FIRST® Impact

July 27, 2018

FIRST LEGO LEAGUE JR.

FIRST LEGO LEAGUE

FIRST TECH CHALLENGE

FIRST ROBOTICS COMPETITION

The mission of *FIRST*...

Inspire youth to become science & technology leaders and innovators,
by engaging them in exciting, mentor-guided programs
that build science, engineering, and technology skills,
inspire innovation, and foster well-rounded life capabilities.

FIRST LEGO LEAGUE JR.
Ages 6-9 (Grades K-3)

FIRST LEGO LEAGUE
Ages 9-16* *(Grades 4-8)
*Ages vary by country

FIRST TECH CHALLENGE
Ages 12-18 (Grades 7-12)

FIRST ROBOTICS COMPETITION
Ages 14-18 (Grades 9-12)

FIRST

FIRST® – 2017-18 (estimates)

518K
students on 59k teams
In 86 countries

250K
Mentor, Coach, Judge, & Volunteer roles

18M
Volunteer hours

>$90M
scholarship opportunities from nearly 200 providers

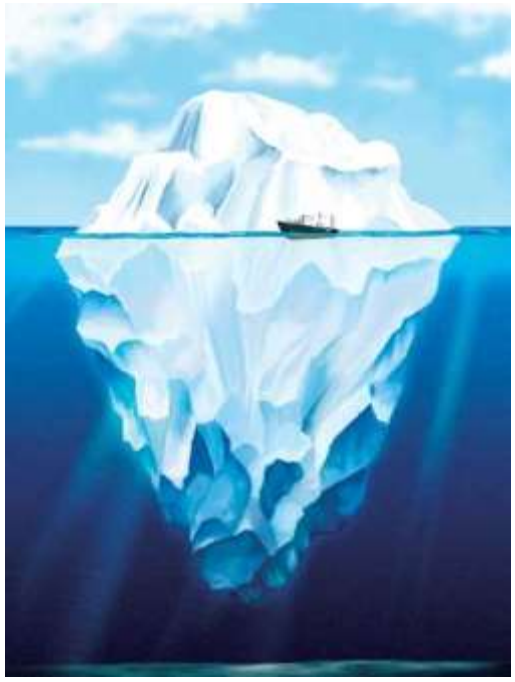
2,900+
events in 70 countries

>64K
participants at annual *FIRST*® Championships

"The only sport where everyone who plays can turn pro"

FIRST® Impact: "More than Robots"

- ***STEM Awareness, Skills and Intent***
  - Increase the number of youth who pursue post-secondary education and careers in STEM-related fields and industries
- ***Innovation and Entrepreneurship***
  - Inspire youth to become leaders and innovators in their field and society
- ***21st Century Work-Life Skills***
  - Enable youth to develop valuable, real-world skills applicable to all career choices and outcomes
  - Ethos of Gracious Professionalism® and Coopertition®



FIRST® Progression of Programs

FIRST LEGO LEAGUE JR.

Ages 6 – 10

Teams of up to 6 kids build interest in science with a real-world challenge solved by guided research and imagination.

AQUA ADVENTURE

FIRST LEGO LEAGUE

Ages 9 – 14

Teams of up to 10 kids build LEGO®–based robots and develop research projects based on a real-world scientific challenges.

HYDRO DYNAMICS

FIRST TECH CHALLENGE

Ages 12 – 18

Teams of up to 15 students develop strategy, design and build sophisticated robots using a modular kit-of-parts, then compete head to head using Snapdragon technology.

FIRST RELIC RECOVERY

Qualcomm

FIRST ROBOTICS COMPETITION

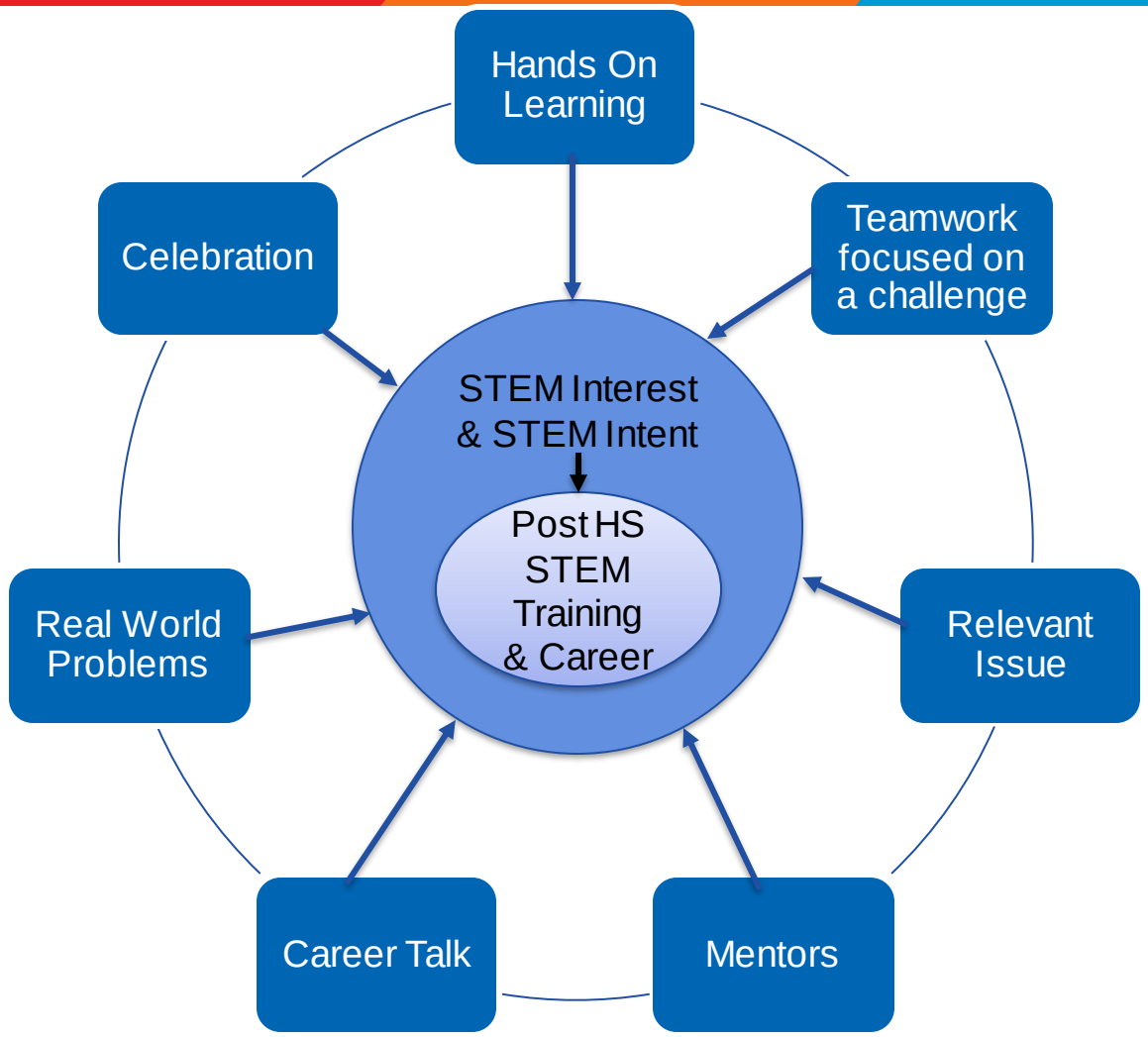
Ages 14 – 18

Teams of ~25 students compete in this "Varsity Sport for the Mind," combining the excitement of sports with the rigors of science and technology.

FIRST POWER UP

FIRST Theory of Change

- *FIRST* LEGO League Jr
- *FIRST* LEGO League
- *FIRST* Tech Challenge
- *FIRST* Robotics Competition



Assessing Impact

FIRST Longitudinal Study: Overview

Multi-year, industry-leading study conducted by Brandeis University focused on *FIRST*® LEGO® League, *FIRST*® Tech Challenge, and *FIRST*® Robotics Competition

Sample: *FIRST* participants: new members on veteran *FIRST* teams (822) and Comparison group: students in math and science classes at same schools (451)

Evaluation Questions:

- What are the short- and long-term impacts of the *FIRST* Robotics Competition, *FIRST* Tech Challenge and *FIRST* LEGO League programs on program participants?
- What is the relationship between program experience and impact? To what extent are differences in experiences associated with differences in impacts among *FIRST* participants?
- To what extent are there differences in experiences and impacts among key sub-populations of *FIRST* participants?

