

***FIRST*<sup>®</sup> Longitudinal Study:  
2021 Survey Results (96-Month Follow-Up)**

*Prepared by:*

**The Center for Youth and Communities  
Heller School for Social Policy and Management  
Brandeis University  
Waltham, MA**

**Tatjana Meschede, Principal Investigator  
Marjorie Erickson Warfield, Co-Principal Investigator  
Matthew Hoover, Sr. Research Associate  
Zora Haque, Research Associate**

*Prepared for:*

***FIRST*<sup>®</sup>  
Manchester, NH**

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## **FIRST® Longitudinal Study: Findings at 96-Month Follow-Up<sup>i</sup>**

***“Most of what I have taken from my experience in FIRST is confidence. The ability to stand my ground and defend my actions and ideas from the criticism and/or dismissal of my bosses at work, as well as the ability to openly talk about what is important to me with complete strangers and end up with new friends.” (FIRST female participant)***

***“I think participating in FIRST at such a young age **opened my mind to loving science and math.** Before I wasn't very inclined to gravitate towards it but now I think I do.” (FIRST male participant)***

### **KEY FINDINGS AT 96-MONTH FOLLOW-UP**

- *FIRST*® participants continue to show positive impacts on STEM-related interests and attitudes eight years (96 months) after they entered the program. Impacts include higher interest in STEM, involvement in STEM-related activities, STEM identity, STEM knowledge, and interest in STEM careers when compared to a matched comparison group.
- Participants from all major population groups and community types show positive impacts, including both males and females, underrepresented racial/ethnic groups, youth from lower and higher income families, and from urban, rural, and suburban communities.
- Impacts on STEM attitudes and interests continue to be significantly greater for young women in *FIRST* than those for young men.
- *FIRST*'s impacts persist into college. Through the fourth year of college, *FIRST* alumni:
  - continue to show significantly greater scores on STEM-related attitudes than comparison students;
  - are significantly more likely to be interested in majoring in computer science and engineering;
  - are two to close to three times more likely to take computer science and engineering courses in college; and
  - are significantly more likely to declare a major in computer science, engineering, or a STEM-related field than comparison students. By the end of their 4<sup>th</sup> year of college, 81% of *FIRST* alumni had declared a STEM major; compared to 32% of comparison group study participants.
  - Female *FIRST* alumni continue to pursue STEM-related courses and majors at a high rate in college. Female *FIRST* alumni were 3.6 times more likely to major in engineering than their comparison group counterparts.
  - Preliminary data on early career positions show *FIRST* alumni at greater rates in engineering, mechanical, and technical positions with close to 60% of them working in a STEM field.

## Impacts 96-Months After Program Entry

In this report, we summarize trends on the long-term impact of participating in FIRST (please see the Appendix for study details). The results are based on eight years of data, including survey data from

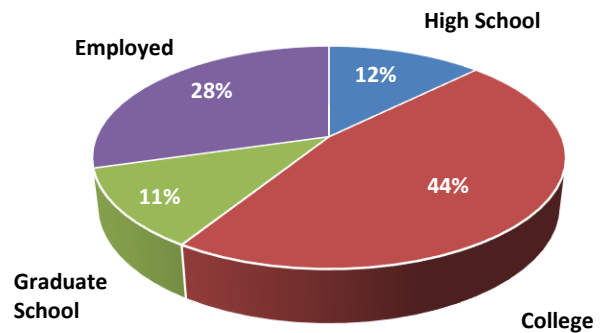
### Data Collection through 96-Month Follow-Up

GROUP	Baseline	12-Month Follow-Up (Post-Program)	24-Month Follow-Up	36-Month Follow-Up	48-Month Follow-Up	60-Month Follow-Up	72-Month Follow-Up	84-Month Follow-Up	96-Month Follow-Up
FIRST Participants	822	677	665	636	611	602	550	554	570
Comparison Group	451	259*	411	409	406	397	386	389	385
Total	1273	936	1076	1045	1017	999	936	943	955

\*The initial group of comparison students did not complete a post-program survey but have participated in all subsequent follow-up surveys.

baseline and post-program surveys and six rounds of annual follow-up surveys. As such, it reflects the impacts of participation in FIRST eight years after study participants entered the program. Of the 1,273 students who began the study, 955 students (75%) completed the 96-month follow-up survey, including 570 FIRST participants (69% of those at baseline) and 385 comparison students (85% of those at baseline). Of the FIRST participants responding to the follow-up survey, 80% were post high school and 19 (3.4%) were still active in the program.<sup>ii</sup>

### 96-Month FIRST Survey Respondents



The findings from the 96-month follow-up surveys extend and underscore the positive impact findings from the prior (2015-2021) annual impact reports: **FIRST participants continue to show significantly greater average levels on STEM-related attitudes and interests than comparison students and are statistically significantly more likely to show higher levels in STEM-related education and employment outcomes than students in the comparison group.** These positive impacts hold true for participants who originally enrolled in any one of the three FIRST programs in the study (FIRST LEGO League Challenge, FIRST Tech Challenge, and FIRST Robotics Competition), across key demographic groups, and for those living in different types of communities (urban, rural, suburban).<sup>iii</sup> Data on students in their first four years of college also point to positive, statistically significant long-term impacts. **Through their fourth year of college, FIRST alumni show stronger STEM-related attitudes and interests than comparison students; are more interested in majoring in key STEM-related fields (engineering, computer science, and robotics); are more likely to take engineering and computer science courses; and are more likely to have declared majors in engineering and computer science. By the fourth year of college, of the FIRST alumni who had declared a major, 81.3% were majoring in a STEM-related field.** In most cases, these college impacts apply to both male and female FIRST alumni. Major findings are as follows:

## Impacts on STEM-Related Attitudes (All Participants)

At 96 months, *FIRST* participants continue to show positive, statistically significant impacts on all of the STEM-related attitude measures in the study, including interest in STEM, involvement in STEM-related activities, STEM identity, STEM knowledge, and interest in STEM careers. *FIRST* participants are approximately twice as likely to show higher levels on STEM-related measures eight years after entering the program as students in the comparison group.

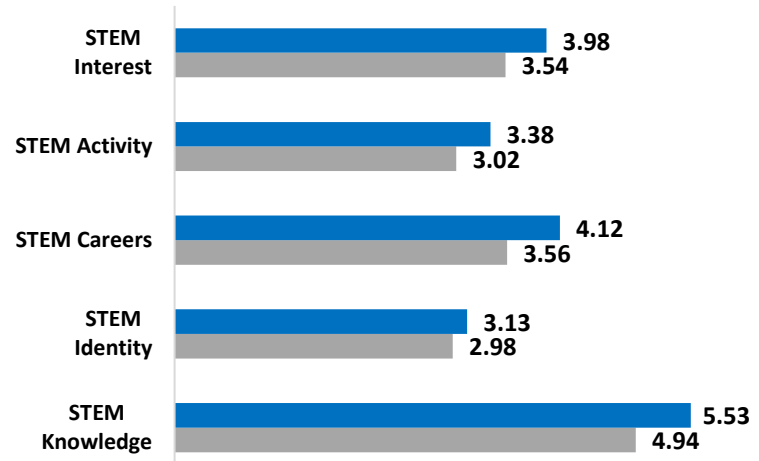
- ***FIRST* participants continue to show significantly higher levels on all measures of STEM-related interest and attitudes than members of the comparison group.** In each case, the “effect size” (a measure of the magnitude of the impact being measured) was large enough to indicate a *practical* difference in attitudes and interests.<sup>iv</sup> The STEM-related measures include:
  - *Interest in STEM,*
  - *Involvement in STEM-related activities,*
  - *Interest in STEM careers,*
  - *STEM identity* (for example, “I see myself as a math, science, or technology person”), and
  - *STEM knowledge/understanding* (items include: “I want to learn more about science and technology,” “I have a good understanding of how engineers work to solve problems,” and “I can use math and science to make a difference in the world”).

