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This is Gabriella, a girl who loves STEM.



For all the girls struggling to find footing in a male-dominated field: the journey is long and hard, but every step that you take is a step for the rest of us, too. Keep climbing—we'll meet you at the top.

Also, for Mrs. Lewis: thank you for all that you do and for keeping us in line. We know it's not an easy job.

Finally, for Mr. B: your guidance has been invaluable. Thank you for being an inspiration to us everyday and always supporting us. We truly wouldn't be here without you.

What is **STEM**?

STEM is an acronym (a word made from combining the first letters of other words), that means **S**cience, **T**echnology, **E**ngineering, and **M**ath! Chemistry, algebra, robotics, and so much more are all considered part of **STEM**!

One day at school, she noticed a poster.

It was for the robotics team! The first meeting was the next day and she wanted to attend.



She was so excited to meet other girls who also liked STEM!

The next day after school, Gabriella excitedly walked into the first meeting, only to be disappointed when she realized...

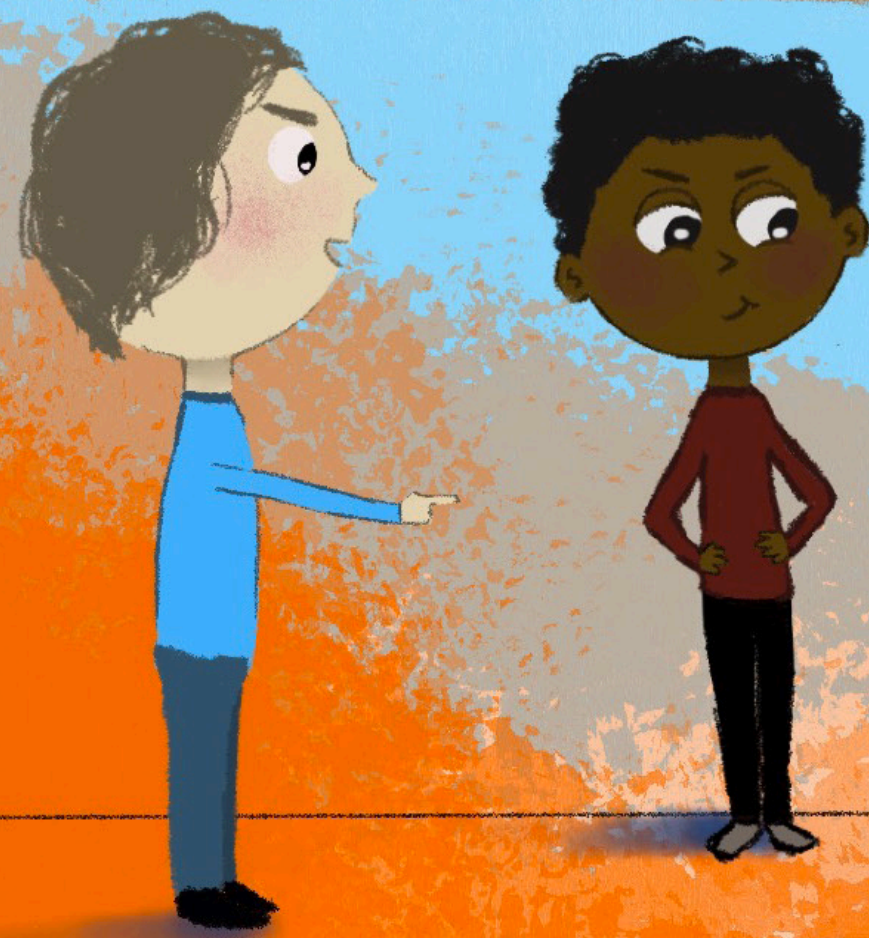


ROBOTICS
MEETING
TODAY!

She was the
ONLY GIRL!

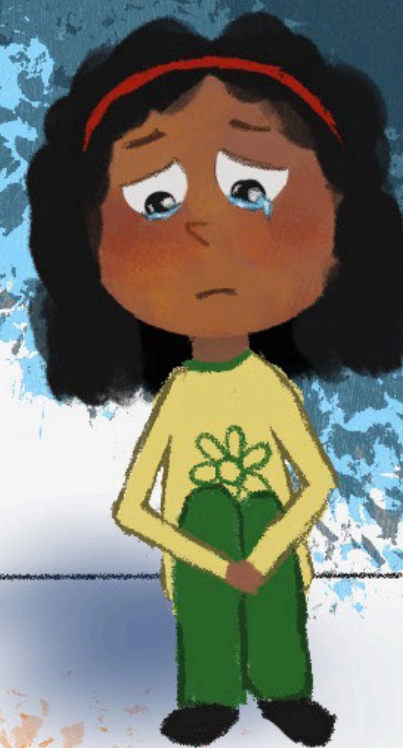


WELCOME TO ROBOTICS TEAM



“What are you doing here?” one of the boys on the team, James, spat at her, **“Robotics isn’t for dumb little girls.”**

The other boys on the team laughed and Gabriella started crying. Even though she really wanted to do robotics, it didn’t feel good to be excluded and made fun of by the team members.



The next day, the robotics coach Mr. B pulled her aside.

