Star Gazers

Gia Toran, Lauren Breyer, Anna Breyer and Maia Rodriguez International Spanish Language Academy (ISLA)

STEM Process: Ask

What is the problem? What are the limitations?

What problem and Limitations

The problem was sending something into orbit, but we had limitations:

- Could not have flying objects
- Item going into orbit could not be too heavy
- Could not take up too much space
- How to go up when machine uses gravity and is built top down
- Dimensions of the rube

STEM Process: IN GINE



Brainstorm Solutions. Choose a Solution to Try!

1/4/2023

Gia's idea

My idea is to make a thing where the goal is to get a toy rocketship to the little kid by having it go through a track. My idea for the track is one that is kind of hanging in the air in a spiral and in the center, there is a tube or some sort of contraption that brings the toy ship down. The center of the spiral would have a sun, and in other parts of the spiral we can have planets that the ship would go through. That would make it look like the ship is flying through our solar system. 1/4/2023

Lauren's idea

My idea is that each 2 steps a planet drops down to the bottom and at the end all the planets are in order and then earth or something has a light and shines it on the sun kinda like we are learning about in school. Another idea is that Billie is inside the rocket ship and so it looks like he is in his dream and he isn't just sitting there and then when the rube goldberg ends then Billie drops into is bed and the rocket ship lands on earth.







Anna's idea

My idea is that we create a Rube Goldberg machine that shows how gravity works in space and earth and also I think that we create a machine that is tied to us learning space in school so with the book a wrinkle in time we can create something that can connect to that project.





Maia's Idea

My idea is to have a spaceship fly to multiple planets and each planet contain an obstacle of some sort. Which the rocket ship would have to get through in order to complete the end goal. Maybe we could even include a little sci fi where the spaceship is battling aliens that have turned off the light in space and the end goal is to re-light space.



Original Group ideas

- Floating rube goldberg (spiral floating and planets)
- Rocket Botton starting the Rube Goldberg
- Have a big thinking bubble in the background
- Have the ship fall into Billy's arm at the end
- Rocket boosters are separated and shown how they work once they seperate

Story line

A girl named Billie is reading a space themed sci-fi book before she goes to bed. She has a dream about being an astronaut. At first it's a pretty normal dream. Billie is in a rocket ship and is travelling through the galaxy. But then she encounters some aliens and while she tries to escape the aliens, it all goes black and she realizes that the aliens had turned off all the stars in space. As she finds her way through the dark her mission goes from exploring space to rescuing space. But since she cannot see she accidentally flies straight into the middle of asteroids. As she is escaping the asteroids and trying not to be hit she finds the switch for the stars and if her luck couldn't be greater she turned them on first try and the aliens were never to be heard of again.

STEM Process: Plan

Sketch the Idea. Identify materials and steps.

1/4/2023-1/6/2023

Group drawings

First designs.





Materials



- Orbit: wire
- Ramp: cardboard
- Walls/base: Wood
- Billie: doll
- Room decor: recycled carpet and cardboard
- Plinko: cardboard and recycled carpet
- Starting ramp: cardboard and foam
- Billie's launch: plastic tube, string and rubber ball.

STEM Process: Create

Bring the Idea to Life! Test it and take notes.

Day one of our RG STEM - 1/10/23

Today was our first day working on our Rube Goldberg. We decided that our goal is going to be launching Billie into space and into orbit. There were several limitations that we had to work around. We couldn't have flying objects and we also had limitations on things we could buy. We also looked around the school for any spare objects and recycled stuff to use. We started planning our steps and figuring out what we wanted to do.

Today we worked on getting the base and starting to plan out what materials we wanted and where we could get them. We thought of the idea of getting from a local hardware store from donations. Today we worked awesome in a group and we stayed focused. Today was a good progress day.

This week we found a base and started to figure out how we wanted to connect each steps. We all worked together today and we got alot done. This week we also started problem solving the first 3 steps on how fast a step will go. We have 5 steps planned out so far.

1/29/23

Today is saturday and we are going to make the goal to make the first 3 steps work all together and paint the Rube Goldberg.



Week 1/31/23



Today we made the first 2 steps and started to get things moving through the Rube goldberg. Today we worked really well as a team and we all got a lot of stuff done.

Group pictures 1/10/23 - 1/31/23



Steps & the Simple Machine Type

- Step 1 Dream run-Inclined Plane
- Step 2 In to space-Pulley
- Step 3 Rocket Launch-Lever
- Step 4 Fly time-Inclined plane
- Step 5 Into orbit-screw
- Step 6 Out of orbit-inclined plane

Step 7 - Alien Attack-Pulley Step 8 - Blackout-inclined plane Step 9 - Asteroid belt-Inclined plane Step 10 - Escape-inclined plane Step 11 - Light up the Stars-inclined plane

STEM Process: Improve

Make it better! Repeat the process.