48 Months of Data Collection

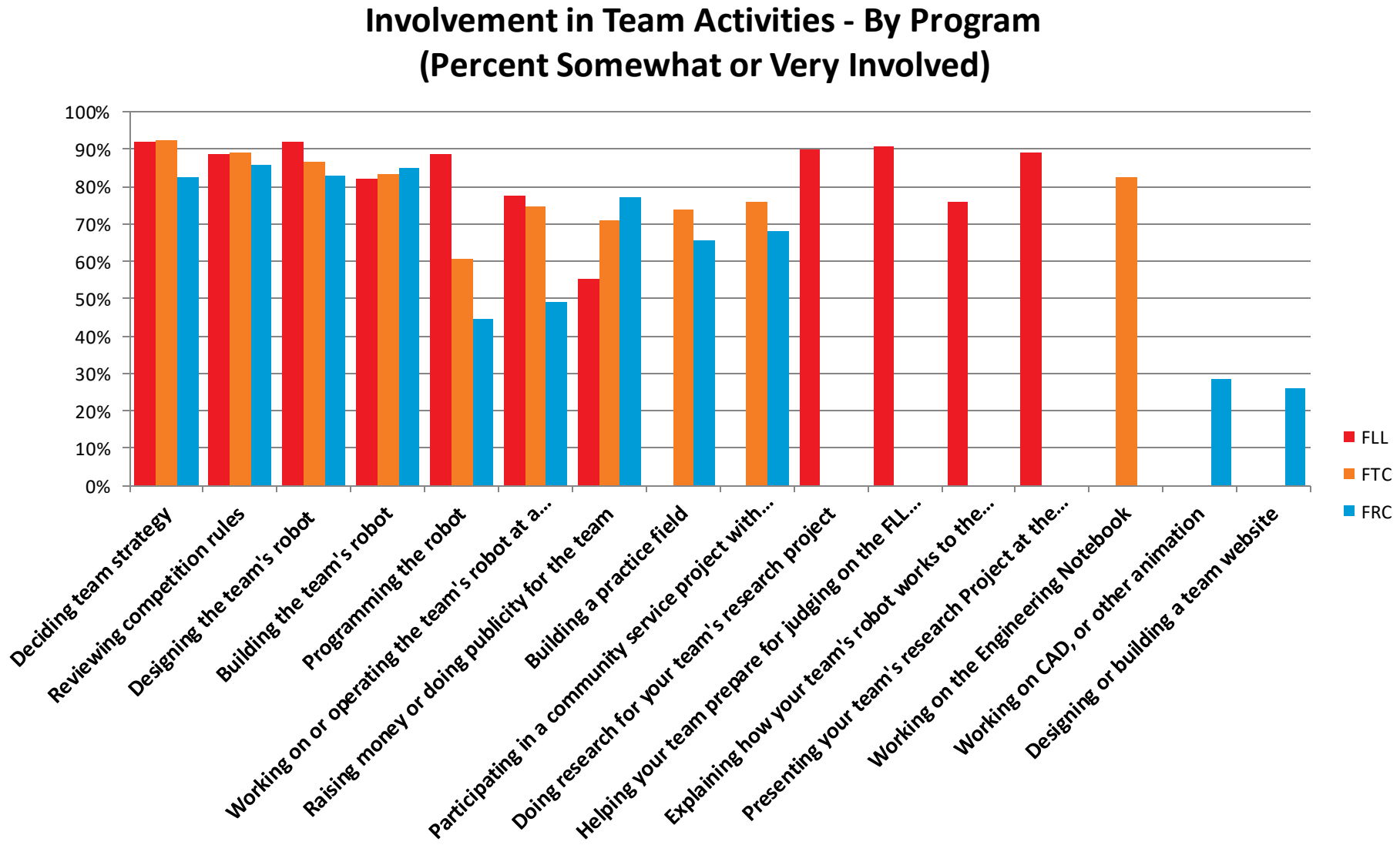
- Analysis includes four full years of survey data: baseline and post survey (Year 1) and three additional annual follow-up surveys (at 24, 36 and 48 months)
- Analysis controls for baseline differences in gender, race, socioeconomic status, parental support for STEM and baseline involvement and interest in STEM among the *FIRST* participants and comparison group

Participant Characteristics at 48 Months

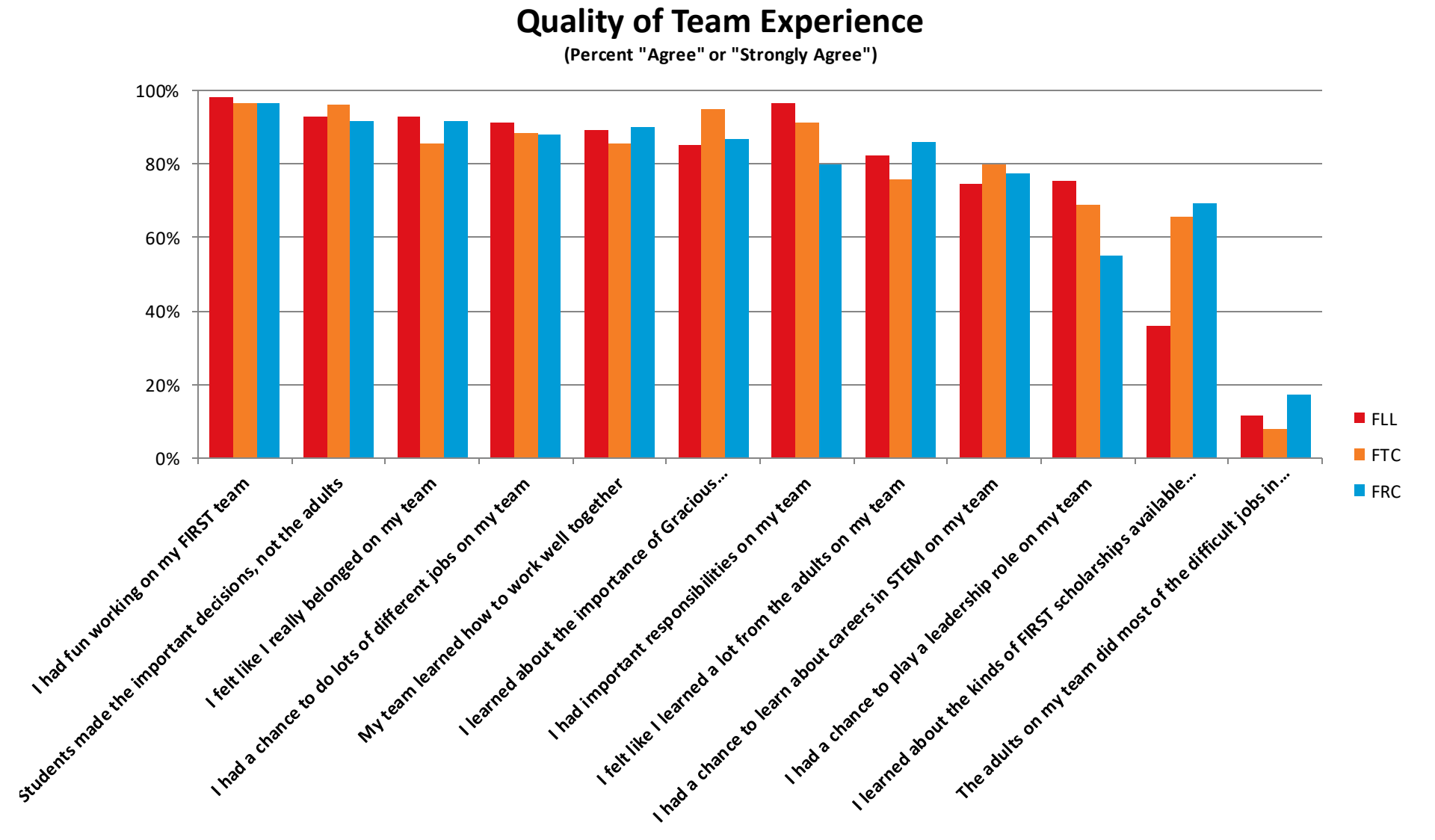
		FIRST Group n=611 74% of baseline	Comparison Group n=406 90% of baseline
Gender	Male	66%	41%
	Female	34%	59%
Race/Ethnicity	White	67%	84%
	Asian	19%	9%
	African American/Black	8%	6%
	American Indian or Native Hawaiian	5%	0%
	More than 1 Race	1%	0.3%
	Hispanic	13%	10%
Income	Low Income (under $50K)	35%	37%
	High Income	65%	63%
Year in High School	6-8th Grade	12%	8%
	9-10th Grade	13%	23%
	11th Grade	9%	12%
	12th Grade	25%	18%
	Graduated High School – Not in College	8%	4%
		59%	61%
Year in College	Freshman	10%	15%
	Sophomore	12%	9%
	Junior or Senior	9%	8%
	Missing	3%	3%
	Graduated College	<1%	<1%
		33%	35%
Community	Urban	25%	25%
	Suburban	52%	52%
	Rural	23%	23%