After controlling for differences in baseline characteristics and baseline scale scores, *FIRST* participants are 2.3 times more likely than comparison students to be interested in STEM, from baseline to 96-month follow-up.<sup>v</sup>

*FIRST* participants are also:

- 2.2 times more likely to report a stronger *STEM identity*;
  - 1.8 times more likely to score higher in *STEM knowledge/understanding of STEM*;
  - 1.7 times more likely to show higher involvement in *STEM activity*; and
  - 1.6 times more likely to show higher interest in *STEM careers*.
- ***The 96-month data also continue to show positive, statistically significant impacts on STEM-related outcomes for participants from all three FIRST programs in the study (FIRST LEGO League Challenge, FIRST Tech Challenge, FIRST Robotics Competition).*** Participants from each of the three *FIRST* programs (program type at entry into *FIRST*) show significantly greater gains on STEM-related measures than comparison students from the same age/grade span.

**STEM-Related Interests and Attitudes at 96 Months**  
(Averages in Scale Scores)



Note: All results are statistically significant at  $p \leq .05$ . All impacts showed a medium to large effect size. *STEM Interest, Activity and Careers* are based on a 5 point scale; *STEM Identity* on a 4 point scale, and *STEM Knowledge* on a 7 point scale.

- **STEM-related impacts continue to be evident across all major population groups and among students from historically underrepresented communities (compared to similar students in the comparison group).** Each of the following groups – males and females, lower and higher income students (family incomes below and above \$50,000), White youth and historically underrepresented racial and ethnic groups in STEM, and urban, suburban, and rural youth – shows significantly greater levels in STEM related attitudes for *FIRST* participants over counterparts among comparison group students.

**Positive and Significant Impacts for Underrepresented Communities**

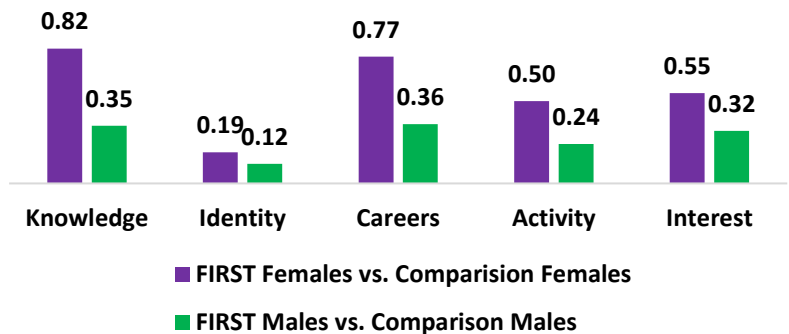
Outcomes	Girls and Young Women	Economically Disadvantaged	Underrepresented Racial/Ethnic Groups	Urban	Rural
STEM Interest	+	+	+	+	+
STEM Activity	+	+	+	+	+
STEM Careers	+	+	+	+	+
STEM Identity	+	+	+	+	+
STEM Knowledge	+	+	+	+	+

Note: + indicates a positive, significant impact at  $p \leq .05$ . Impacts are relative to comparable subgroups in the comparison population (for example, girls and young women among *FIRST* participants are compared to girls and young women in the comparison group). Economically Disadvantaged is defined as those whose family income is below \$50,000. Underrepresented Racial Groups include Black or African-American, Native American, Hawaiian/Pacific Islander, Multi-Racial, and Latinx. The number of youth who responded as non-gender-binary was too small for analysis.

**While the data show positive impacts for both male and female *FIRST* alumni, *FIRST* female participants continue to show significantly greater impacts than male participants on all of the STEM-related attitudinal measures.**

The chart on the right shows the differences in outcomes for young women in *FIRST* compared to young women in the comparison group, and for young men in *FIRST*, compared to young men in the comparison group. While all of the differences between *FIRST* participants and comparison students are statistically significant, the impacts for female participants in *FIRST* on each measure are also significantly greater than those for male participants, as evidenced by the higher purple bars below.

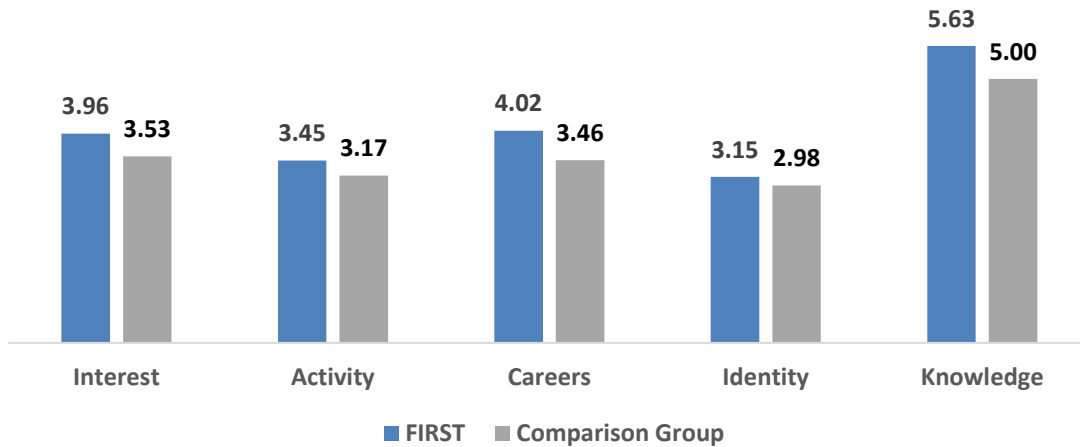
**Differences in Scale Scores on STEM-Related Interests and Attitudes between *FIRST* and Comparison Group**



Note: Values on the chart represent the differences in outcomes (estimated scale scores) 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  $p \leq .05$ .

**FIRST's impacts on STEM-related attitudes and interests persist into college.** FIRST alumni continue to show consistent higher scores than comparison students on measures of interest in STEM, STEM activity, interest in STEM careers, STEM identity, and STEM knowledge and understanding through the fourth year of college. Both male and female alumni show significant impacts; however, female FIRST alumni continue to show significantly higher levels than male alumni on all STEM measures.