"I saw you at the meeting last night. I'm sorry about what happened," he said. "Give robotics another chance!"

The boys made Gabriella feel bad yesterday, but she remembered all the books she had read about amazing women who faced challenges in STEM and knew she couldn't quit.

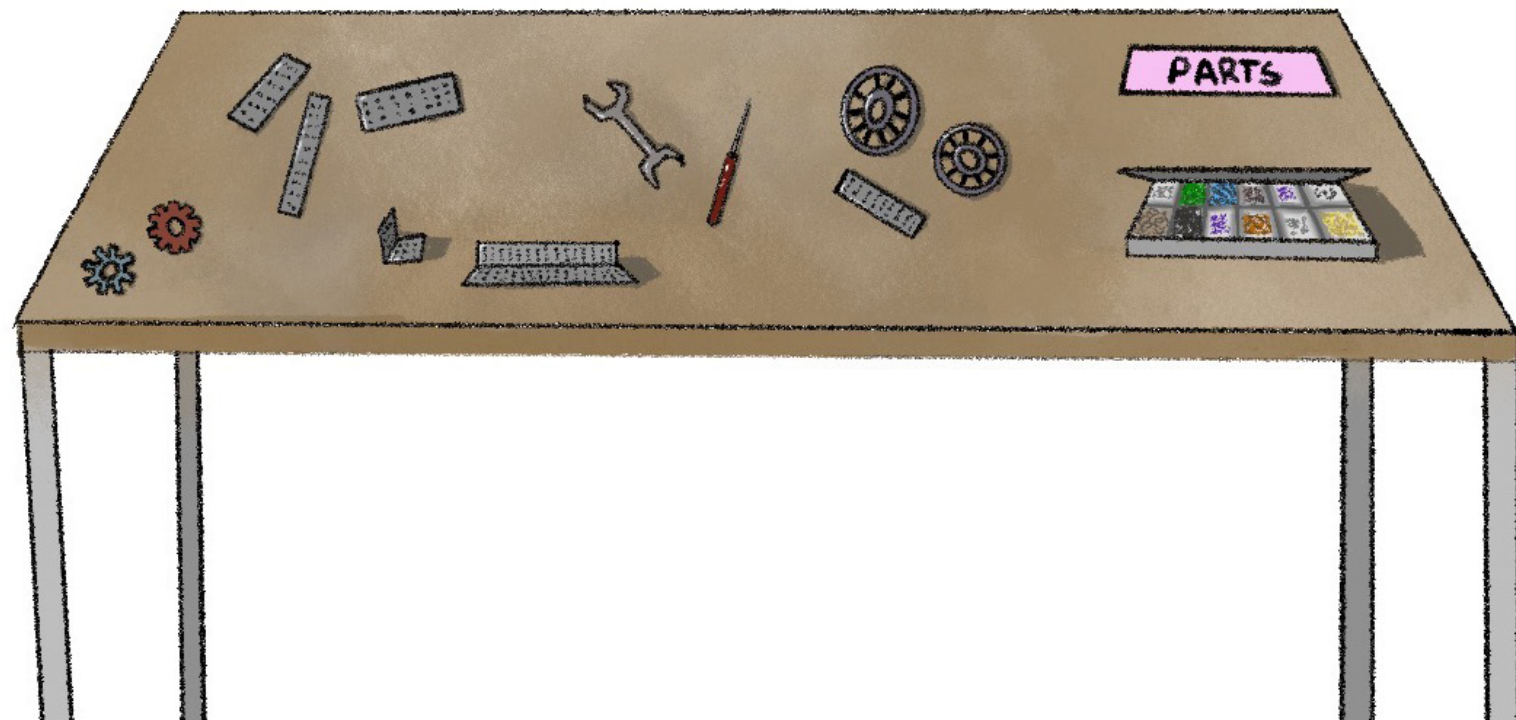
"The next meeting is tomorrow," said Mr. B, "I hope to see you there."



"I'll be there," Gabriella responded.

