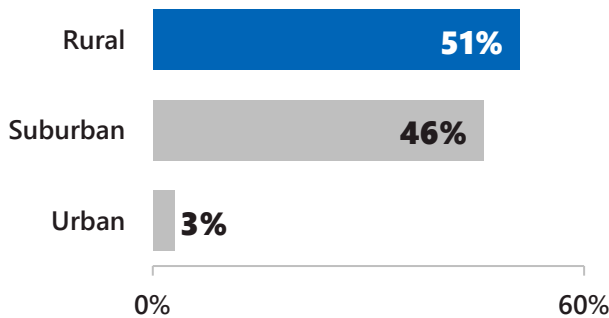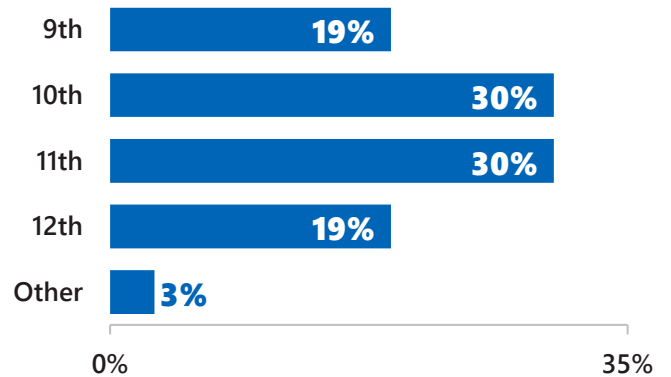# *FIRST* Robotics Competition
2024 Evaluation Report

FIRST Robotics Competition (FRC) is a program that introduces high school students to real-world engineering and coding skills in an engaging, inclusive, and creative learning environment. This evaluation report showcases results from the 2024 student survey, in which participants were asked to rate their attitudes from both **before** and **after** their participation in FRC. A total of **176** students completed the survey.

12
school districts represented

49%
first-year participants

34%
female

48%
underrepresented minorities*

* Includes students who identified as Asian, Pacific Islander, Black or African American, Hispanic/Latino, Native American, multiracial/biracial, or another racial identity not listed.

Over half of students represented rural districts.

Rural **51%**
Suburban **46%**
Urban **3%**

0%　　　　60%

Students came from all grade levels (9-12).

9th **19%**
10th **30%**
11th **30%**
12th **19%**
Other **3%**

0%　　　　35%

FRC students showed growth in critical social-emotional skills like teamwork and grit.

● Before　● After

I am a good team member. — 70% — 91%

I can compliment or encourage others. — 76% — 93%

I learn from my mistakes. — 76% — 97%

I can be respectful even when I don't win. — 78% — 98%

0%　　% Students who Agreed/Strongly Agreed　　100%

When asked what they liked best about FRC, students most often mentioned the **community** and **friendships** they formed while working toward a common goal. As one student said, "[I like] the **teamwork, dedication, and passion** we hold to make a robot together for every season! There is a **family-like feeling** when there's so much fun and work that goes into a project!"

Students reported their perceptions around engineering became significantly more positive during the FRC program.
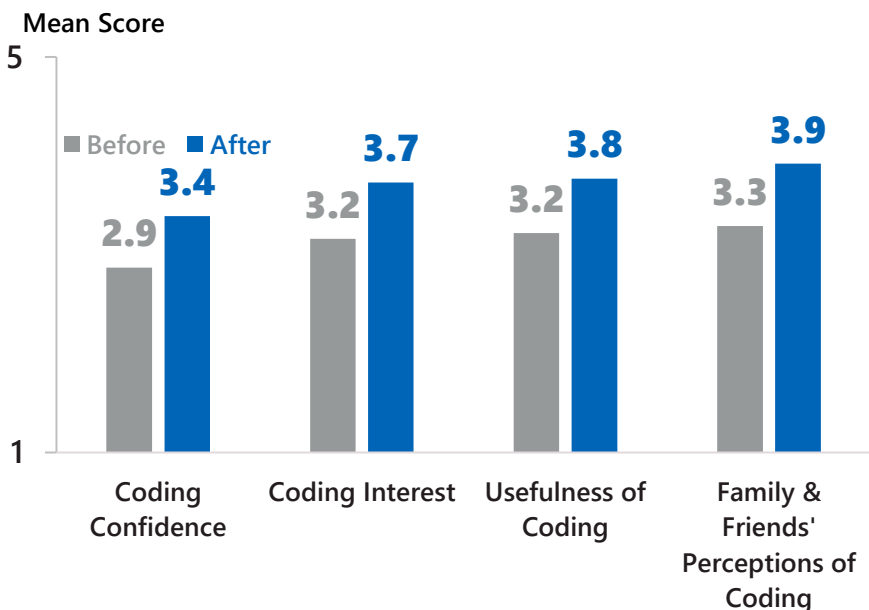
These scales were adapted from the Elementary Student Coding Attitudes Survey (Mason & Rich, 2020). Each scale ranged in value from 1 (lowest) to 5 (highest). All changes were statistically significant (p<.001), and the program had a large effect on these outcomes (Cohen's d>0.8). There were no differences in scores based on race or county-level economic disadvantage.