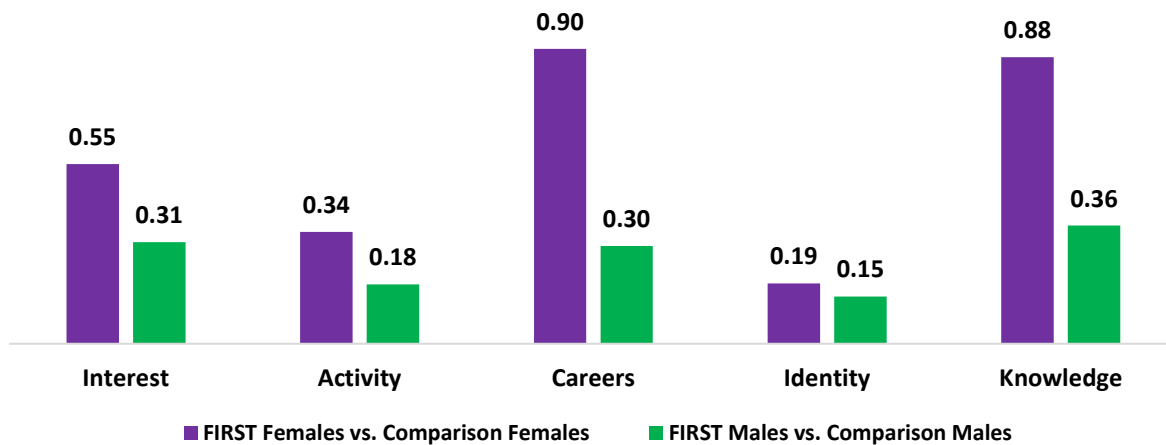
### STEM-Related Interests and Attitudes, 4th Year of College



Note: All results are statistically significant at  $p \leq .05$ . STEM Interest, Activity and Careers are based on a 5-point scale; STEM Identity on a 4-point scale, and STEM Knowledge on a 7-point scale.

FIRST participants consistently show significant higher levels on STEM outcomes than comparison students of the same gender. These differences are greatest for young women, especially for the careers and knowledge scales, when comparing FIRST participants with female comparison group members.

### Differences in Scale Scores between FIRST and Comparison Groups on STEM-Related Interests and Attitudes, 4th Year of College, by Gender



Note: Values on the chart represent the differences in outcomes (estimated scale scores) between FIRST alumni 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  $p \leq .05$ .

## Impacts on College Pathways through Four Years of College

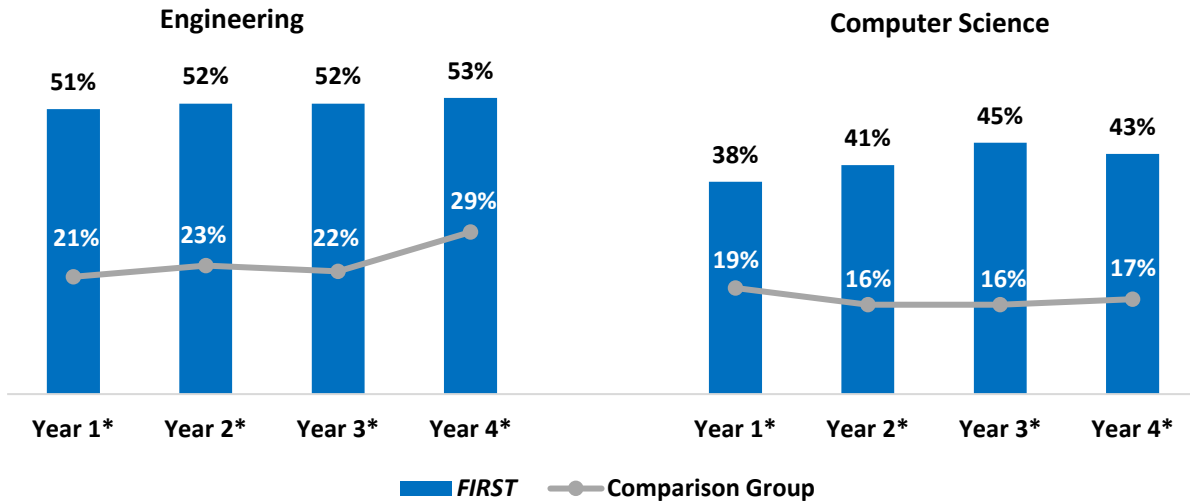
In addition to its impacts on STEM-related interests and attitudes, participation in *FIRST* has a significant impact on the education trajectories of *FIRST* alumni attending college

# of Students by Year in College	N
4 years completed	399
3 years completed	586
2 years completed	729
1 year completed	881

Through their fourth year of college, *FIRST* alumni are significantly more interested in majoring in engineering and computer science than comparison students; are more likely to take engineering and computer science courses; and are more likely to have declared majors in engineering and computer science. By the fourth year of college, 81% of *FIRST* alumni were majoring in a STEM-related field compared to 68% of comparison students; 61% had declared a major in engineering or computer science versus just 26% for comparison students.

- FIRST* alumni report significantly stronger interest in majoring in engineering and computer science than comparison students through all of the first four years of college.** *FIRST* alumni were significantly more likely than comparison students to be “very interested” in majoring in engineering and computer science than comparison students.

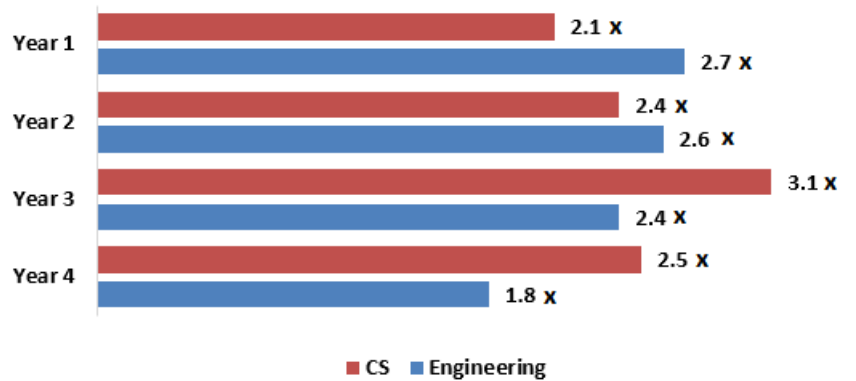
**Interest in Engineering and Computer Science Majors, Years 1-4 in College**  
(Percent “Very Interested”)



Note: 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”). Asterisk (\*) indicates statistically significant at  $p \leq .05$ . *FIRST* alumni also showed significantly stronger interest in majoring in robotics (not shown) in all four years.

