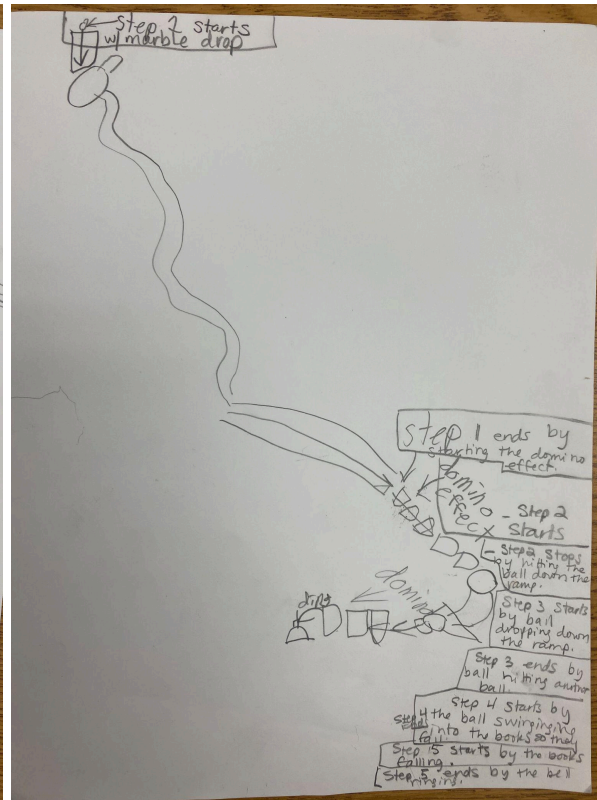


Planned Machine Design Sketch and Description



Plan 1



Plan 2

Our first plan started at the beginning and only had 6 steps. It was not very descriptive or clear, and we discovered we were having trouble building it. So, we made our second plan a little more descriptive and clear by telling where each step began and where it ended. It only had 5 steps, and we were not sure what to do to add more steps.

- 1.) Marble drops down an inclined plane.
- 2.) The marble makes the dominoes fall and knock each one over.
- 3.) The dominoes fall into the ball and make it fall down the inclined plane.
- 4.) The ball runs into another ball and makes it swing into the books so they fall.
- 5.) When the books fall, they fall on the bell and make it ring.

Step 1:

Try a smaller ball >

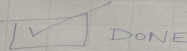
Mrs. Greenland will order the ball and mousetrap

Ask Brandon to bring cardboard from the warehouse. []

Step 2:

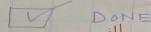
- * Make a barrier around the ~~marbles~~ ^{base} to stop marbles from flying
- * Improve the design of the marble box if a smaller ball does not work

Kenzie will work on



Step 3:

- * Add support tape to keep it together > Kaelyn will work on



Step 4:

Add a lever to be set off by the marbles and have a string attached to the back that will make it fall

Kinsley + Nash will work on

Step 5:

Make a larger platform for the bottle or spread out the platform so the balloon has more room to expand

Easton will work on

Step 6:

May not need improved if we fix Step 5's kinked balloon

Step 7:

Maybe no change needed

Step 8:

Maybe no change needed

Step 9:

Maybe no change needed

Step 10:

Maybe no change needed

List of Machine Steps

- 1.The metal ball goes down the inclined plane.
- 2.The metal ball goes into the bucket and the weight of the ball moves the pulley and the other bucket goes up to the marble run.
- 3.The marbles reach the top of the barrier and then go out of the bucket and then down the marble run.
- 4.The marbles then hit the mouse trap causing it to close and release the string.
- 5.When the string gets loose it lets the book fall into the platform on top of the syringe.
- 6.The vinegar filled syringe releases the vinegar through a tube connected to a bottle, and the bottle has baking soda in it. .
- 7.The baking soda and vinegar cause a chemical reaction that builds up carbon dioxide gas and blows the balloon up, which knocks the tennis ball over the tall platform.
- 8.When the tennis ball falls, it knocks over the books.
- 9.The books fall and push the rubber ball into the dominoes.
- 10.When the rubber ball hits the dominoes, it causes them to fall over.
- 11.When the dominoes fall, they fall on top of the bell and ring the bell.

Cost of Machine and Percent of Recycled Materials

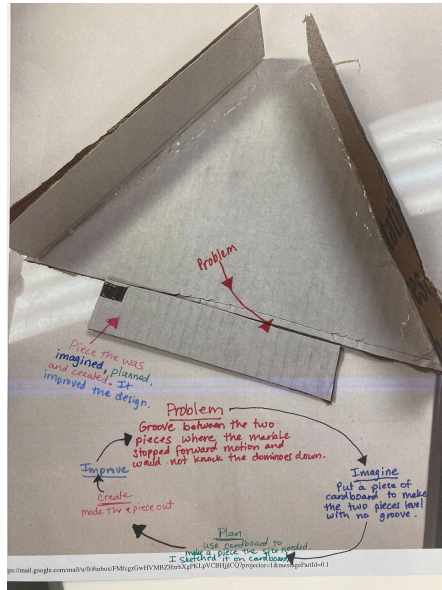
Used

Item	Bought or Donated	Cost
Marble run	Donated in new condition by Nash	\$34.19
Cardboard	Donated by Mrs Greenland	\$5.16
Metal ball	Donated by Nash	\$1.00
Plastic ball	Donated by Nash	\$1.00
Velcro dots	Bought on amazon	\$9.99
Hot glue sticks	Bought on amazon	\$6.28
Tennis ball	Donated by Mr.Victor	\$0.66
funnel	Bought on amazon	\$1.30
Pulley wheel	Donated by Mrs.Greenland	\$0.05
yarn	Donated by Mrs.Greenland	\$0.56
vinegar	Donated by Mrs.Greenland	\$1.96
Baking soda	Donated by Mrs.Greenland	\$0.49
6 Balloons	Bought on amazon	\$0.80
Rubber tubing	Donated by Mrs.Shaffer	\$2.37
Big syringe	Donated by Mrs.Shaffer	\$3.50
<i>The One and Only Bob</i> book	Donated by Mrs.Greenland	\$18.99
Lemonade War book	Donated by Mrs.Greenland	\$8.99
Mouse trap	Bought on amazon	\$1.29
		<u>TOTAL: \$77.15</u>
	 <p>Items Used</p> <p>recycled 71.0%</p> <p>new 29.0%</p>	<u>percent of recycled materials: 72%</u>