Program Experience at the end of Year 1 in *FIRST*

Most Team Members Report Involvement in Core Team Activities



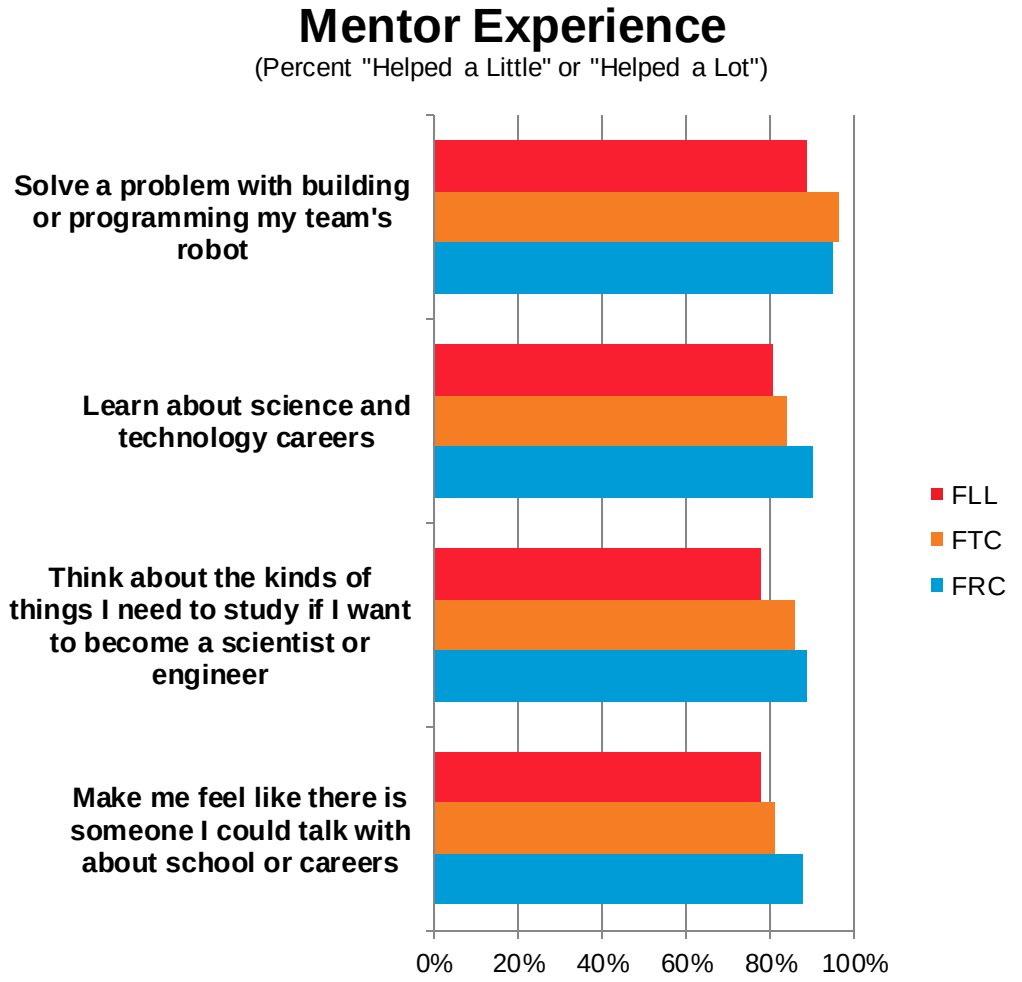
Most Reported a High Quality Program Experience



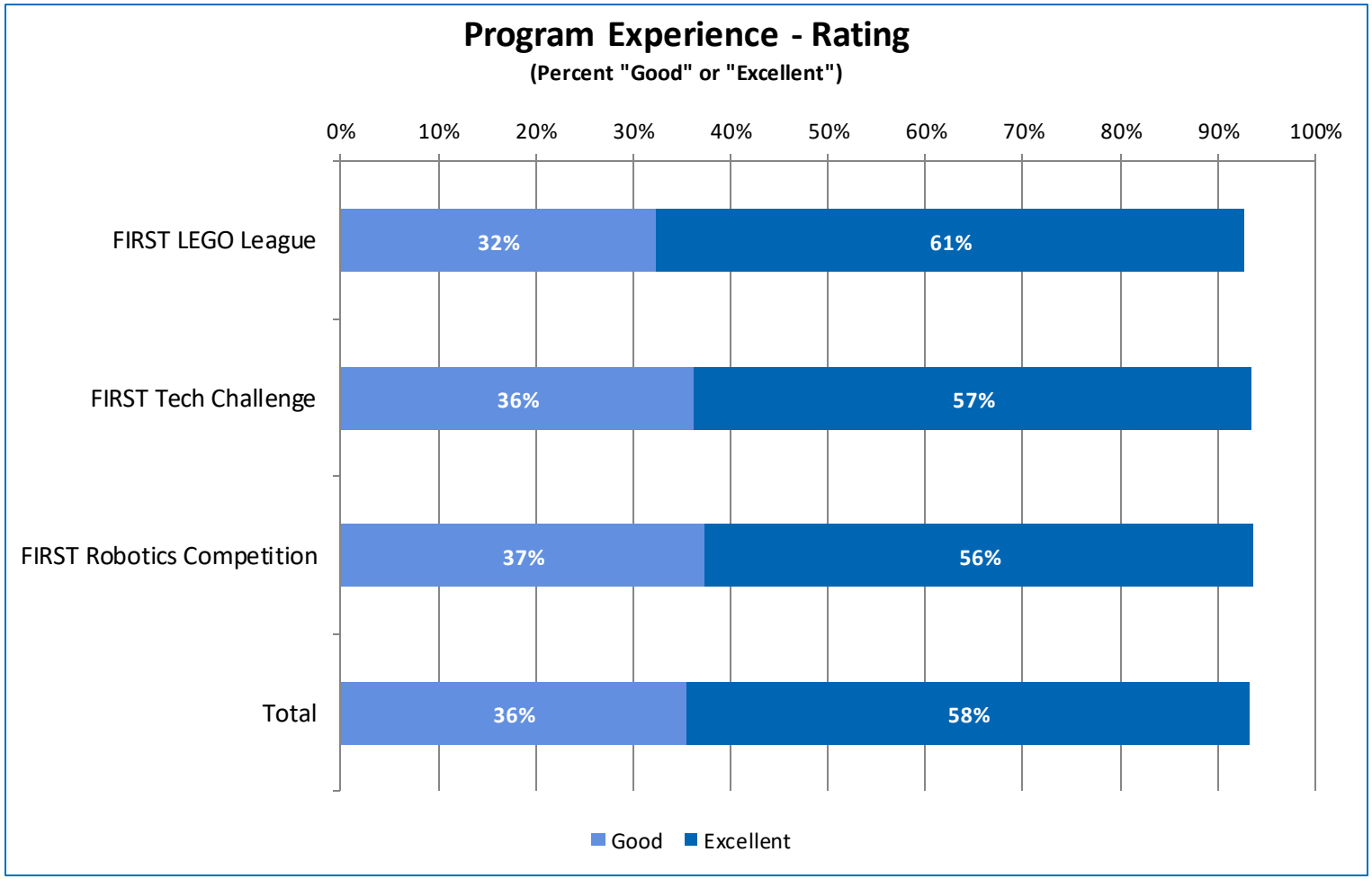
Most Team Members had a Positive Mentor Experience