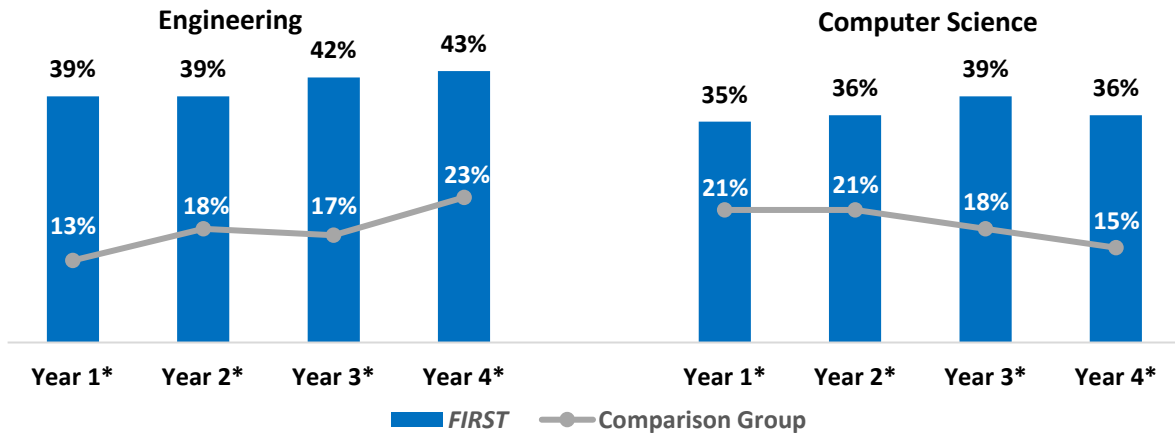
- For **engineering**, the difference in reporting an interest in majoring in engineering was statistically significant in all four years, though the gap narrowed slightly by Year 4.
- For **computer science**, the gap in reporting an interest in majoring in computer science between *FIRST* alumni and comparison students widened from Year 1 through Year 4, mostly due to a decline in interest among the comparison group respondents.

**FIRST Participant Interest in Engineering & Computer Science Majors**



- **FIRST alumni are also significantly more likely to take engineering or computer science courses during their four years in college than comparison students.** In their first year of college, 39% of *FIRST* alumni were taking an engineering course, compared to 13% in the comparison group, and 35% a computer science course, compared to 21% of comparison students. In their second college year, 39% of *FIRST* alumni were taking engineering and 36% computer sciences courses, compared to 18% and 21% of comparison students. By the third year of college, 42% of *FIRST* alumni reported taking at least one engineering class and 39% reported taking at least one computer science course compared to roughly 18% of comparison students. And by the fourth year of college, 43% of *FIRST* alumni reported taking an engineering course and 23% for the comparison group, an increase for the comparison group over the prior college years. For computer science in the same year, 36% of the *FIRST* alumni reported taking a computer science course, compared to just 15% among the comparison group.

**Engineering and Computer Science Course-Taking Years 1-4 in College**



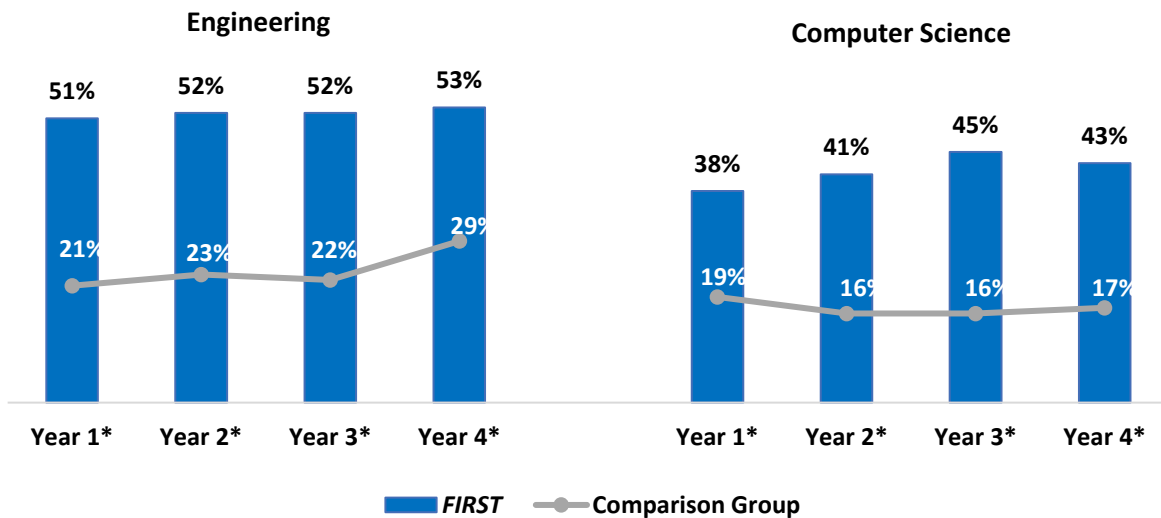
Note: Percentage of full-time students who reported taking at least one course in engineering and/or computer science. Asterisk (\*) indicates statistically significant at  $p \leq .05$ .



- In Year 4, *FIRST* alumni were 2 times more likely to have taken an engineering course, and 2.9 more likely to have taken a computer science course than the comparison students.
- **Consistent with their greater interest in engineering and computer science majors and increased course-taking in those fields, *FIRST* alumni are significantly more likely than comparison students to declare a major in engineering or computer science. They are also significantly more likely than comparison students to declare a major in a STEM field generally by the end of their fourth year of college.**
  - *Engineering majors:* *FIRST* alumni were significantly more likely to declare a major in engineering in all four years of college than comparison students: 51% vs. 21% in the first year of college, 52% vs. 23% in Year 2, 52% vs. 22% in Year 3, and 53% vs. 29% in Year 4. In Year 4, *FIRST* alumni were twice as likely to major in engineering as comparison students.
  - *Computer science majors:* In all four years of college, *FIRST* alumni declared a major in computer science at a significantly higher rate than comparison students: 38% vs. 19% in the first year of college, 41% vs. 16% in Year 2, 45% vs. 16% in Year 3 and 43% vs. 17% in Year 4. In year 4, *FIRST* alumni were more than twice as likely (2.1 times) as comparison students to major in computer science.

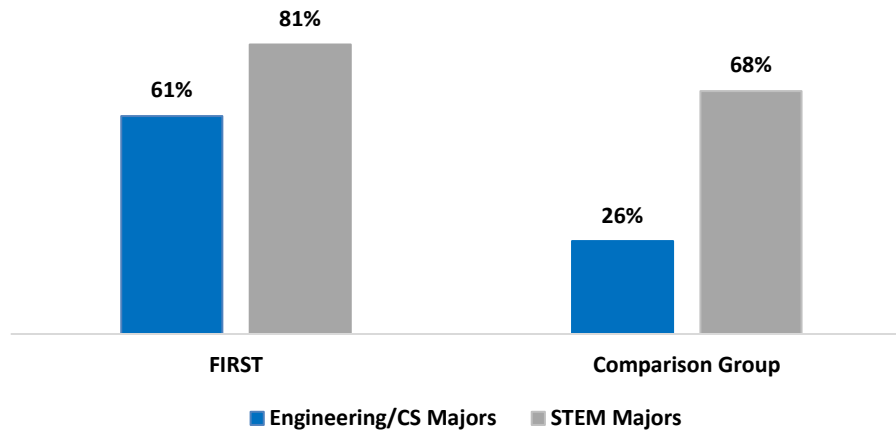
### Engineering and Computer Science Majors Years 1-4 of College

(Percent of those who Declared Majors)



Note: Percent of students who declared a major in specified fields as a percentage of all those who declared a major in that year. Asterisk (\*) indicates statistically significant at  $p \leq .05$ .