Mean Score

	Before	After
Engineering Confidence	3.5	4.3
Engineering Interest	3.8	4.4
Usefulness of Engineering	3.7	4.4
Family & Friends' Perceptions of Engineering	3.6	4.3
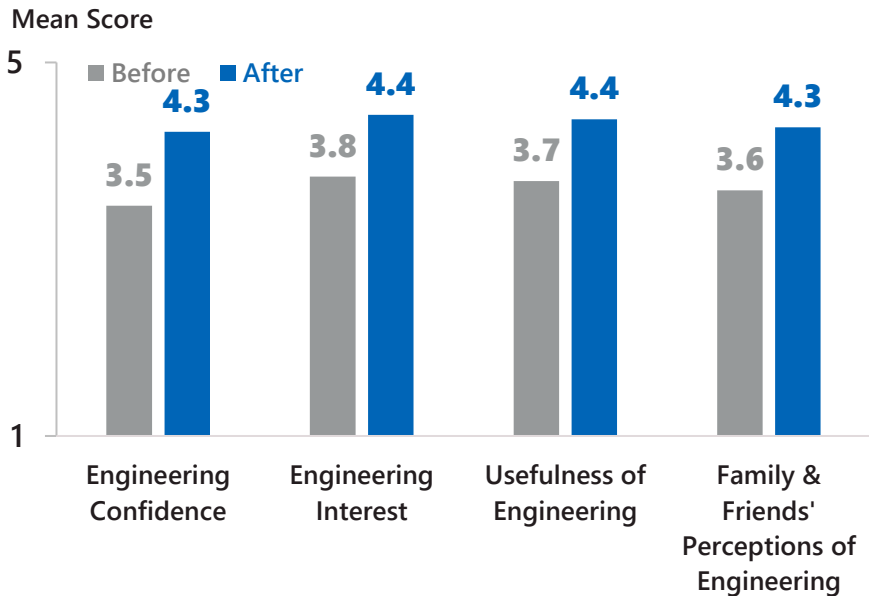
88%
of students said they wanted to **learn more about engineering** after participating in FRC.

Students' perceptions of coding also grew more positive during the FRC program, though their scores were lower than for engineering.

Scale scores are from the Elementary Student Coding Attitudes Survey (Mason & Rich, 2020). Each scale ranged in value from 1 (lowest) to 5 (highest). All changes were statistically significant (p<.001), and the program's effects were medium to large (Cohen's d=.6 - 1.0). There were no differences in scores based on race or county-level economic disadvantage.

Mean Score

|	Before	After
Coding Confidence	2.9	3.4
Coding Interest	3.2	3.7
Usefulness of Coding	3.2	3.8
Family & Friends' Perceptions of Coding	3.3	3.9

Students said they learned **many new skills** in FRC, such as:

- Engineering
- Coding
- Leadership
- Problem-solving
- Design
- Welding
- Business
- Confidence
- Communication
- Mechanics
- Power tools

After participating in FRC, students reported higher levels of self-efficacy in all STEM disciplines.