Overall, 85% of team members reported that their team had an adult who was an engineer, scientist, or knew programming:

- 72% on *FIRST* LEGO League
- 87% on *FIRST* Tech Challenge
- 91% on *FIRST* Robotics Competition



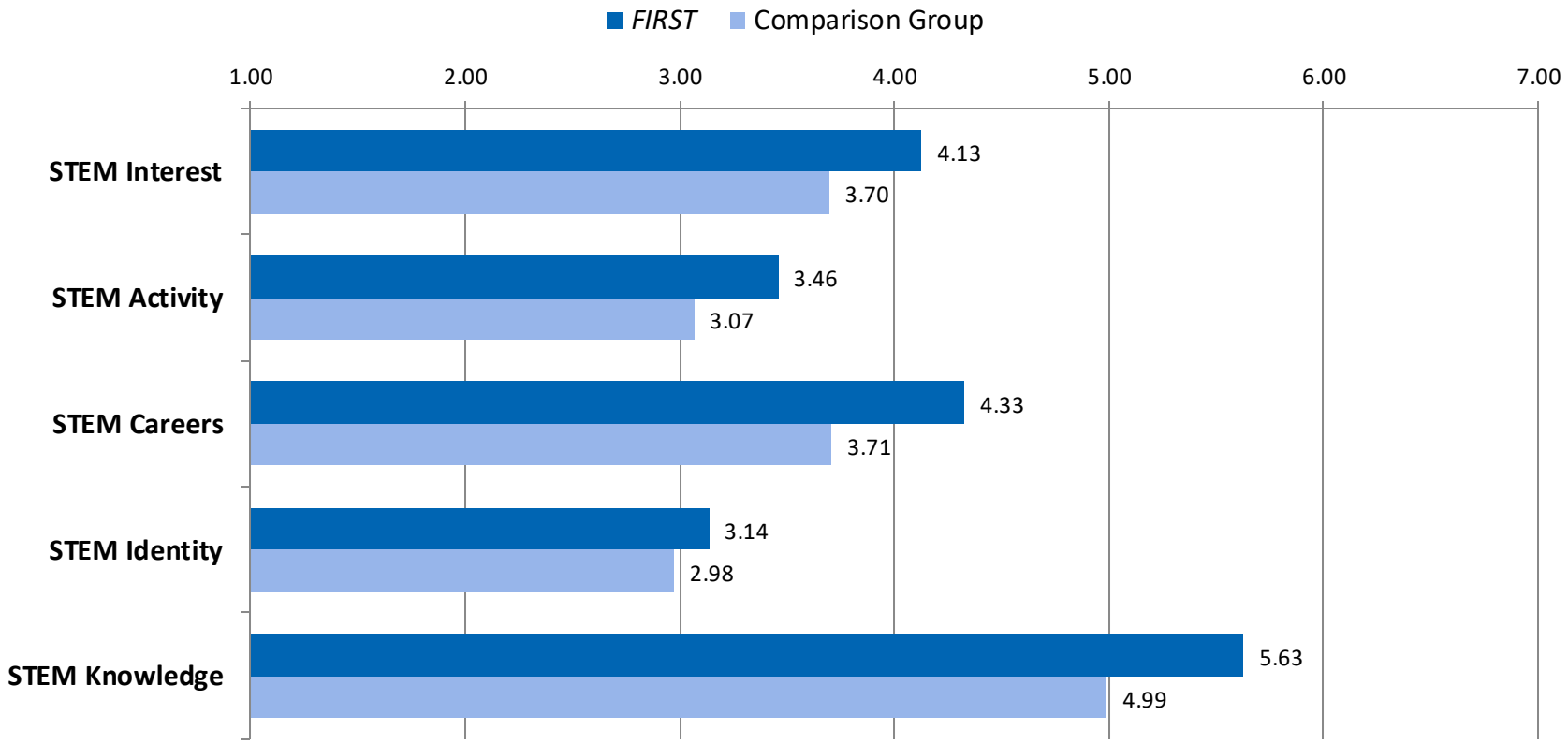
Most Team Members Rated their Experience Positively



Impacts on STEM Attitudes at the end of 48 months

At 48 months, FIRST participants continue to show significantly *greater average gains* on STEM-related measures than comparison students

Difference in STEM-Related Scale Scores at 48 Months



NOTE: Based on survey data from all *FIRST* team members and comparison students in sample 48 months after entering the study. All results are statistically significant at p≤05. All impacts showed a medium to large effect size. Range of scales vary from 1-4 for STEM Identity, 1-5 for STEM Interest and STEM Activity, and 1-7 for STEM Careers and STEM Knowledge.

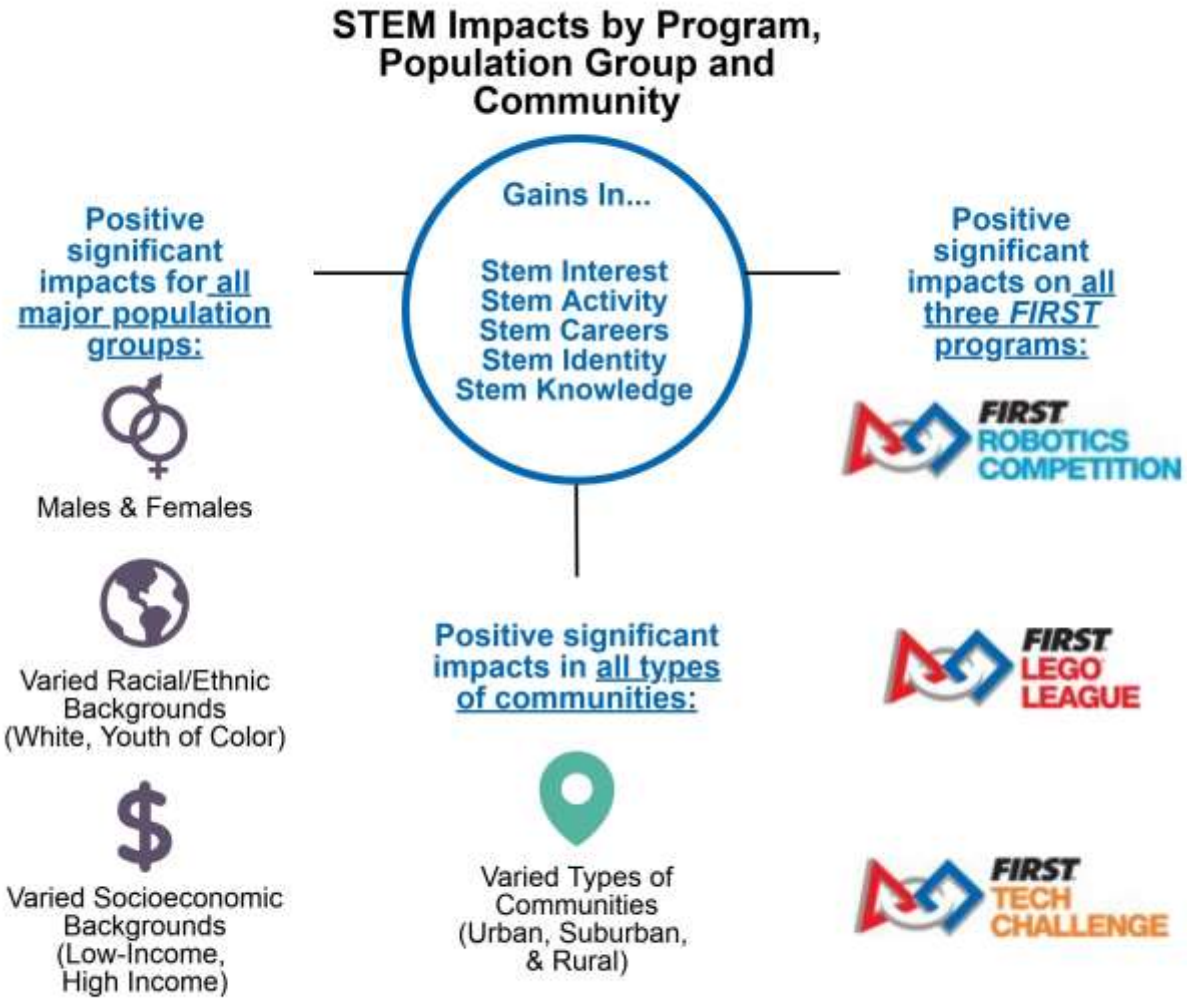
FIRST participants are significantly *more likely* to show gains on STEM-related measures at 48 months