## Engineering/Computer Science Majors & STEM Majors - Year 4



*Note: Data represents percentages of those who declared a major in years 1-4 of college. All differences are statistically significant,  $p \leq .05$ . STEM fields include: biology, computer science, engineering, health professions, mathematics, physical sciences, vocational/ technical fields, and robotics.*

- *Engineering/Computer Science: By Year 4, 61% of FIRST alumni had declared a major in either computer science or engineering vs. 26% of students in the comparison group.*
- *STEM majors overall: FIRST alumni were also more likely to declare a major in a STEM field generally. By the end of Year 4 in college, of those who had declared a major, 81% of FIRST alumni overall had declared a major in a STEM-related field compared to 58% of comparison students.*

### Gender Differences in College

*"I now work in aerospace. I don't think I would've had the courage to enter such a male dominated field had it not been for my FIRST experience in high school." (FIRST female participant)*

*"... introduction to robotics and programming really opened my eyes to the possibilities there are out there. It made it so that making robots and engineering are something people do, something accessible that I could do too." (FIRST female participant)*

The impacts on college pathways were shared by both male and female FIRST alumni for all three outcome measures at the college level: interest in majoring, course taking, and declaring a major in engineering or computer science. A larger proportion of male and female FIRST alumni reported higher degrees of interest in majoring, course taking, and declaring a major in engineering or computer science, although not statistically significant in all years, as detailed below.

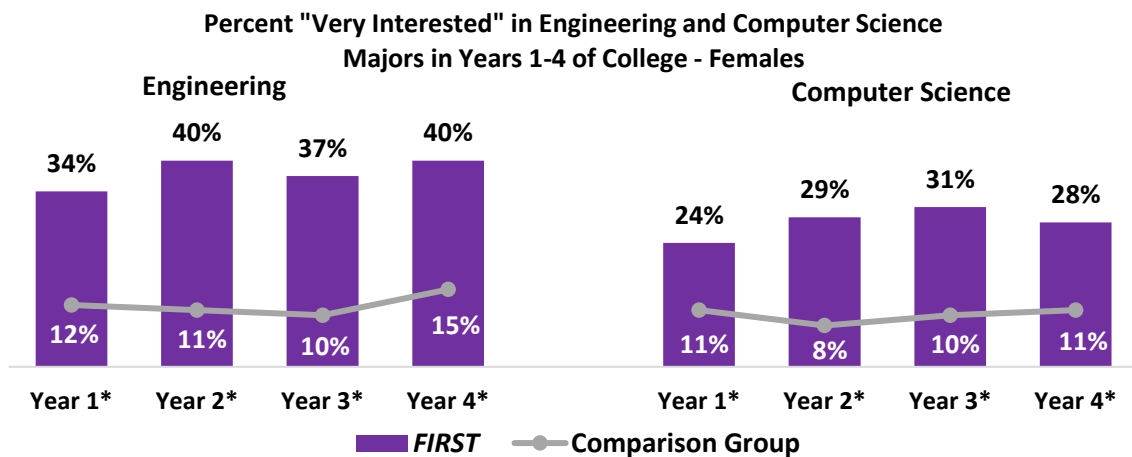
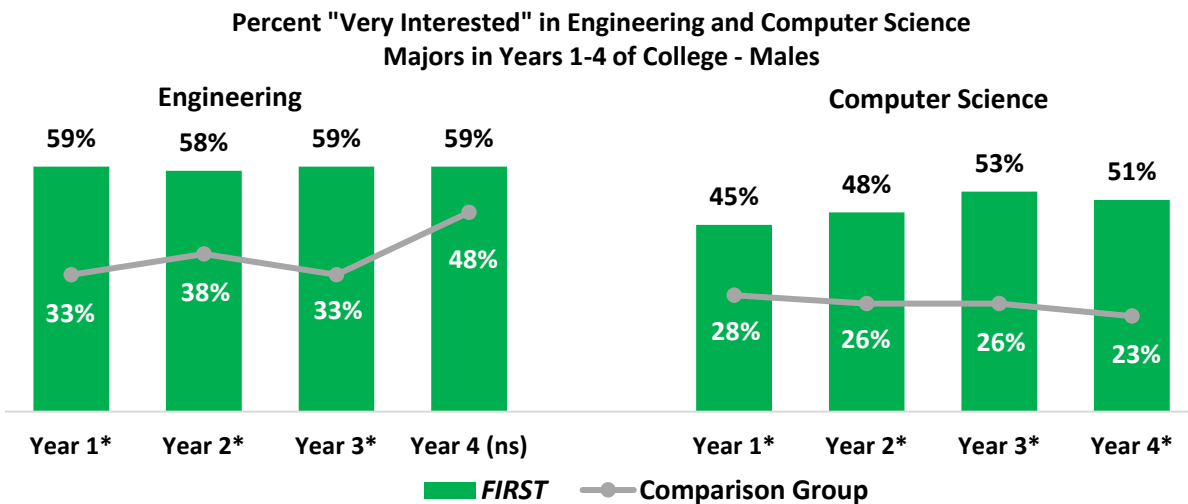
At the same time, the college outcome data show somewhat different patterns of impact between males and females. In general, the gap between FIRST and comparison group males in interest in engineering and computer science majors, engineering and computer science course-taking, and declared majors

remained the same or narrowed slightly, mostly due to an increase in the comparison group, and these differences not always statistically significant.

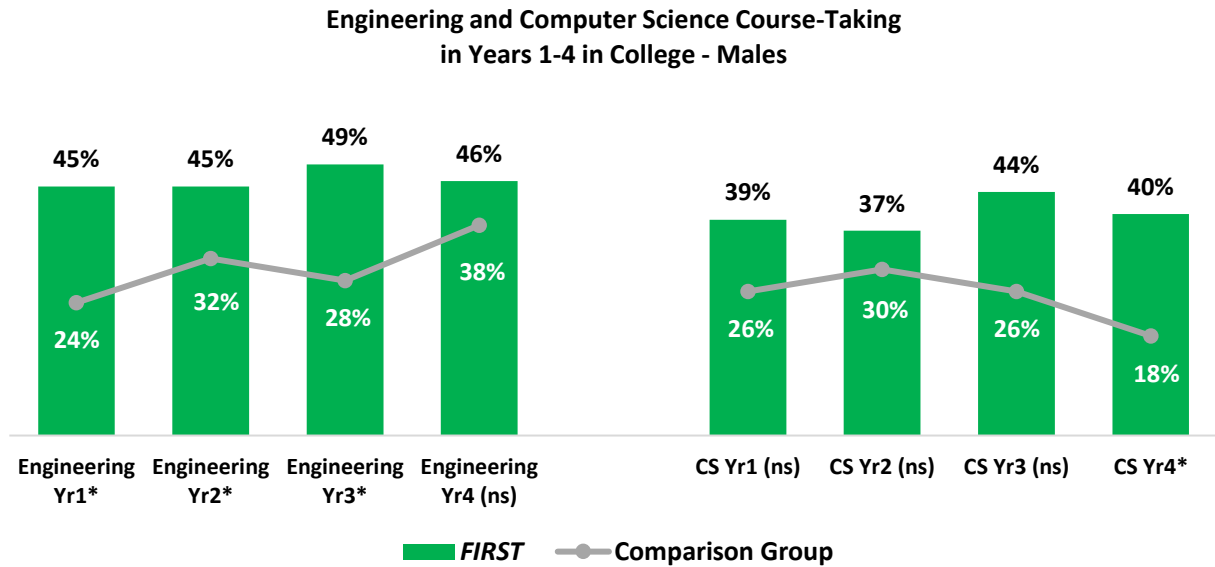
In contrast, the gap between female *FIRST* alumni and comparison students started to widen, with female *FIRST* alumni significantly more likely to be interested in engineering and computer science, to take engineering and computer science courses, and to major in engineering. These differences are strongest for the engineering. Next, we present these patterns in more detail.