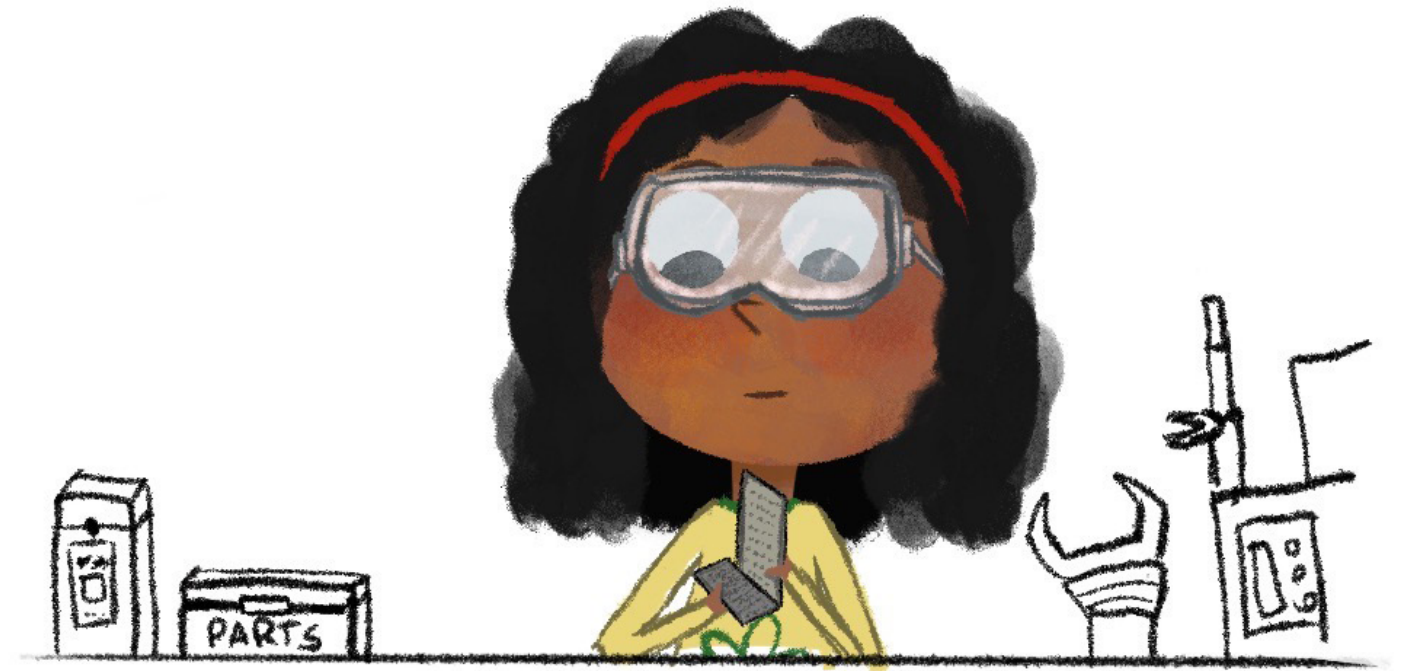
The next afternoon, Gabriella walked into the robotics room to find tools, parts, and wires laid out on the tables.

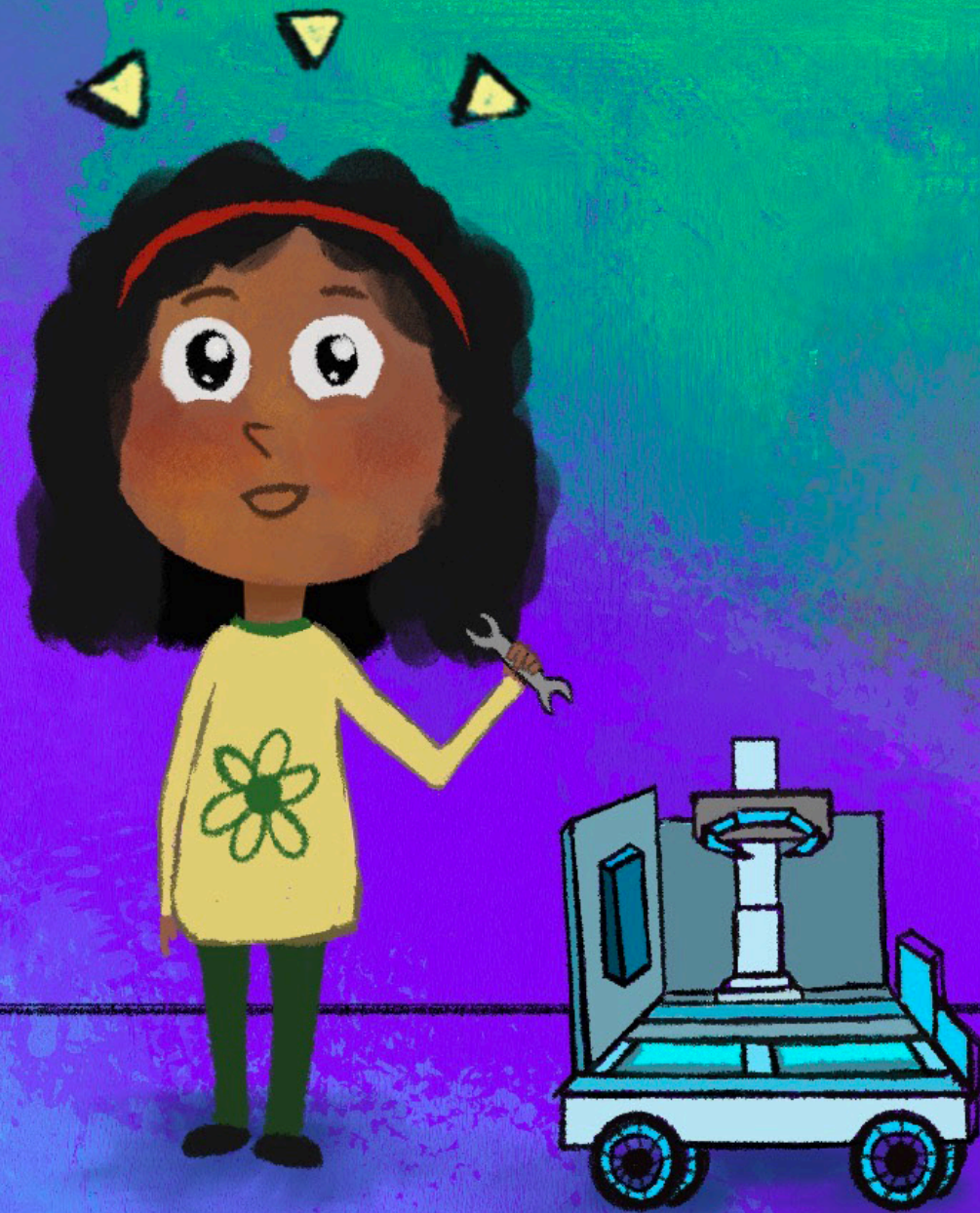
Today, the team will begin building their robot!