At 48 months, FIRST participants are:	3.0 times more likely to show gains in STEM Interest
	2.2 times more likely to show gains in STEM Activity
	3.0 times more likely to show gains in STEM Career Interest
	1.6 times more likely to show gains in STEM identity
	2.4 times more likely to show gains in STEM knowledge

than comparison students.

All results are statistically significant at p≤.05. Gains are based on the difference between STEM scale scores at baseline and 48 months.

STEM-Related Impacts are evident Across All Three Programs, Major Population Groups, and Different Types of Communities



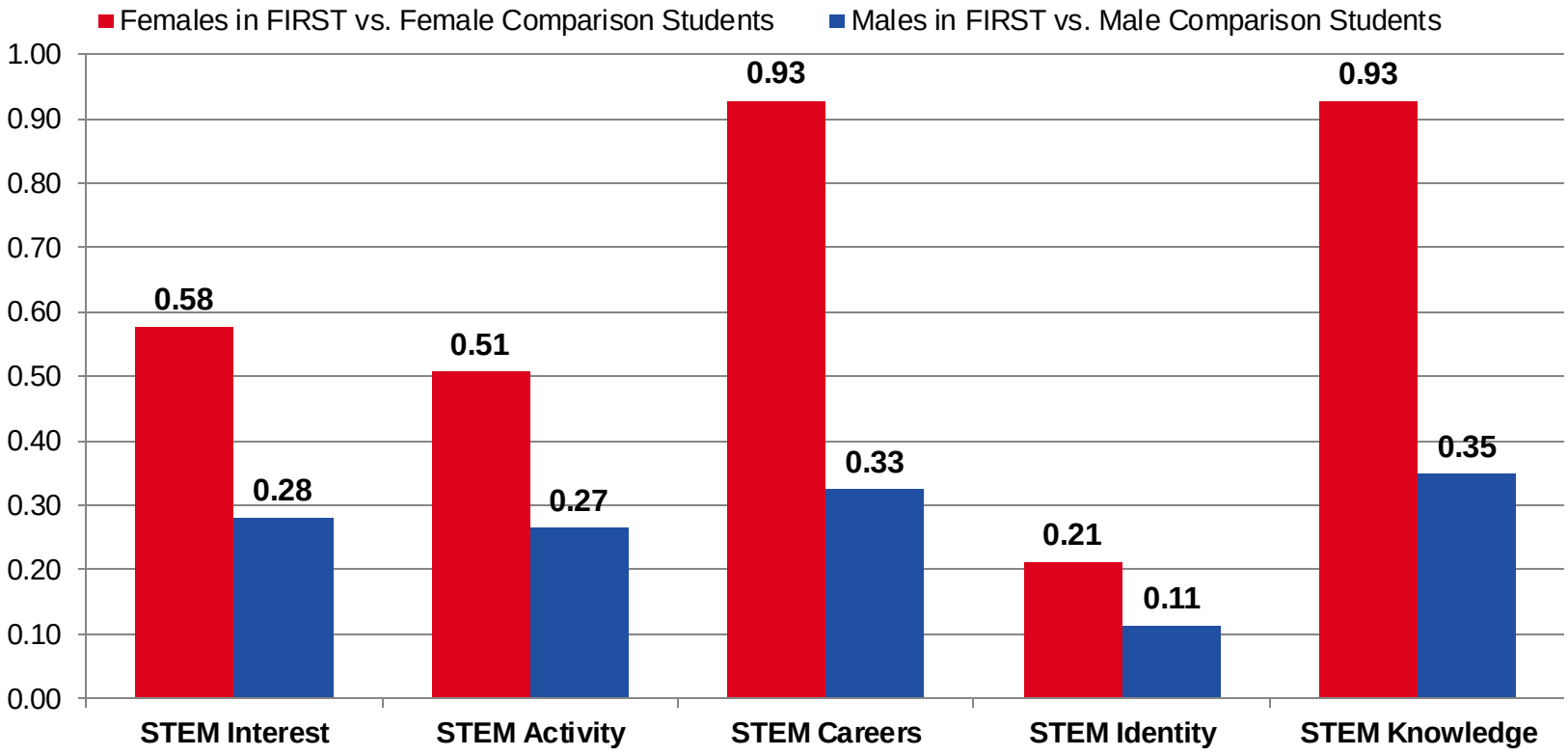
STEM-related impacts are evident for all major population groups

Outcomes	Males	Females	Low Income	High Income	White	Non-White	Urban	Suburban	Rural
STEM Interest	+	+	+	+	+	+	+	+	+
STEM Activity	+	+	+	+	+	+	+	+	+
STEM Careers	+	+	+	+	+	+	+	+	+
STEM Identity	+	+	+	+	+	+	+	+	+
STEM Knowledge	+	+	+	+	+	+	+	+	+

Note: Plus mark (**+**) indicates a positive, significant impact at the .05 level based on analysis at the 36 month follow up of the study. Impacts are relative to comparable subgroups in the comparison population (for example, male *FIRST* participants compared to male comparison group members). Low income is defined as those whose family income is below $50,000.

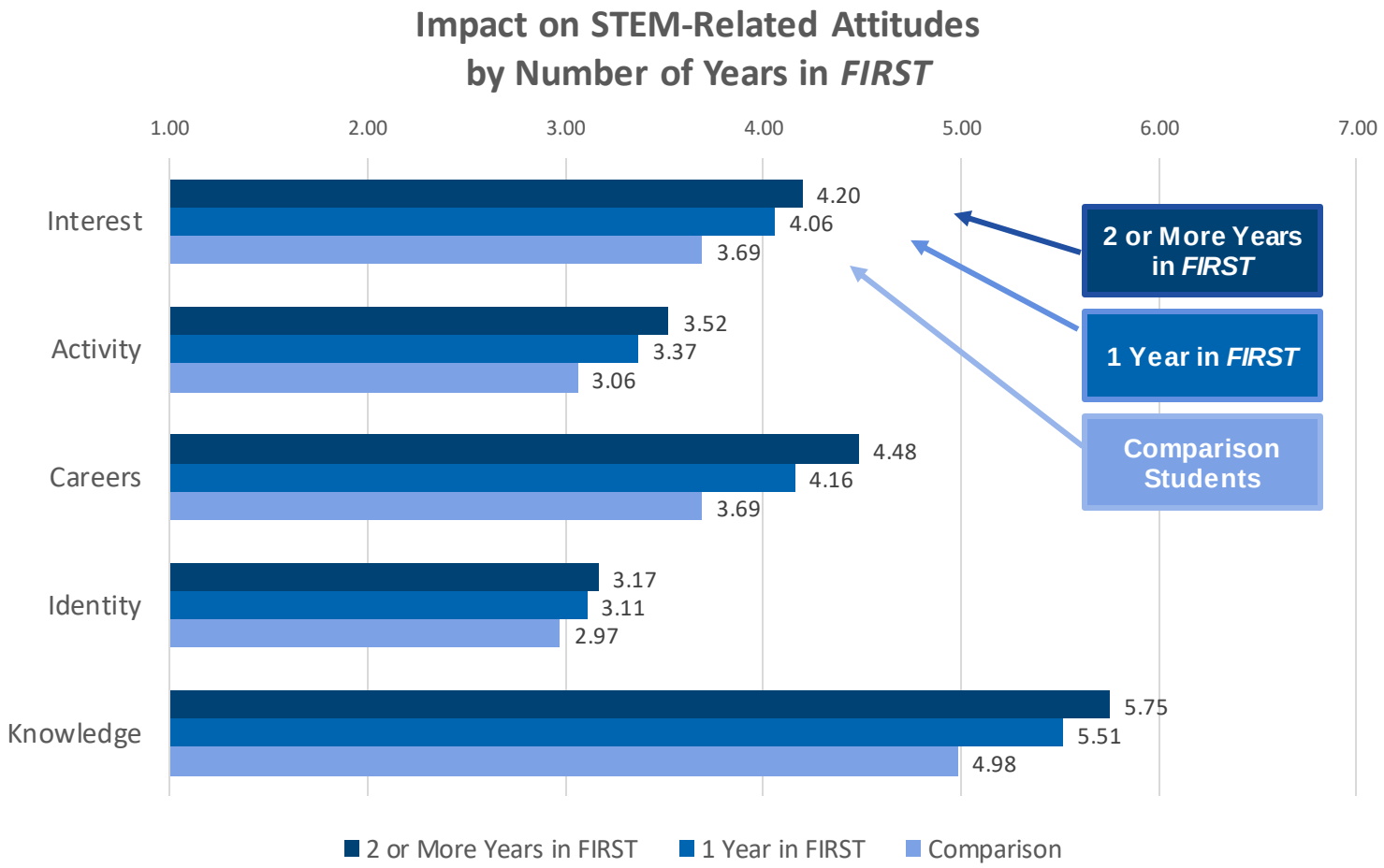
Girls in *FIRST* continue to show significantly greater impacts on STEM measures than boys