- **While *FIRST* alumni were significantly more likely to be highly interested in majoring in engineering and computer science than comparison students, the patterns for male and female alumni were different.**

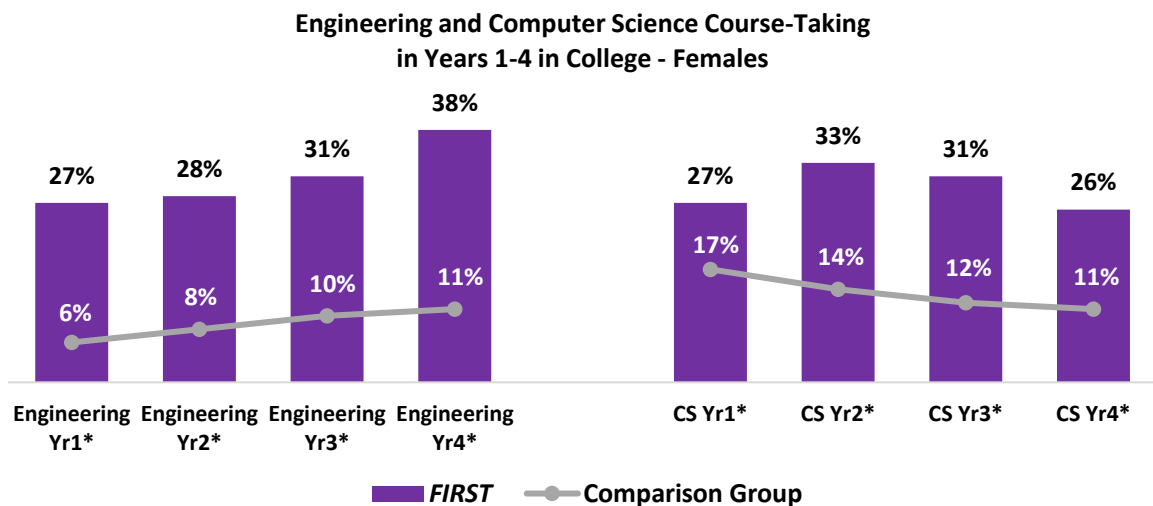
Over four years of college, the gap in interest in engineering majors narrowed between male *FIRST* alumni and male comparison group members as interest grew among comparison group members, so that by Year 4, the difference in interest was no longer significant. In computer science, the gap is only statistically significant in the 4<sup>th</sup> year in college when the course taking rate for the male comparison group dropped. Female *FIRST* alumni, in contrast, were significantly more interested in both engineering and computer science majors through all four years of college, with the difference in engineering growing more substantial over time.



- Over the first 4 years of college, the gap in engineering and computer science course-taking remained relatively stable (and in the case of computer science, not significant) for males, but grew and became statistically significant between female FIRST alumni and comparison young women. By Year 4, the percentages of female FIRST alumni taking courses in engineering and computer science were both three times higher than that for young women in the comparison group (38% vs. 8% in engineering and 34% vs. 9% in computer science).

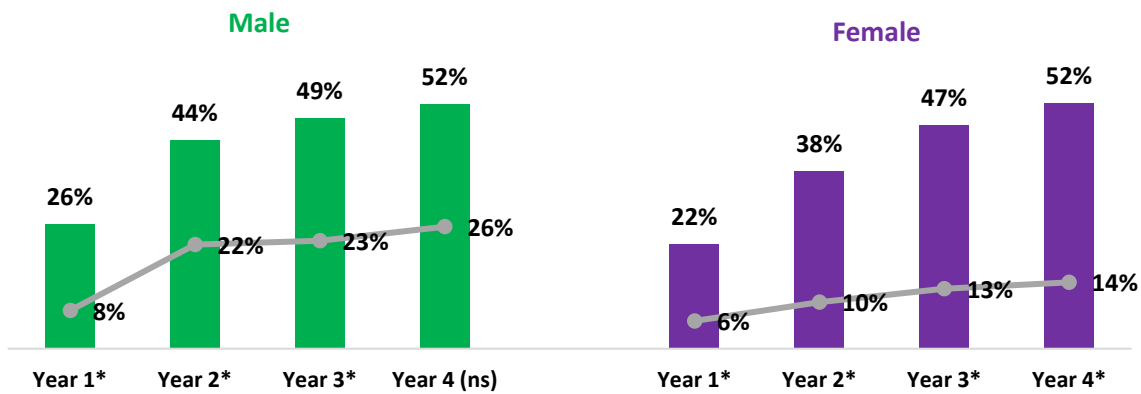


Note: Percentage of full-time students who reported taking at least one course in engineering and/or computer science. Asterisk (\*) indicates statistically significant at  $p \leq .05$ . NS indicates that differences are not statistically significant.

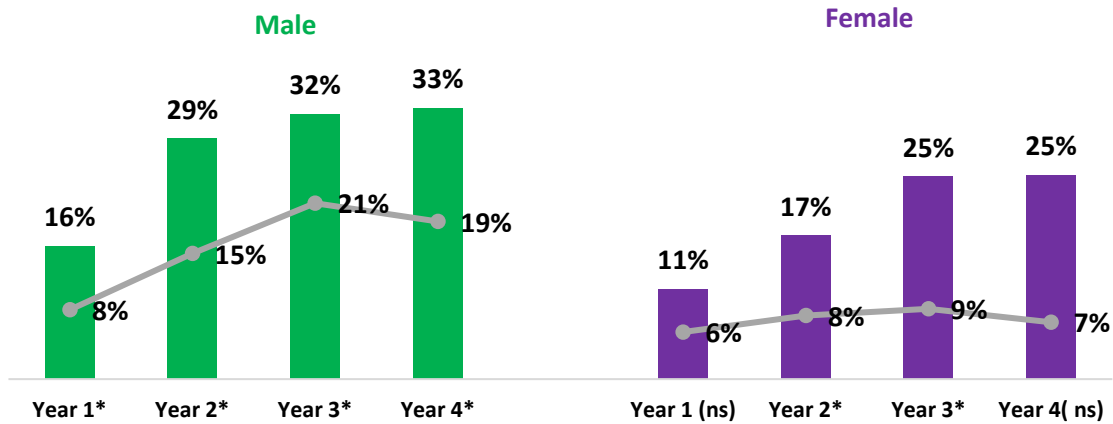


- In terms of declared majors, the gap in declared majors in engineering between male *FIRST* alumni and comparison males narrowed substantially over the four years of college, largely as a result of a substantial increase in engineering majors among comparison males. By Year 4, the difference between male *FIRST* alumni and male comparison group members was no longer significant.
- Among young women, however, the gap widened substantially, and female *FIRST* alumni continued to declare majors in engineering at a significantly higher rate than women in the comparison group. Notably, by Year 4, 70% of female *FIRST* alumni had declared majors in engineering, a rate comparable to that of the male counterparts in the comparison group.

