Ilana Walder-Biesanz
Riverdale High School

It's a normal Saturday for my seven-year-old self: wake up, do a little homework, and head to a Girl Scout event. We're carpooling to Mountaindale for something called a LEGO robotics sampler. I don't know what that is. I mean, I've built stuff with LEGOs, like every other little kid. But how do you build *robots* out of little plastic bricks?

When we get to Mountaindale, an excited 13-year-old in a bright green shirt greets us.

"Hi. I'm Sarah. I'm on the Green Grinches."

The Green Grinches? What?

She continues, "Come into the lodge. We'll start by showing you our robot for last year's competition." Sarah leads us to a ping-pong table with edges. On it are a number of LEGO structures and figurines.

Another girl in a green shirt introduces herself as Tammy and takes over the explanations. "This is the Artic Impact Challenge. Our robot has to go get these two LEGO people, get over this ice field, and grab these barrels of waste…" As she talks, she turns on the robot. She and Sarah take turns aligning it, letting it run a task, and changing its attachments. I watch in wonder.

For the next hour, we play. They have robots set up so that we can control them with two touch sensors. I'm impressed, but impatient. "When do *we* get to make the robots?" I ask.

Sarah laughs. "That's what you're doing next."

They explain the "Can-Do Challenge." There are five cans in a black circle and we want to push them all out in as little time as possible. Easy, right?

My team builds the robot by following the pictures in the instruction book. We add a small bumper to the front and program the robot using the light sensor to keep it in the circle. Our strategy? If the robot bumps around inside the circle for long enough, it might push all the cans out.

Three hours later, the teams convene to share their robots. My group never got our program working, so I'm embarrassed when our robot drives out of the circle after ten seconds. It only pushed out one can.

At home that night, I try to fall asleep, but ideas keep popping into my head. Why didn't we just extend a huge bumper and push all the cans out at once? Why didn't our stay-in-the-circle program work? Could we have changed the basic robot design? Would it have helped to have a touch sensor in the bumper so the robot would know when it ran into a can?

When I wake up the next morning, I run to my mom and ask to join the Green Grinches.

"No," she tells me, "They're too far away."

I'm the best negotiator in our house (even though my dad negotiates professionally), and I'm not going to let her off that easily. "But it helps with math and science. And they said there aren't enough girls doing it. I'll learn building and programming and a lot of science stuff on a LEGO robotics team. Plus, I can win trophies for playing with LEGOs."

"Ilana, I won't drive you to team meetings in Vancouver three times a week."

"Then I'm starting a team here!"

I started two teams over the course of my four-year *FIRST* LEGO League (FLL) career. We consistently had award-winning robots and research projects, but eventually the novelty of LEGO robots wore off. I grew, and I wanted the real thing—the big, five-foot-tall, 120-pound robots.

I tried to start a *FIRST* Robotics Competition (FRC) team at my school freshman year but only four students signed up. So I put my dream of a Riverdale team on hold and enlisted the most enthusiastic of the robotics-interested kids, Zeno, to join me as a

founding member of Tualatin High School's robotics team. We quickly became essential, with Zeno running the mechanical end of things and me fund raising, marketing, and leading community outreach. I gained valuable skills and put them to use. I planned and led a bilingual (Spanish/English) FLL camp for elementary school girls, taught fund raising seminars, spoke to the Oregon Science Teachers' Association and to various TV and print news reporters about *FIRST*.

After two years with the Tualatin team, we again surveyed the student population at Riverdale and discovered enough interest for a team of our own. We were concerned about abandoning Tualatin, but softened the blow by fund raising for them for another year and leaving them a notebook documenting all our marketing, fund raising, and project management techniques. They dubbed it the "marketing Bible" and since have put it to good use.

Meanwhile, we scraped together sponsors, students and mentors for a Riverdale team. We had long meetings with the principal to get approval, and longer meetings with our Athletic Director to get robotics recognized as a varsity sport. We found fifteen enthusiastic students and six excited mentors (who, in turn, found us another six mentors by dragging them to team meetings). For our first team meeting, we borrowed 80/20 extruded aluminum from the Catlin Gabel team. Our prospective designers drew a shape for us to build; our soon-to-be builders had to construct it with our limited assortment of bar lengths and connectors.

We spent the rest of this first meeting setting goals. Our primary objective was to "set reasonable goals and achieve them." Our logical programmers wryly remarked that this was recursive. Nonetheless, we have accomplished it.