Impacts on STEM-Related Outcomes for Male and Female *FIRST* Team Members



Note: Values on the chart represent the differences in outcomes between *FIRST* participants and students of the same gender in the comparison groups (i.e., the difference in scores between males in *FIRST* and males in the comparison group and between females in *FIRST* and female comparison students). All differences are statistically significant at p=.05 or less. The impacts for girls in *FIRST* are significantly greater than those for boys.

Participants in *FIRST* for 1 year show significant impacts on STEM measures; impacts are greater for those in *FIRST* 2 or more years

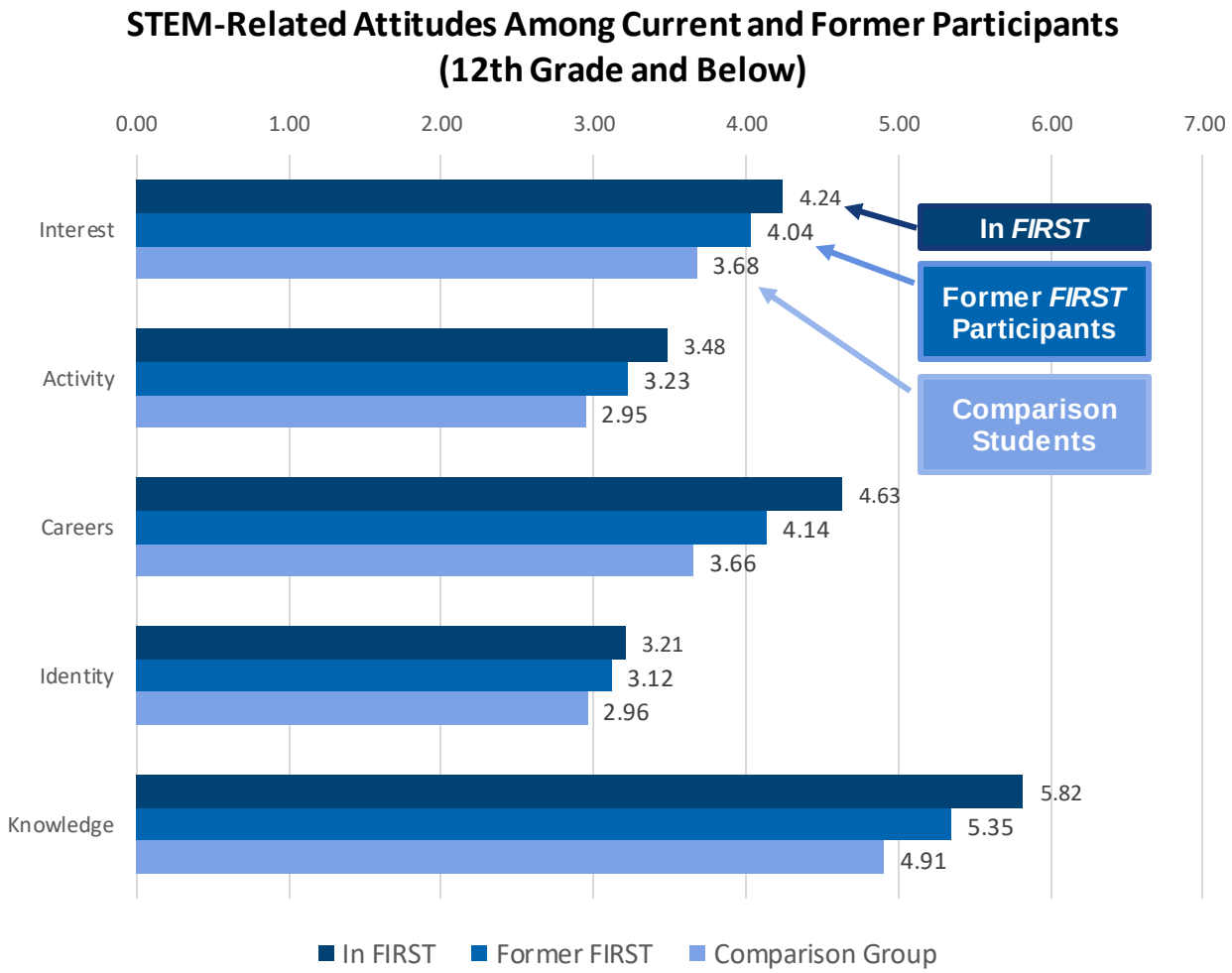


All differences between *FIRST* participants (1 Year and 2 or More Years) and comparison students are statistically significant at p≤ .05. Range of scales vary from 1-4 for STEM Identity, 1-5 for STEM Interest and STEM Activity, and 1-7 for STEM Careers and STEM Knowledge.

Note: It is important to be cautious in interpreting this result, since students who stayed in *FIRST* for more than one year were self-selected and may have had interests different from those who left the program.