The scales below were adapted from the Student Attitudes toward STEM (S-STEM) Survey (Friday Center for Educational Innovation, 2012). All changes were statistically significant ($p<.001$). Effect sizes were small-to-medium for math (Cohen's $d=0.4$), medium for math (Cohen's $d=0.5$), and large for engineering and general STEM (Cohen's $d>0.8$). Students from underrepresented minority groups lagged behind white students in science and math by approximately 0.3 at both time points; other subgroup differences are reported on the following page.
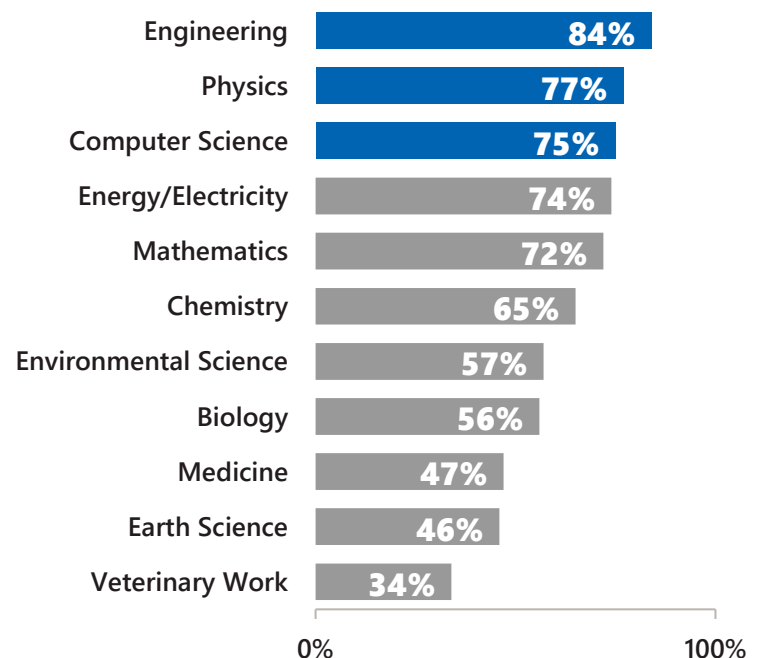
Mean Score

	Before	After
General STEM	4.1	4.6
Engineering	3.8	4.3
Science	4.0	4.2
Math	4.0	4.1
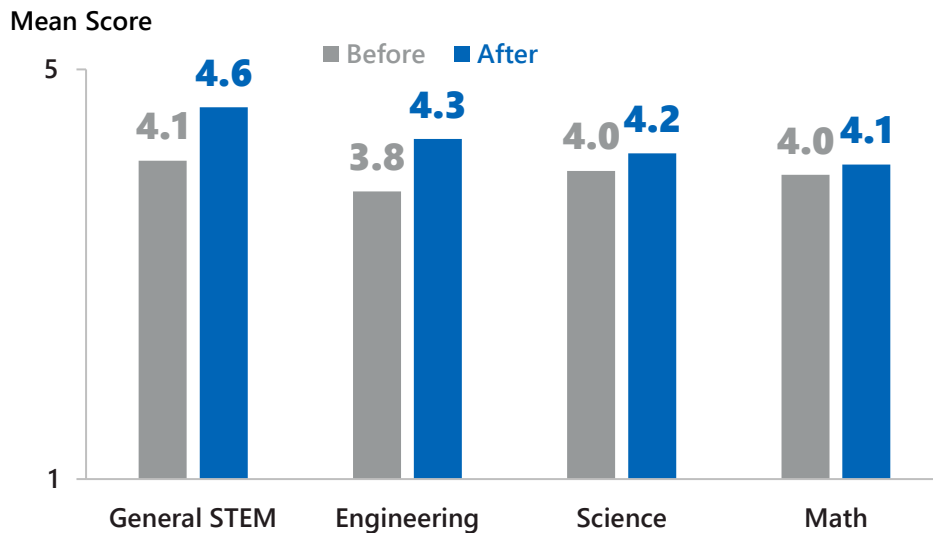
99%
of FRC students said **STEM is really important** for the world.