Identified Improvements

Our team made improvements to the rube throughout the process. Here are a few of the improvements we made to the machine as we tested it through engineering design process.

- Step 1 Ramp height to increase the momentum of the marble
- Steps 2 & 3 Troubleshooting the weight of the person going into orbit. Too light didn't trigger the next step and had too much movement, too heavy didn't lift high enough to trigger the next step.
- Step 3 Added lever to the step to increase predictability between step 2 and 3.
- Step 5 Straightening the orbit wire to make the spaceship more predictably travel, go faster, increasing the momentum to hit the next step with more force.
- Step 6 & 7 improved ramp transition because it was unpredictable. Created a more reliable track by increasing the gap to continue movement of the marble



Near final picture

Finished Machine

Make it better!



Make it Better 2/21/23

The team completed all the steps and we are very proud of our work. We did some last touches on Saturday to make it the best we can for the competition. We had a pizza party to celebrate and we loved doing this competition and can't wait to show it to the judges.

How we improved after the competition

After the first competition, we had to make several changes.

- 1. We learned that we had more words in our reflection than we were supposed to have. So we had to update it.
- 2. Our actual Rube Goldberg machine was also not being predictable every time. We stabilized steps to make them more predictable.
- 3. We decorated more to match our theme.



Improved machine!

Introduction

The Star Gazers' Rube Goldberg is a great success and was fun to build! We loved seeing this machine come together. We enjoyed being an all girls team to prove that girls can be engineers and help worldwide problems just as much as anyone can! We had great take-aways from start to finish of the project. We built better friendships and had a great experience with the building process. We built the rube together as a team and helped one another with any challenges we may have had. We love the competitions! This was a great experience for building and using STEM processes.

Successes

We had a few parts of the Rube Goldberg that were huge successes. Our first success as a team was finding a strong and sturdy base. The base is a really important part to stabilize the machine and the steps.

The Billie trigger was another big achievement because we tested a bunch of different ways and different size toys until we figured out how to use gravitational energy, pull and the correct weight of the toy to bring our character up into space. First, it was really big for us because it was difficult to figure out how to get Billie into space and have her land in the desired place on the machine to trigger the next step. Our work paid off because now it's predictable and works every time.

Another success we had was the orbit because the metal wire we used for that step was a recycled Christmas Tree topper. It was hard to work with and not very flexible. We pulled through and figured out how to bend it the right way, smoothing the edges, so the piece moving through the screw would not get stuck and the momentum gave it enough power to trigger the next step, but not too much so that it wouldn't fly off.

Challenge

A challenge that we had was that we couldn't all work on the same step since it would get too crowded and we wouldn't make progress on other steps.

In the beginning we were not communicating well so two people would be working on one step and two on another step and as a result the steps wouldn't line up. Thankfully we overcame that pretty quickly once we saw how badly that was affecting the rube. Our communication is now really good.

Another pretty big challenge was time, because we started working on the rube late compared to last year. We met for 6 weeks, 90 minutes a session. Between the four of us our schedules are pretty busy so it was hard to find a time that worked for all of us, but we overcame this by focusing during our time together.

The last challenge we had was getting people to remember to take pictures for the journal. This was a challenge because the whole team wanted to work on the Rube Goldberg steps, so we would forget to take progress photos and updates until the end of the sessions.

Key Steps

Key Steps

The team included energy transfers in our project by using the key opponents like gravity, pulleys, and momentum to create our key steps. Step 2 utilizes anti-gravity by having a pulley trigger bring Billie from bed into space to correlate with her dream. Step 5 used the force of gravity and momentum to help during the orbit rotations so that we could trigger the next step after the rocket ship goes into orbit. One big step that we have is our final step where Billie turns on the lights to illuminate space. This was one of the hardest and most important steps because the marble has a very small target area to hit a key spot, which will then push our battery into place illuminating space.

STEM Process

We used the STEM process to help us complete this project:

- 1. **Inform**. The very first thing we did was inform ourselves about the theme of this year's contest and all of the rules and requirements for completion. We figured out how to make that our main focus of our story.
- 2. **Asking questions**. We started by asking questions like "how can we incorporate orbit into this rube goldberg?", "What are some big questions and materials we may need?", "How do we make it as close to 100% recycled as we can?", "Where and how will we get our base?"
- 3. **Research**. We did some research about the NASA rockets, some key components that may need to be added into the rube and how gravity works. We also did some research on pulleys to help us with our Billie launch step.
- 4. **Inquiry and Generate Ideas**. Our first conversation as a team was about what we wanted to do for the project. We started with FaceTime and texting. The first day we started by trying to build parts of the machine, but we didn't have a good plan yet or the right materials. We imagined what we could do to make this machine what we wanted it to be. We drew out our ideas on pieces of paper. Our team had some really good ideas that made it all the way through our Rube Goldberg and quite a few that didn't.
- 5. **Planning and Teamwork**. We started to plan what the rube would look like, maybe have a rocket or a pulley system. During the planning we really made sure to incorporate everyone's ideas into what they were feeling was necessary on the rube. If someone disagreed we would say, ok how can we make the idea still be incorporated but make it easier to build or to imagine? But surprisingly no one really disagreed with anyone on what to build except for the ending, which we were torn on what to do.
- 6. **Prototype.** We built our machine out of recycled wood from our school. We started building our machine and moving through the parts that needed more work and the parts that were good. First we created the base and then while some people were building and painting the base we started to build steps 1-11.
- 7. **Testing**. We started to test the machine to see the problems we had. We realized that some steps weren't very reliable so we made them more reliable with better directions and movement for the marble or we changed them completely. Maybe the marble run started to go before we wanted it to, or we had success like the Billie trigger working right when the ball hit it. Sometimes we would get frustrated that we needed to touch the marble to go because it got stuck or because it went before it was supposed to.
- 8. **Process Improvement and Final Build.** Lastly, we started to improve the process, making the machine predictable. The last step is to present our results. We are very excited and can't wait to see how it goes. Our rube has changed and improved drastically from our first idea to our final one. Our team really bonded throughout this experience and we can't wait to show the judges our machine!

How we learned about STEM and how to incorporate it into our Rube

The Star Gazers attend the International Spanish Language Academy. We learn new STEM words in Spanish every day! We are bilingual and love the experience of learning new things! We participate in a STEM class once a week with Sra. Maldonado. In class we learn coding and building. We code with CODE.ORG and we build games which help us see how the codes lined up to power something. Sra. Maldonado gives our classes lots of challenges, like giving us limited materials and having us build a useful object with those materials. This helped shape our rube to be almost 100% recycled. We applied our classroom experiences to our Rube.

Conclusion & Apply to the Future

This was a really fun and challenging experience. We enjoyed working on a STEM project together and getting closer as a team. Some of us were new to the competition and others have competed in previous years. Compared to last year's rube we improved a lot and have a much more complex machine. This was a hard challenge but we succeeded in building and working hard as a team to make it! Regardless of how we do, it was an awesome experience. Being creative and using different materials to build new things helped us to create our machine. We learned as a team that our Rube wasn't just about being able to work machines and get each individual step to work, but that everything needed to work together and thrive off of each other so that we could complete our end goal. We also learned that this Rube was complete artistic freedom. We all really enjoyed doing this project and hope to continue to do projects like these in middle school and far into the future! This engineering machine is the best one yet!

Thank you!

Team Star Gazers Anna Breyer Lauren Breyer Gia Toran Maia Rodriguez

Bibliography

Simple machines types, ideas for steps and energy transfers <u>https://sciencing.com/lesson-introduce-simple-machines-8078032.html</u> <u>https://education.nationalgeographic.org/resource/energy-transfers-and-transformations/</u> <u>https://www.billnye.com/the-science-guy/simple-machines</u> <u>https://study.com/academy/lesson/gravitational-potential-energy-lesson-for-kids.html</u>

Engineering design process

https://engineering.mnsu.edu/engineering-machine-design-contest/handbook/

Wrinkle in Time by Madeleine L'Engle for inspiration (The book that we were inspired by to make the rube goldberg out of)

Journal Appendix

Maia

I felt like this was a really fun experience and that I got a lot closer with my teammates. I did this last year and even had hesitations about doing it this year but I had a lot of fun. I also feel that compared to last year's rube we improved a lot and have a much more complex one. I really hope we place and get to advance because I don't want this to be over yet, but regardless of how we do I had so much fun doing it and it was an awesome experience.

Gia

This was my first year doing this project. When I got invited to do it, I was really happy. It was so fun creating the project with Maia, Anna and Lauren. I remember our first conversation about what we wanted to do for the project. We started it out with FaceTime and then through texting. I also remember our first time meeting up together to do it. That day we started by trying to build parts of it, but we didn't have a good plan yet and the right materials. After that day, we started building and getting far with the project. I think that we had a hard challenge but we succeeded in building and working hard as a team to make it. I have loved the process and working with my teammates and it was a really nice experience.

Journal Appendix

Lauren

I really enjoyed this experience and I'm so glad I got this opportunity. This is my third rube and I've always enjoyed doing them because I always make new friends, grow the friendships I have, and work on a challenge. This was really fun to see the steps come together and I'm so happy with how it turned out. This was so fun and I'm so glad I did it again this year.

Anna

This was a really fun experience for me because I love doing Rube Goldberg and STEM projects! I think that I connected closer with my friends and my teammates! We did a really good job at working as a team and I think that this was awesome for everyone! I have done three rube goldbergs in my lifetime, when I was in second, fifth and sixth grades. I love that there are these competitions. I think that this Rube Goldberg is the best one yet! I loved the experience and hope to do another one soon!

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