The boys wouldn't talk to her, but she was still having fun learning how to build a robot!

She looked at the missions that their robot should accomplish: it needs to pick up and lift blocks to build a tower.





After countless hours of sitting and tinkering with the parts, she finally came up with the first version of the robot.

While it wasn't perfect, it was able to pick up the blocks most of the time!

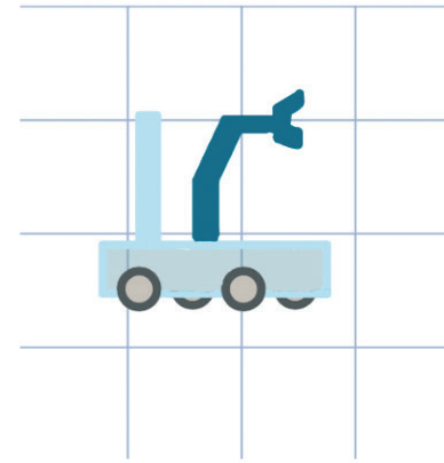
But, Gabriella still wasn't satisfied. She wanted the robot to be even better!

So, she came up with a second **iteration** of the arm and claw system: she improved it by adding rubber bands to keep the arm steady.



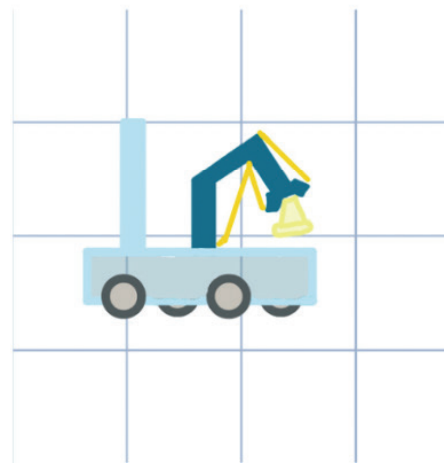
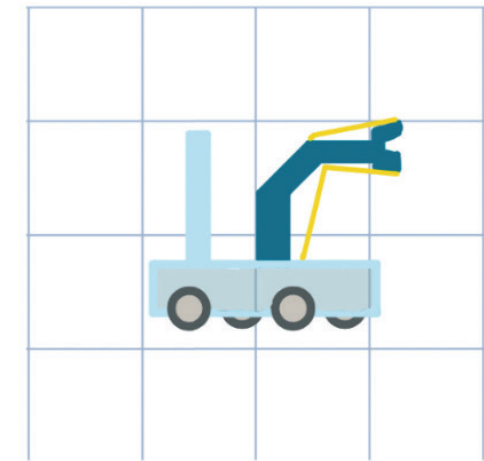
What's an **Iteration** Anyway?

An iteration is basically a version of something (in this case, of a robot). In order to make a good robot, it needs to be tested and improved multiple times. Most of the time, the first iteration of a robot will be changed a lot before the final iteration is made. In robotics, the only way to know if your robot works is to test it!



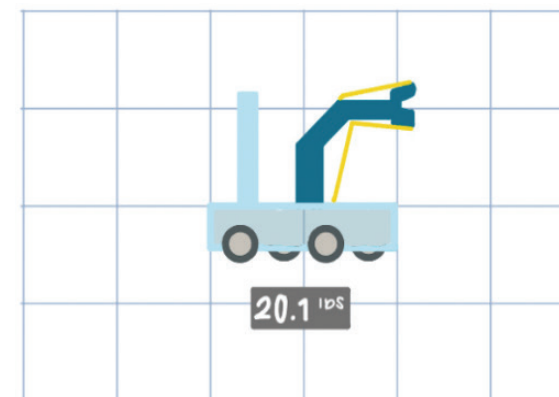
This made her robot even better, and she was very happy with the final result!

First, she added just a few rubber bands on the outside of the arm. This made the arm more steady, but it wasn't enough.