Goal: "Stay on schedule with a good project management system." After getting the year's challenge, I led the team in the creation of a Quality Function Deployment (QFD) spreadsheet to map our basic strategy. From there, we determined a rough robot design and schedule for filling in design details, building components, and putting it all together. It was ambitious, as it called for the completion of our robot a week and a half before ship date. Thanks to our organization, we stuck to it almost exactly, without adding practices or pulling all-nighters.

Goal: "Make friends from other teams." We found that the best way to do this is to help other teams when they need it, and ask for help when we need it. We didn't have enough skills to help other teams in technical areas, but we knew what we were good at—project management and marketing—and helped with those. I created a generic marketing PowerPoint for Oregon teams and led a seminar about effective fund raising and sponsor outreach techniques. I e-mailed resources I created including grant-proposal writing guides, sample grant proposals and sponsor updates, and phone scripts to other area teams. In return, we sought and received help from Oregon teams when we ran into programming issues or needed extra parts. We further hope to make friends with *FIRST*ies and non-*FIRST*ies internationally. We've made this a little easier by translating our team website (www.riverdalerobotics.com) into Spanish and French (and Thai, Japanese, and German are in the works).

Goal: "Build a sustainability plan." The best way to be sustainable is to involve our sponsors, school, and community in the team. To this effect, I've included our school board and Parent-Teacher Committee in all our biweekly sponsor updates. I wrote robotics blurbs for the community newsletter. The community responded: a local cable access channel agreed to film a documentary about our team, which will air throughout Portland in the spring. We worked with physics and experimental science class members and teachers, as well as our school custodian (who is an avid inventor with two patents and three more pending), to get robot input. We showed off our robot at basketball-game halftimes and school assemblies. We surveyed the school population

and found that more students need help in math and science than in any other subjects. In response, we set up a bulletin board where peer tutors (including robotics team members) post contact information and what subjects they'll support.

Goal: "Learn to work as a team." A lot of this has come about naturally as a result of our unified investment in the team's success. We work together well during meetings because we have a strong organizational plan. We begin each meeting listing the day's tasks. As team captain, I then delegate them to the proper sub-teams and give each sub-team leader a completion deadline. Each sub-team leader divides his or her team's task among the members. At the end of the meeting, we report back to each other about our progress. We're further connected by a common country—our programming lead, Max, is the king of the made-up nation Aefira, and over half of the robotics team members are citizens. We have our own parliament, constitution, currency, and laws. Listening to our team members chat is confusing: the conversation switches from Aefiran and US politics to philosophy to website or code or hardware issues, without transitions or pauses. We're comfortable with each other, and enjoy spending time together outside of the robotics context.

Goals: "Add technical skills," "Get the robot moving," "Pass robot inspection," "Have a robot that works at competition." Done! We have an impressive robot (see picture) in a crate and on its way to competition. Hopefully, it will work as well when it gets there as it did during testing.

Goal: "Have fun." By my definition, fun includes being overscheduled and doing obscure math problems. Because our team was well organized we got everything done with a minimum of stress. This enabled me to do other things I enjoy: take college courses, compete in the science bowl, and prepare for the regional mock trial competition. Our team also had group fun, as evidenced by pool noodle fights with robot-bumper-building materials and spontaneous eruptions of philosophical discussions. Our idea of fun can be somewhat geeky: during one lull in activity, three of us decided to come up with a complex mathematical formula to produce our team number, 2915. It included surreal and complex numbers, Wronskians, trigonometric functions, mods, sums of series, integrals, factorials, the Riemann zeta function, and binomial coefficients. We're looking forward to writing this formula on our robot at competition and watching other teams try to puzzle it out.

Seven years after my first robotics experience:
"Why is there a panda button on your shirt?" the nine-year-old member of the Fire-Breathing Penguins asks me impatiently.
"It's my robotics team logo," I explain.
"You're on a robotics team?"
"Yes."
She looks puzzled. "Why aren't you competing here?" she asks, gesturing to indicate this FLL tournament venue.
"I'm too old for this," I explain, "I build big robots now."
"How big? Bigger than me?"
I laugh. "A lot bigger than you. Five feet tall. Almost as tall as I am."
Her eyes grow wide. "Can I build big robots too?"
"When you're a little older, you can move from LEGO robots to big robots," I reply, "by joining your high school's team."
"What if we don't have a team?" she complains.
"You can start your own. That's what I did."