After participating in FRC, students said they were more interested in taking upper-level STEM courses and in pursuing a STEM career.
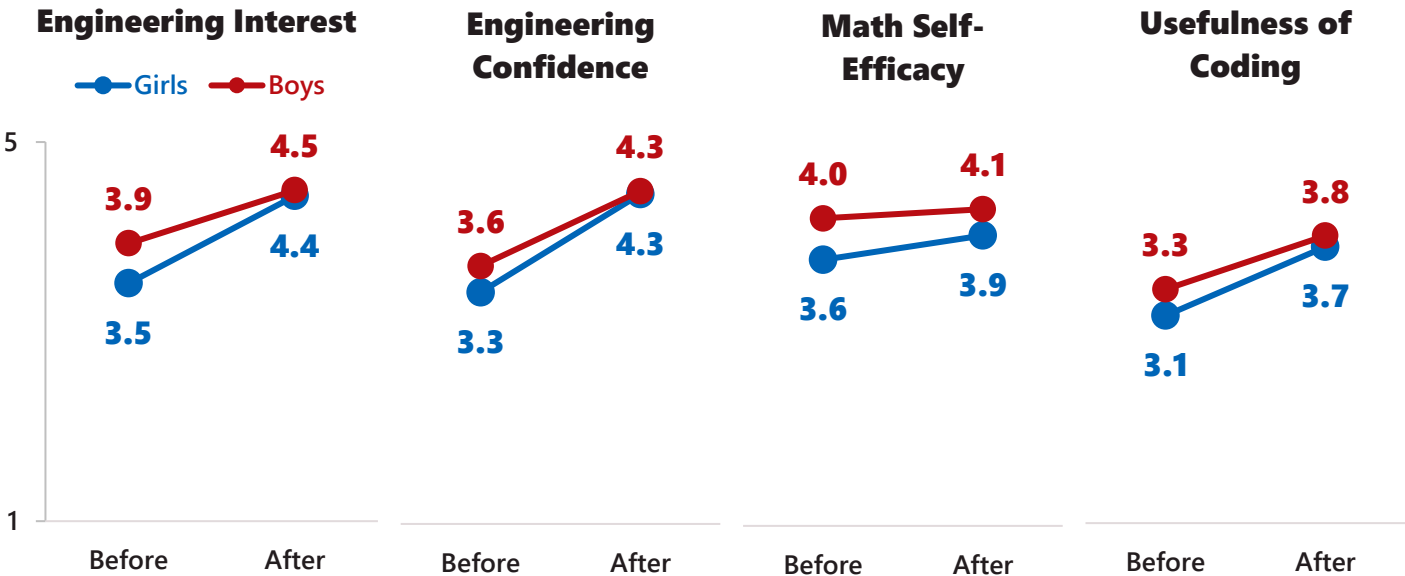
FRC students said they plan to …

- Take STEM elective classes. **(92%)**
- Pursue a four-year college degree. **(88%)**
- Complete an internship or apprenticeship. **(85%)**
- Take challenging science courses. **(79%)**
- Take challenging math courses. **(76%)**
- Take computer science courses. **(60%)**

The most popular career fields were engineering, physics, and computer science.

Field	Percent
Engineering	84%
Physics	77%
Computer Science	75%
Energy/Electricity	74%
Mathematics	72%
Chemistry	65%
Environmental Science	57%
Biology	56%
Medicine	47%
Earth Science	46%
Veterinary Work	34%

Before enrolling in FRC, girls said they had lower levels of interest and confidence, and self-efficacy. By the end of the program, however, this gender gap had largely disappeared.

Engineering Interest

— Girls — Boys

5

3.9
3.5
4.5
4.4

Before   After

Engineering Confidence

3.6
3.3
4.3
4.3

Before   After

Math Self-Efficacy

4.0
3.6
4.1
3.9

Before   After

Usefulness of Coding

3.3
3.1
3.8
3.7

Before   After

1

Even after completing the program, rural students lagged behind suburban/urban students on how they, their families, and friends perceived STEM and coding.

STEM Perceptions

— Rural
— Urban/Suburban

5

4.2
4.0
4.7
4.6

Before   After

Usefulness of Coding

3.3
3.2
3.9
3.6

Before   After

Family & Friends' Perceptions of Coding

3.4
3.2
4.1
3.8

Before   After

Family & Friends' Perceptions of Engineering

3.7
3.6
4.4
4.2

Before   After

1
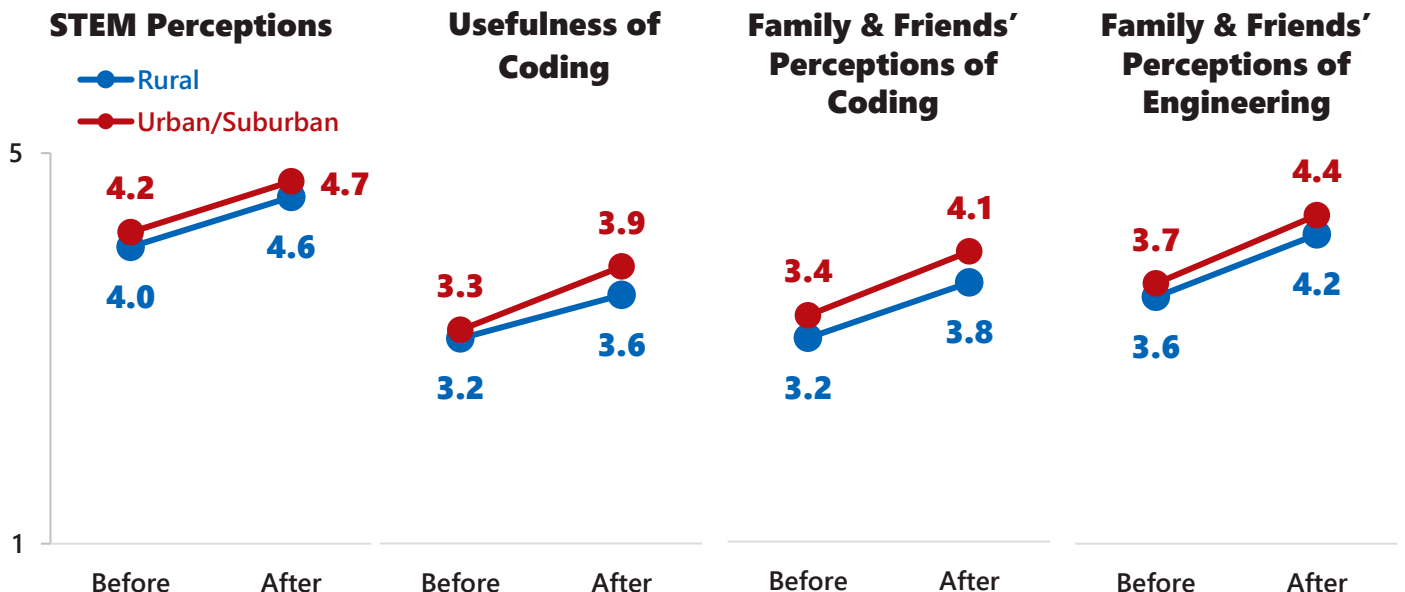
👍 **Nearly all students had positive experiences in FRC and described the program as...**