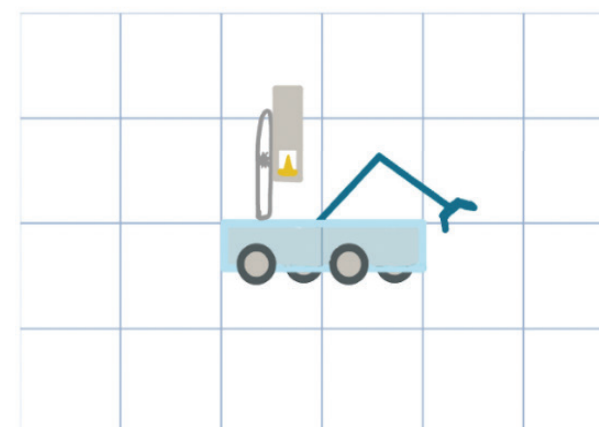
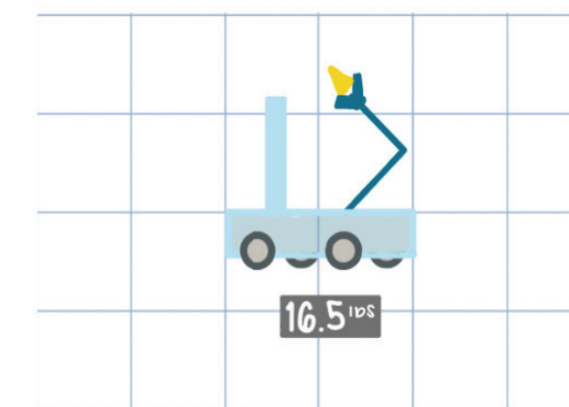
To make the arm even more steady, she added rubber bands on the claw as well. Now, the arm was super sturdy and stable!

Gabriella loves building because she can apply the **physics concepts** she's learning in school.



Her robot was slow, so she used lighter materials to decrease its weight. This way the motors could move her robot at faster speeds!

She also used her knowledge of pulley systems to build a linear slide, a **mechanism** that moves up and down, allowing her robot to pick up objects off the field!



What's a Mechanism?

A mechanism is a system of parts that work together in a machine. Gabriella's linear slide is a mechanism because it's made of different parts such as metal pieces, gears, and string which creates a machine that slides up and down.

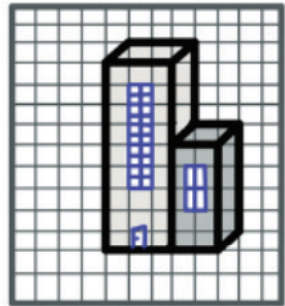
What are Some Engineering Careers?

Mechanical Engineering



Mechanical engineers design, develop, build, and test all sorts of mechanical devices. For example, they may work on machines ranging from car engines to elevators to watches. Anything with moving parts is fair game!

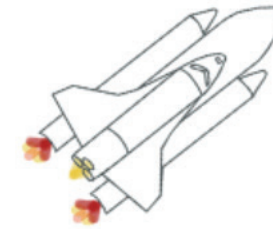
Architecture



Architects design buildings such as houses, schools, office buildings, and any other buildings you can think of! They have to make sure their building design looks good, is sturdy and strong, and fits the needs of the people who will be using the building! For example, a school needs to have lots of classrooms, so an architect needs to make sure they account for that in their design.

Many of the skills Gabriella is learning from building the robot can be used in real world jobs!

Aerospace Engineering



Aerospace engineers design and build aircrafts like space rockets and planes. They use lots of math and science to build things like rockets that travel very high and very far. They make sure these aircrafts don't crash, even when they fly super high or even go into space!

Construction



Construction workers build all the buildings, bridges, and other structures you see around you! They look at the architects' designs and actually bring their plans to life. Their job involves lots of drilling, nailing, and sawing to build all kinds of structures.

So, instead of sitting alone,
Gabriella sat together with the
whole team to learn to code.

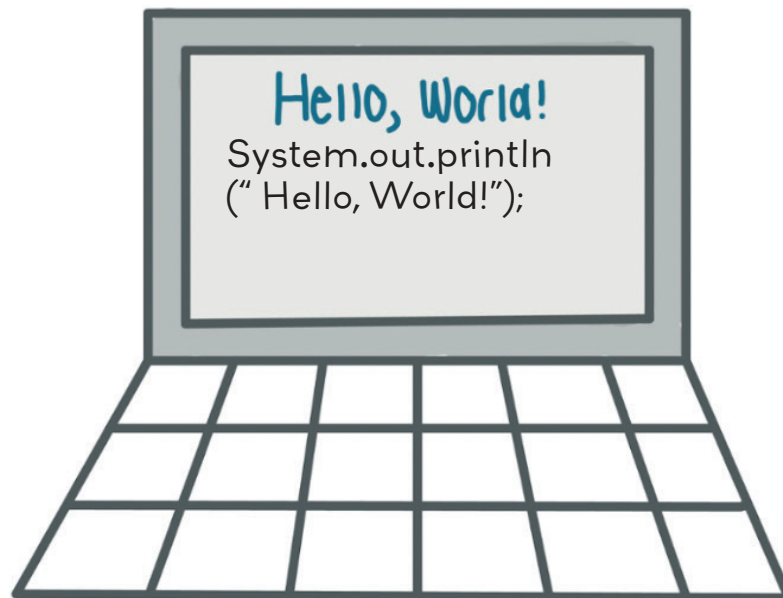
Now that the robot was built, it
was time to code!

Over these past few days, the boys
on the team had seen her talent
with building, and began to accept
her as a member of their team.