### Declared Majors in Engineering, Years 1-4 in College



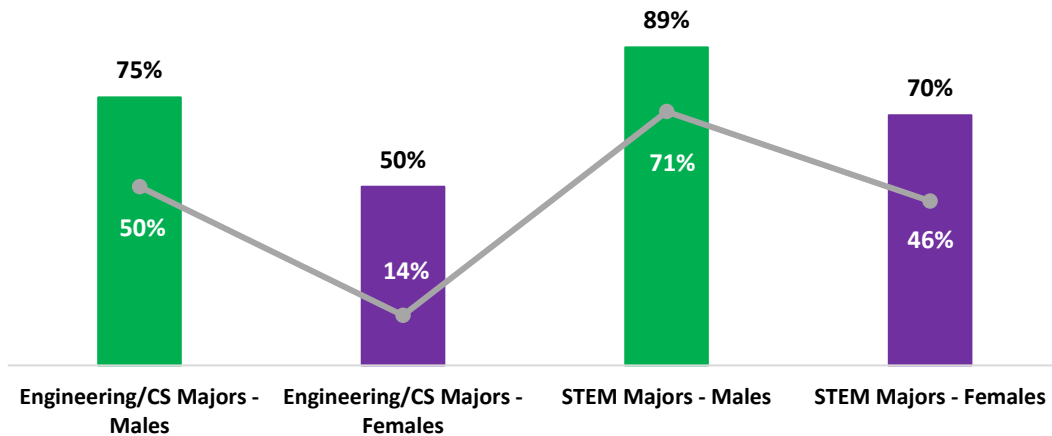
### Declared Majors in Computer Science, Years 1-4 in College



Note: Percentage of students who declared a major in years 1-4 of college. Asterisk (\*) indicates statistically significant at  $p \leq .05$ . NS indicates that differences are not statistically significant.

- **In computer science, the pattern was similar:** by Year 4, the gap in computer science majors between male FIRST alumni and male comparison students had narrowed, while the gap between female FIRST alumni and comparison women had grown, though because of the small numbers of women in computer science overall, the difference was not statistically significant.
- **Finally, while there are variations between results for male and female FIRST alumni when engineering and computer science majors are looked at separately, when engineering and computer science majors are combined and when looking across STEM majors as a whole, both male and female FIRST alumni are significantly more likely to major in STEM fields than their comparison group counterparts.** Overall, 75% of male and 50% of female FIRST alumni declared a major in engineering or computer science by the fourth year of college (compared to 50% and 14% of comparison students respectively); 89% of male and 70% of female FIRST alumni declared a major in a STEM-related field (compared to 71% of male and 46% of female comparison group members).

**Engineering and Computer Science Majors and STEM Majors  
Year 4, by Gender**



*Note: Data represents percentages of those who declared a major in years 1-4 of college. All differences are statistically significant,  $p \leq .05$ . STEM fields include: biology, engineering, computer science, health professions, mathematics, physical sciences, vocational/ technical fields, and robotics.*

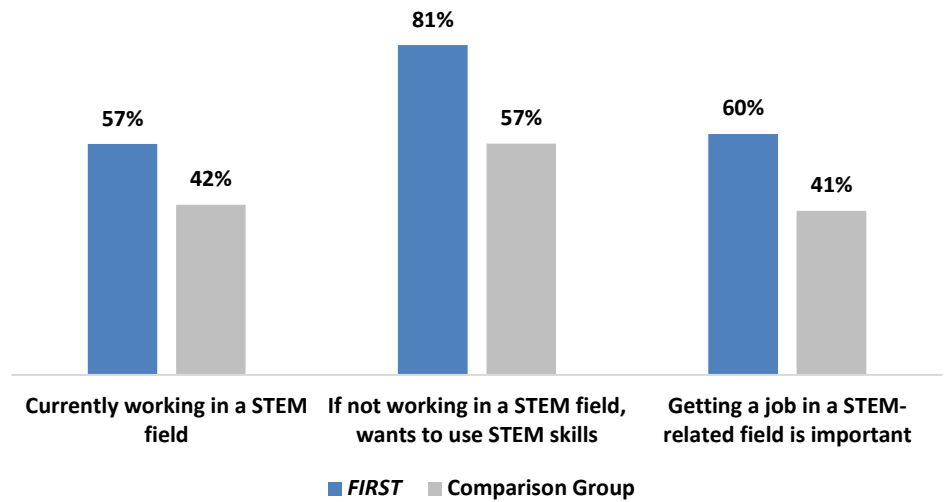
### Engineering Majors Sub-Fields

We added a question on type of engineering fields selected for college majors to the 96-month survey. Mechanical and electrical engineering are most popular among FIRST alumni, and proportionately comparison group students leaned more towards civil engineering. The comparison group tended to be more interested in biomedical engineering, albeit the small sample sizes don't allow for conclusive results.

## Employment in STEM

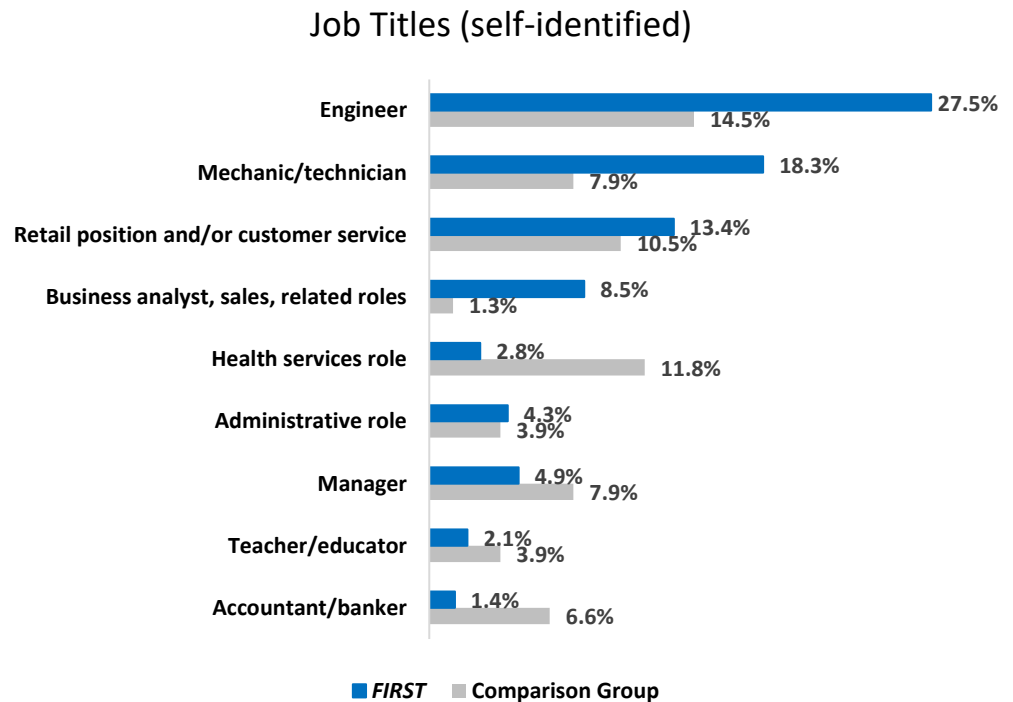
### Entering Employment

As the study participants begin to move beyond college, we are interested in their early work careers. Below we show differences between *FIRST* and the comparison group along self-identified job titles.