FIRST Makes a Difference Even After Team Members Leave *FIRST*

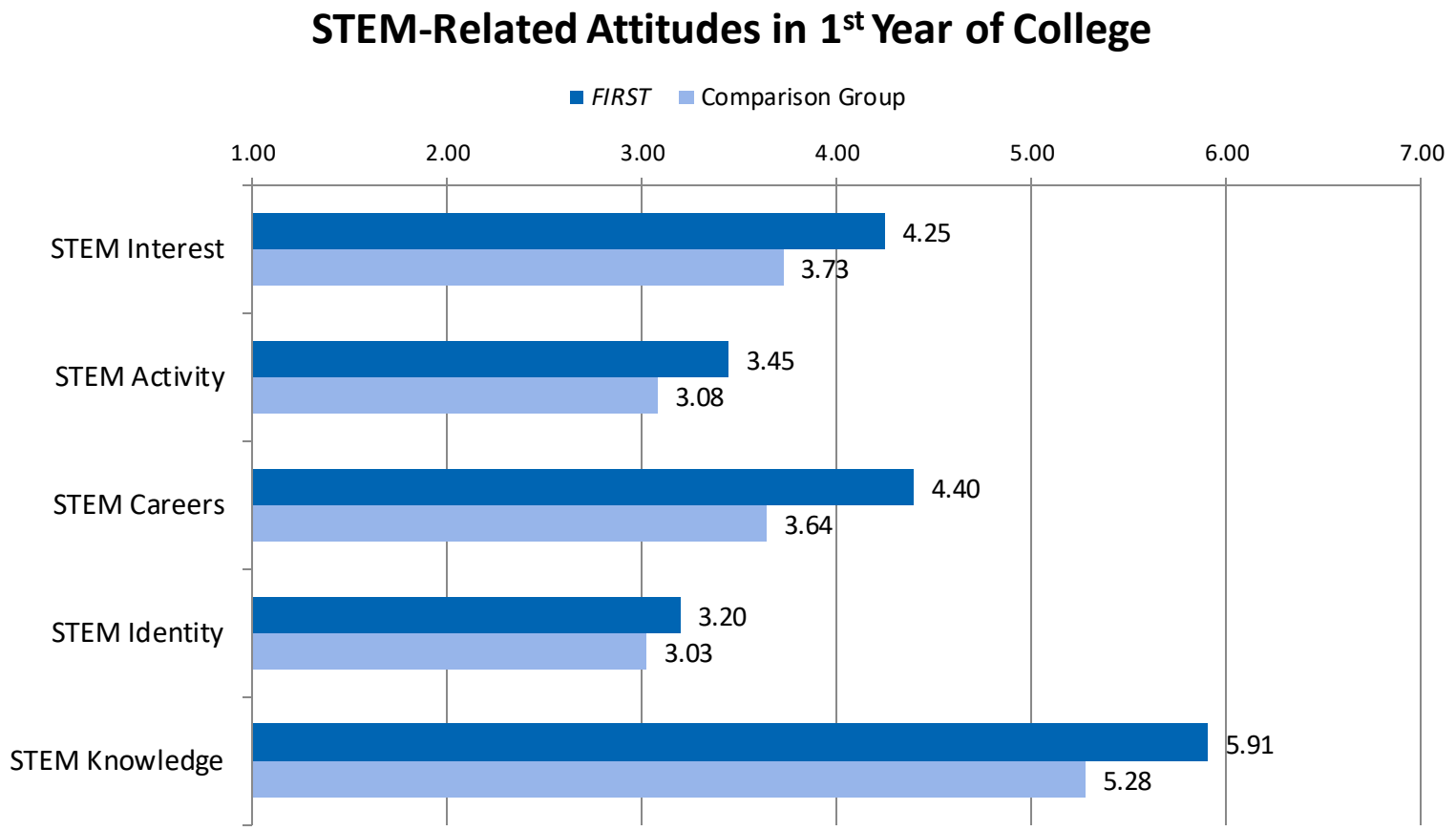
FIRST team members continue to show significantly greater gains on STEM measures than comparison students even after leaving the program. Participants still in *FIRST* continue to show the greatest gains.



All differences between *FIRST* participants and comparison students are statistically significant at p≤.05. Range of scales vary from 1-4 for STEM Identity, 1-5 for STEM Interest and STEM Activity, and 1-7 for STEM Careers and STEM Knowledge.

College Outcomes

FIRST alumni continue to show positive, significant, impacts on STEM-related attitudes in their 1st year of college



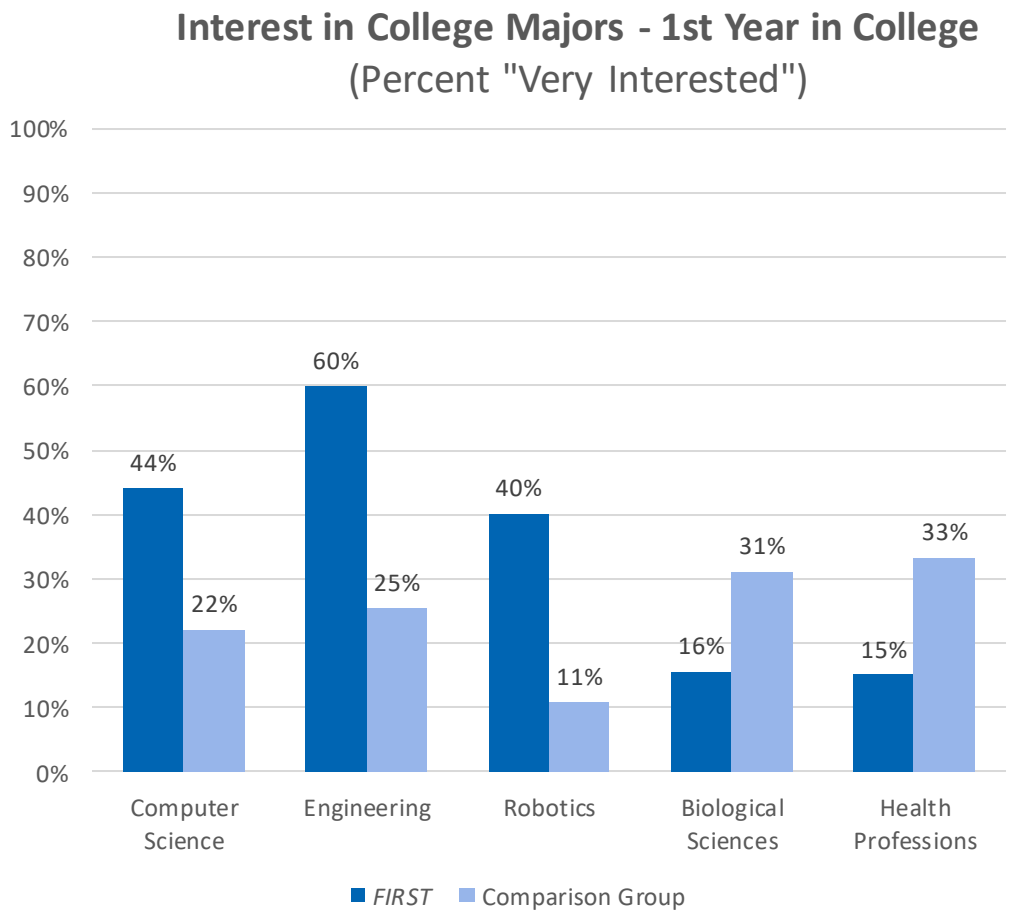
NOTE: Based on survey data from all 1st year college students in the sample 48 months after entering the study (N=451 first-year college students). All results are statistically significant at p≤.05. Range of scales vary from 1-4 for STEM Identity, 1-5 for STEM Interest and STEM Activity, and 1-7 for STEM Careers and STEM Knowledge.

FIRST Alumni Report Significantly Stronger Interest in STEM-Related Majors in their 1st Year of College

FIRST alumni are:

- nearly twice as likely (1.8x) to be interested in majoring in computer science
- 2.3x more likely to be interested in engineering
- 3.9x more likely to be interested in robotics than comparison students