Fun

"I've had a lot of fun meeting so many new people and have learned so much about technology, engineering, and myself."

"The atmosphere at competitions is electric, with teams from all over the world coming together to share knowledge, compete, and have fun. Plus, there's the satisfaction of seeing months of hard work pay off when your robot performs well on the field."

Life-changing

"My FRC team has absolutely changed my life! I made friends, I found my passions, and I grew as a person and leader."

"It's the best thing I have ever been a part of. This team saved my life."

"Being part of an FRC team is a transformative experience that combines technical skills with personal growth and community engagement. It's about more than just building robots— it's about building future leaders and innovators who are prepared to tackle the challenges of tomorrow."

Open to Everyone

"This team has always believed in and enabled me to thrive. They never allowed my disabilities to stop me from achieving my goals."

"[I liked] being a part of a team and being able to find a place where I fit in."

Collaborative

"I liked how everyone had a specific role in the team, and everyone fulfilled their role. It's nice knowing I have a part to play in the team."

"I love the environment FRC creates. Our team is structured through collaboration. We pass on our knowledge to our peers and support each other's opinions and ideas."

"I love how FRC makes certain to encourage an environment of cooperation and collaboration."

Encouraging

"My favorite part of FRC was the support we received from other teams. As a part of a rookie team, it greatly benefited my enjoyment of the events that other teams were willing to support our engineers and me, as a coder, in learning a new coding language."

"I like how everyone, no matter what the situation, always has a good attitude, and is always looking for a way to help others."

Time Commitment

"I do not like the crunch period when building the robot because there are late nights, and it can be stressful. However, it is amazing to see a robot begin to work, and the competition would definitely not be the same without the limited time aspect."

"It was definitely a bit more fast-paced than I expected."

"My least favorite part of FRC was the large amount of time I had to dedicate to the events. Although the events were fun, waking up early in the morning and returning to a hotel late at night after working on code all day was, to say the least, exhausting."

Cost

"[I did not like] the ability for teams with more money to dominate the competitions."

"I don't like how we have to do so much work to do funding."

"[For] newer teams or teams going to Worlds for the first time, it's very hard financially to do it."

Discussion

During the 2023-24 FRC season, high school participants demonstrated **strong growth** in their social-emotional skills, attitudes toward STEM, and interest in STEM pathways and careers. All student subgroups experienced meaningful growth across all survey scales, regardless of gender, race, geographic location, or level of economic advantage. However, even at the end of the program, **minority students scored lower than white students** in math and science self-efficacy, and **rural students scored lower than urban/suburban students** in their perceptions of STEM and coding.

In reflecting on their experiences, students described the overall learning environment of FRC as one that promoted **holistic growth** not only in technical STEM knowledge but also in leadership, life skills, and social-emotional learning. Because of the program's strong focus on teamwork and collaboration, participants **overwhelmingly felt supported** by their peers, including both those from their own team and those from competing teams. Although a few students struggled to find their niche amid a "**steep learning curve**," most expressed pride in their ability to make **meaningful contributions** and achieve their team's goals. Students expressed appreciation for the unique opportunities they received through the program and were eager to continue participating in the future, either as returning students or as program volunteers.