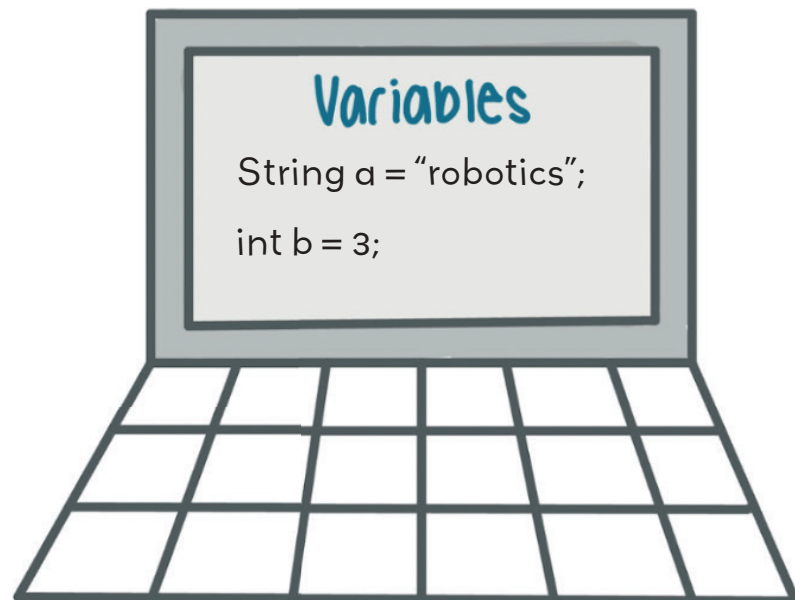
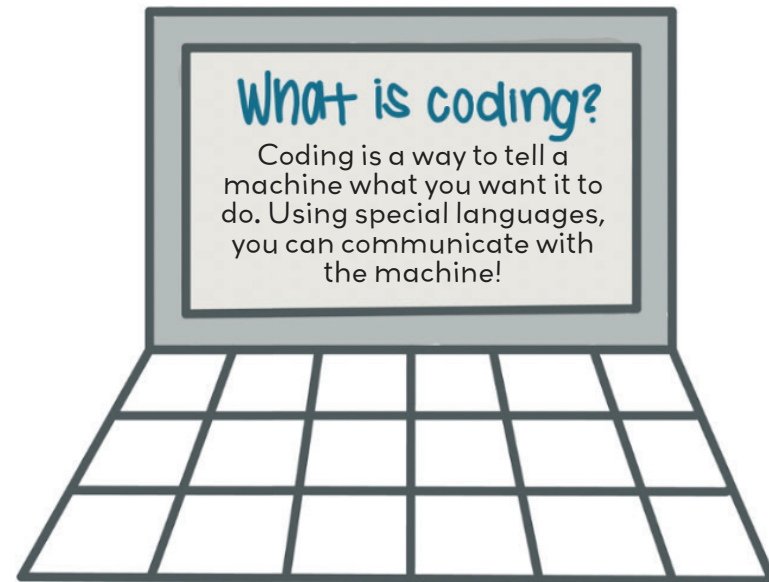


Let's Learn the Basics of Coding!

Sometimes when we're coding, we want to print a line of text. In **Java**, a common coding language, you can print out your text using the command shown below.



In coding, variables are a way to store data, such as words or numbers, under a different name to use later in your code. For example, if you wanted to store a word, you would create a **String**. If you wanted to store a number, you would create an **int**. On the right, we've created both a String and an int. The String variable stores the word "robotics" and the int variable stores the number 3.



```
int x = 3;
int y = 6;
int z = y/x;
```

What's the value of z?
2! 6 divided by 3 equals 2.

```
int x = 4;
int y = 2;
int z = 4 * 2;
```

What's the value of z?
8! In Java, * is the symbol for multiplication.

Since int variables hold values, you can use basic math operations like addition and division on them! The value of the variable will be used in the operation.

```
String x = "robotics";
int y = "rocks";
int z = x + y;
System.out.println("z");
```

What will print?
"Robotics Rocks!" In Java, you can combine two strings using the plus sign.

Even though a String variable holds words and not numbers, you can still use addition on Strings! Using the plus sign will combine the two Strings into one String.

Gabriella loves coding because she gets to think of creative solutions to problems. There are lots of jobs that use coding everyday and people who have those jobs get to use their problem solving skills all the time!

Let's take a look at some of these careers.



Astronomy

Astronomers study space! They look at planets, stars, and comets and then collect data about them. They use coding to sort through this data and then use the data to create simulations of the parts of space they can't see!

Software engineers build software products like apps and video games and run control systems for things like networks. They're the ones who create the apps we use everyday, like Google, Tiktok, and Roblox. They use coding to make these internet applications.

Software Engineering



WEB DEVELOPER

Web developers create websites! They design and then code websites based on what the website will be used for. Most of the websites on the Internet are created by web developers. They also have to maintain the website to make sure it stays updated and relevant.

Soon, the competition had arrived. Gabriella and her team members clutched their robot nervously on the bus.



They were anxious but excited to compete!

"I really hope we do well," James said to Gabriella.

"Me too," she responded.

But Gabriella knew that even if they didn't win, she would still be proud of how far her and her teammates had come this season, and how she had finally been accepted as a member of their team.

When the competition started and the teams began to play matches, Gabriella's team lost most of them, making her very sad.



At this rate, there was no chance of winning.

"Do you see that?" James said as he pointed his finger. Gabriella looked at where he pointed.