Applied STEM Processes and Use of Engineering

Design Process

1. At first we had a ramp for the beginning. We fixed the ramp a lot then we decided to get rid of it. We got rid of it because our ball wouldn't roll down the ramp, even after we made modifications to it. We made changes to our design by making the ramp smaller with sides so that the ball would go down and have better guidance.



2. We had made our base too big, so it would not fit in the Suburban to haul, so we had to make the base a little smaller. We made it smaller by cutting 4 inches off the base so it would fit in the SUV. Then we cut 4 inches off the base and it fit in the SUV. We also determined that the best place to cut the excess from was the bottom of the base, then we would just flip the base on its side to slide it into the Suburban.



3. We wanted to have a book push a syringe for a chemical reaction but the book would fall off the cardboard platform. So we made sides on the platform to hold the book into place and now it works.



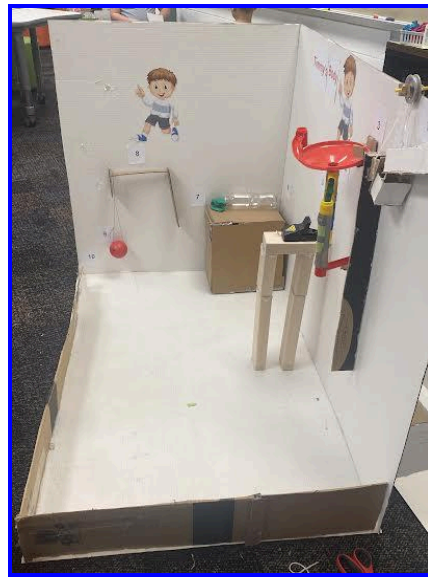
4. We wanted the balloon to blow up and knock over the tennis ball but the balloon was too small. We ended up making the balloon bigger by sizing it up to a 12" balloon instead of a 9" so that way it would knock the tennis ball off.



5. At first the marble run would not stay together when we tested it. The marble run fell apart really easily. So we ended up putting tape on the marble run so it would stay together better.



6. At the competition we had a few problems with the marbles, they would go out of the perimeter and we lost points we did not want to lose points. We made a boundary so the marbles would not fly out of the perimeter.



7. When we were at the regional competition, we had trouble with steps 3 and 4 not transferring enough energy to knock over the book. So, we used the engineering design process to make changes to those steps and make them work better. We brainstormed ideas, and decided the best idea would be to use a mouse trap with a string attached to

the book. We decided the mouse trap would be sensitive enough to be set off by a marble, which would transfer the energy when the trap closed and released the string so the book would fall into the holder on the syringe.



Reflection

Successes

- 1.) The first major success is teamwork. We used teamwork a lot. Without it we could not have made our machine. We had to be on a committee determined by what our strengths were, and we also pitched in to help other team members when our duties were completed. When there were problems with our originally planned machine design, we had to work with everyone at the table to devise a new plan.
- 2.) The second major success is problem solving by using the engineering design process to upgrade our chemical reaction. One example of how we upgraded our chemical reaction is by trying different amounts of baking soda and vinegar to see how much of each it took to expand the balloon. The last example of how we upgraded our chemical reaction is by having the bottle in a different position to see which way would knock the ball off the ledge best.
- 3.) Our third major success was planning. We planned well by starting at the end and working things from there during planning. One example was when we started building we thought about starting at the start but we found it was too difficult so we started at the end. The last example was when our machine didn't have enough steps so we had a planning meeting to add some steps. Every time we used the engineering design process to improve our machine and make changes to our plan, our machine got better and had less flaws in it.

Challenges and Learning

The biggest challenges we faced were time and nervousness. Our school had a lot of school canceled because of snow, so we arranged extra time for our TAG group to finish our project. During the last two weeks, we had a talk about prioritizing what was most important, and we decided we just wanted the machine to be finished and a machine to bring to the competition. We did not care if we had to touch it some to make the reactions work. We had to sacrifice perfection to just get them done and that was kind of like the Wright brothers we learned about last year. Their first time flying was only 12 seconds, and the plane was far from perfect, but it made history and did what they wanted it to do. At the regional competition when we had to do public speaking, we all got nervous and forgot to follow the plan, and we kind of made our own machine have problems when we all started setting things off instead of following the plan we created to have one person set things off if they did not go off. We all learned that we can do public speaking, and we just have to remind ourselves that we can do it and follow the plan and do our role and it all will work out.

Through this project, we learned planning and organizing, and in the future we will be able to plan and organize projects better. We also learned how to build machines and use the engineering design process to improve our machine. This is something we will use in other science classes later in school, and in daily life to fix things.

Our team experienced a lot of growth and practiced many soft skills. These skills are ones that we use every day in life, and will always need in our school, work, and future careers. The biggest soft skills we learned were teamwork, planning, problem-solving, troubleshooting, and patience. We had to work as a team to make a plan before we started building. We decided to break up into teams built around what we were strongest in.

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