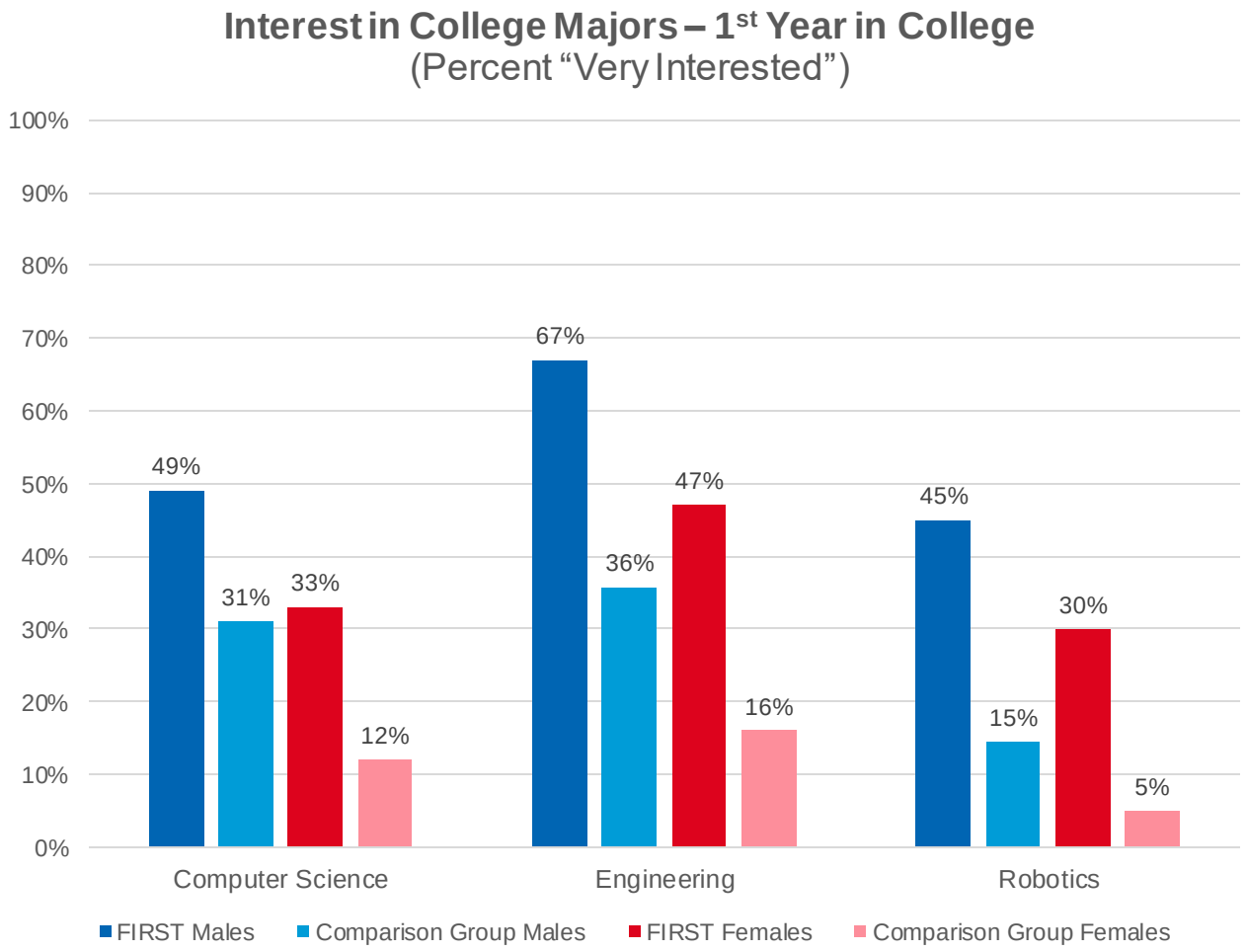
Based on a question asking students to rate their interest in majoring in each of the listed subjects. Values shown are percent of students who are "very interested" in the specified major (i.e., reporting 6, 7 or "already declared" on a scale from (1) "Not Interested at All" to 7 "Very Interested"). All differences are significant at p≤.05.



Impacts on interest in STEM majors apply to both male and female *FIRST* alumni in the 1st year of college

Male *FIRST* alumni are significantly more likely to be interested in majoring in engineering (2.1x) and robotics (3.5x) than male comparison students.

Female *FIRST* alumnae are significantly more likely to be interested in majoring in computer science (3.1x), engineering (3.2x) and robotics (5.1x) than female comparison students.



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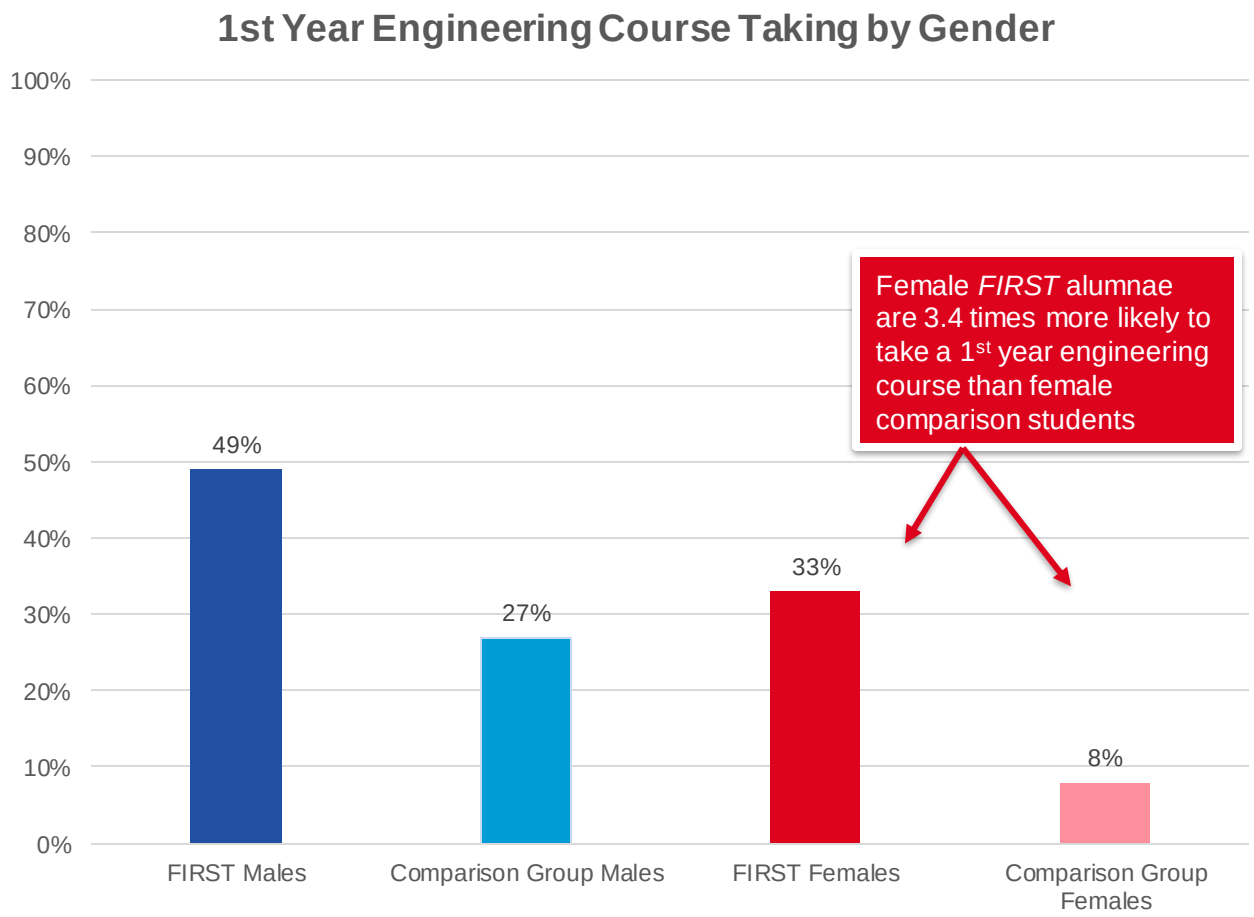
FIRST Alumni are Significantly More Likely to Take Engineering Courses in their 1st Year of College

FIRST alumni overall are ~2.3 times more likely to take an engineering course in their 1st year of college than comparison students.

Overall, 44% of *FIRST* alumni take an engineering course in their 1st year of college.



FIRST Alumni are More Likely to be Engaged in STEM-Related Activities at College than the Comparison Group

Attend a 4 year College
85.8% vs 78.1%

Join an Engineering Club
30.8% vs 12.3%

Join a Computer Club
16.3% vs 7.4%

Participate in an Engineering Competition
11.8% vs 5.6%

Receive an Engineering-Related Scholarship or Grant
8.7% vs 3.1%

Have a STEM Internship
19.0% vs 9.2%

Values shown are *FIRST* vs. Comparison Group at 1st year of college
Differences are significant at p≤.05.

Evaluation of *FIRST* Alumni

FIRST Alumni: Education and Career Outcomes

94% of Alumni expect to receive a degree post-high school:
34% Bachelors
41% Masters
19% Doctorate

FIRST Alumni plan to major in Engineering (54%), Computer Science (32%), Science (22%) and/or Math (11%)

FIRST involvement led to greater:
Problem solving skills: 90%
Teamwork: 90%
Innovative Thinking: 97%
Creative Thinking: 85%
Perseverance: 85%
Leadership: 79%

78% of Alumni are in a STEM field as a student or professional