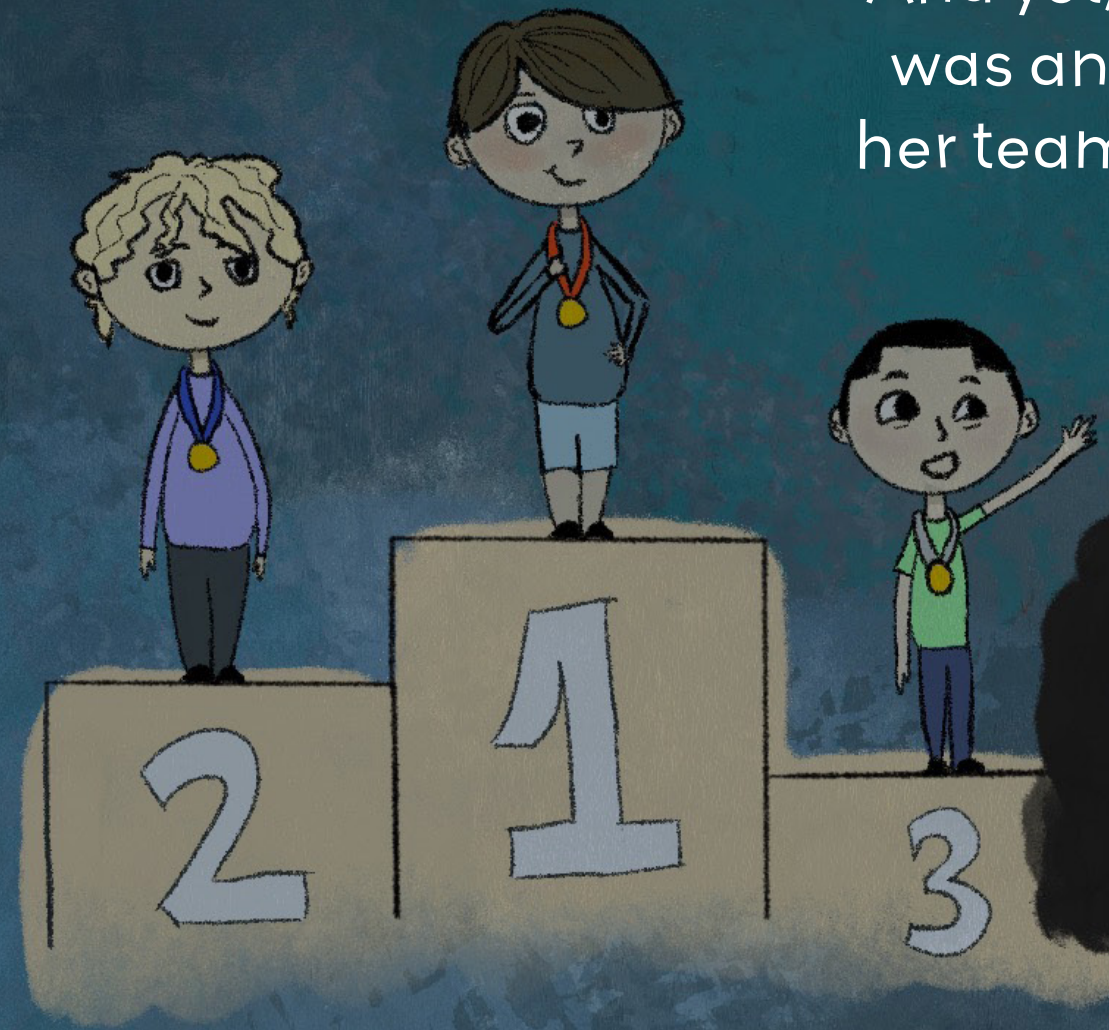
RANKINGS

48		3	1142
49		3	1023
50		2	1015
51		1	971

It was the rankings, and they were in **2nd to last place.**

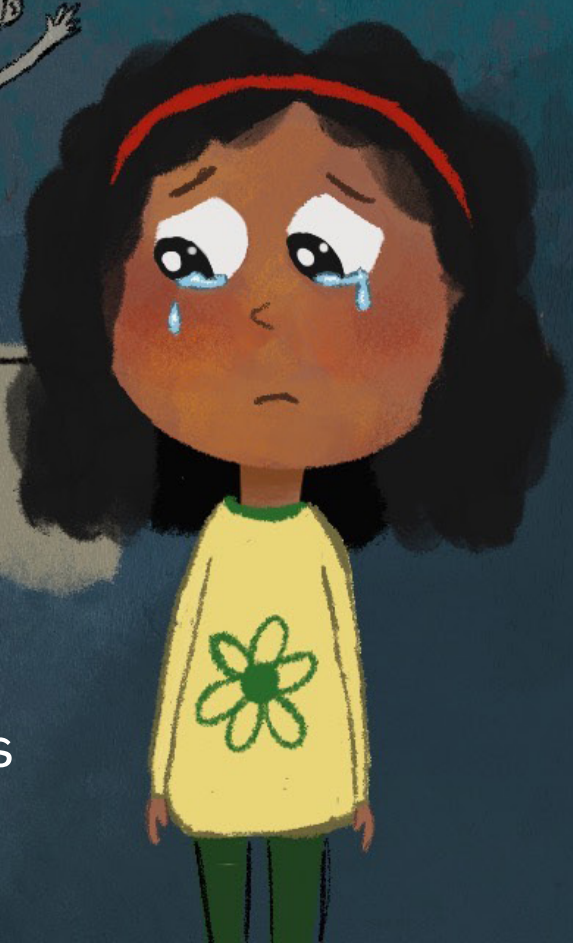
Finally, after a long day of matches, it was time for the closing ceremony where prizes were presented to the winners. After many losses during the robot matches, Gabriella knew that the chance of her team winning anything was low.

But still, she held onto the hope that they might win some kind of award.



And yet, each winner was announced, but her team's name was never called.

Gabriella could feel the tears welling up in her eyes as she saw the winners smiling proudly on the podium.



As Gabriella sadly walked out of the auditorium,
a little girl tapped her on the shoulder.



"I was so excited to see a girl like
me out there," she exclaimed,
**"I never thought that
girls could join
robotics before!"**

Gabriella's frown turned into a smile as she
talked to the little girl about her passion for
robotics. By the time they finished talking, the
little girl agreed that she too would join her
school's robotics team.

Despite losing the competition, Gabriella felt
like a winner. **She was inspiring the next
generation of strong women in robotics!**

James came up to Gabriella once they left the auditorium.

"I wanted to apologize for the way I acted at the beginning of the season. I never knew girls could be interested in robotics, but you're pretty great at it. Can we be friends?" He asked.



"Okay, but in the future, remember that girls can do anything you can do. Lots of girls are interested in STEM and the way you treated me wasn't nice at all," she responded.

"I know and I'll never act that way again! **You've shown me that girls can be as good at STEM as anyone else,**" James said.

Gabriella walked away satisfied, knowing she made a difference in the robotics community by making it more welcoming to girls in the future!



Dear Reader, after reading this book, we hope you found an interest in STEM/pursuing activities like robotics! There are many ways to get involved in robotics in your community, so we'll list some organizations that host competitions in many places across the country.

The organization our robotics team is a part of is **FIRST** (For the Inspiration and Recognition of Science and Technology)! FIRST holds a variety of robotics competitions for different age groups. We compete in **FIRST Tech Challenge (FTC)**, a competition for high schoolers, but FIRST also runs **FIRST Lego League (FLL)** which serves many ages from 4 through 16, depending on your region. Many of our team members have competed in FLL and have made so many great memories in the process. FIRST is an amazing organization that really prepares anyone who participates in their competitions for working professionally in the STEM field. We're so grateful for the organization and all that it does.

Another organization that runs robotics competitions across the United States is VEX. VEX has a competition called VEX IQ, which serves those aged 8 through 14.

Regardless of the organization you decide to compete with, you'll need to find a team or possibly make one of your own! Both VEX IQ and FLL teams can be formed with a minimum of 3 members, so if there isn't a team you want to join, get together some friends or recruit people from your school to participate. Participating in robotics is an wonderful and unforgettable experience!

Our experience competing in robotics has been amazing and we want to spread the knowledge about how to compete like this to readers like you.

If you do decide to start a team, be it FTC or FLL, and need guidance on anything from how to register a team to building and coding, feel free to contact us by email at **despicablemachine6200@gmail.com** and we'll be happy to help. You can also visit our website at **despicablemachine6200.com**.

Why We Wrote This Book

As women involved in STEM, we've faced many challenges on our journey to get to where we are today. All of us can speak to the intimidation we felt when we walked into the first team robotics meeting with mostly all boys who often pushed us aside similarly to how Gabriella was pushed aside by her teammates. Despite this, we stuck with FIRST and made it our mission to recruit more girls onto the robotics team, making robotics more accessible to anyone with an interest. STEM fields benefit vastly from gender diversity, and the gender gap that currently exists puts everyone at a disadvantage.

We want to spread the joy of robotics to those both in and beyond our community, so we've worked on projects such as creating a women in STEM mural to encourage girls to pursue STEM interests, crafting robotics kits to send to underserved kids both locally and abroad who don't have the resources to join a team, and running a Gir1c0de club at our school to foster an environment where girls can discuss their experiences pursuing STEM and learn how to code without fear of judgment or discrimination.

We were also inspired by the various other initiatives that teams around us have started to engage women in STEM, such as FIRST Ladies. **We want to make the STEM community more welcoming, especially to the next generation of young women in STEM.**

About Our Robotics Team

At the time of writing, us three co-authors are part of the robotics program at Barrington High School that competes in the FIRST Tech Challenge. Our team is **#6200, "Despicable Machine."** We're proud to say that we've accomplished a lot within the past few years, such as qualifying for state three times and placing for many awards at both the regional and state level such as the Inspire Award, Think Award, Control Award, and Connect Award. We wouldn't have been able to write this book without the support of the rest of our team.

We would also like to express thanks to our amazing robotics coaches, Mr. Bredemeier and Mrs. Lewis. Mr. Bredemeier was actually the inspiration for the coach in our book as he is always encouraging us to push boundaries and go outside our comfort zone. A successful team can't exist without great mentors, and our coaches have contributed so much to our success.