The survey included a series of questions on job related involvement with STEM. While the sample of respondents employed post-graduation is still small (total N=399), these results should be treated as preliminary. Regardless, we observe significant differences between *FIRST* alumni and comparison group survey respondents.

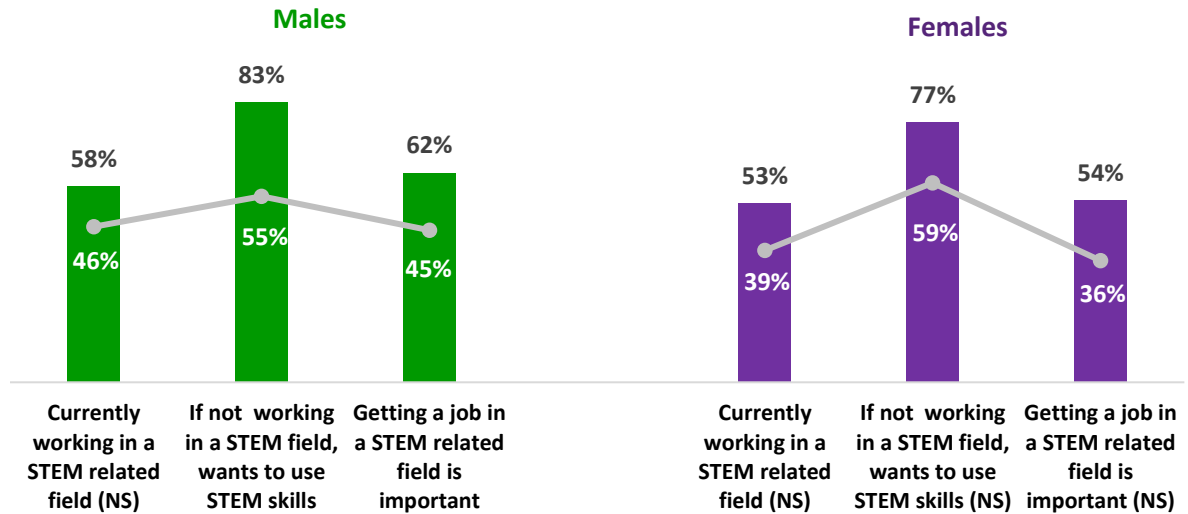
**FIRST alumni are significantly more likely to work in a STEM field** than the comparison group. More than half among them, 57 percent were working in the STEM field, compared to 42 percent of comparison group respondents.



For those not working in a STEM field, **FIRST alumni are significantly more likely to want to work in STEM** and to use their STEM skills. Eighty one percent among them reported wanting to work in STEM, compared to 57 percent among comparison group respondents.

Regardless of working or not working in a STEM field, **FIRST alumni are significantly more likely to report that getting a job in a STEM field as important** to them. Sixty percent among them reported a STEM job as important, compared to 41 percent among comparison group respondents.

We observe the same trends for male and female *FIRST* alumni. There are no gender differences for working in STEM and seeing getting a job in STEM as important.



### Conclusion

Eight years after entering *FIRST*, program participants continue to show consistently greater STEM-related interests and attitudes than similarly positioned students in the comparison group. Positive impacts on STEM-related attitudes and interests are evident across all three *FIRST* programs in the study and across all of the major population groups. *FIRST*'s impacts on STEM-related attitudes are particularly strong for female participants who generally show significantly greater levels over the comparison group than those experienced by male program participants. Data on students through their first four years of college show *FIRST*'s positive impacts on STEM-related attitudes and interests continue into postsecondary education, with *FIRST* alumni continuing to show positive impacts on STEM-related attitudes through the fourth year of college.

For those in college, the data from the study also show that *FIRST* has a positive impact on students' engagement in college pathways in engineering, computer science, and STEM-related fields in general. Through the fourth year in college, *FIRST* alumni are significantly more likely to be interested in technology-related majors, take courses in engineering and computer science, and declare majors in engineering, computer science, and STEM-related fields more broadly. Here, too, while both male and female *FIRST* alumni show positive impacts on interest, course-taking and declared majors, the results for female *FIRST* alumni are particularly strong, with female alumni consistently engaging in STEM-related fields at a rate significantly higher than female comparison students.

Preliminary data on employment post college highlight the *FIRST* impact. A larger proportion of *FIRST* alumni work in a STEM field and report that getting a job in a STEM field is important. Eighty-one percent of *FIRST* alumni currently not working a STEM field report wanting to use their STEM skills.

While the study will continue to follow students through postsecondary education and their early post-graduation careers, the results to date already indicate that *FIRST* is making a lasting difference in career interests and educational choices for the young people who participate in the program.



## Appendix

### Study Background

*FIRST*® (For Inspiration and Recognition of Science and Technology) is a global nonprofit organization that operates after-school robotics programs for young people ages 4-18 in the United States and internationally. The mission of *FIRST* is to inspire young people to be science and technology leaders by engaging them in exciting mentor-based programs that build science, engineering and technology skills, inspire innovation, and foster well-rounded capacities including self-confidence, communication, and leadership. The sequence of *FIRST* programs begins with *FIRST*® LEGO® League and includes *FIRST* LEGO League Discover (ages 4-6), *FIRST* LEGO League Explore (ages 6-10) and *FIRST* LEGO League Challenge (ages 9-14), followed by the *FIRST*® Tech Challenge serving grades 7-12, and *FIRST*® Robotics Competition, serving high school-aged youth (grades 9-12). *FIRST* estimates in 2019-2020, the programs reached over 679,000 young people worldwide.<sup>1</sup>

In 2011, *FIRST* contracted with the Center for Youth and Communities at Brandeis University's Heller School for Social Policy and Management to conduct a multi-year longitudinal study of *FIRST*'s middle and high school programs. The goal of the study, building on more than a decade of short-term evaluation studies by Brandeis University and others, is to document the longer-term impacts of *FIRST*'s programs on participating youth and to do so through a design that meets the standards for rigorous, scientifically-based evaluation research. Three major questions guide the study:

- **What are the short and longer-term impacts of the *FIRST* LEGO League Challenge, *FIRST* Tech Challenge, and *FIRST* Robotics Competition programs on program participants?** Specifically, what are the program impacts on a core set of participant outcomes that include: interest in STEM and STEM-related careers, college-going and completion, pursuit of STEM-related college majors and careers, and development of 21<sup>st</sup> century personal and workplace-related skills?
- **What is the relationship between program experience and impact?** To what extent are differences in program experience – such as time in the program, participation in multiple programs, role on the team, access to mentors, quality of the program experience – associated with differences in program outcomes? What can we learn about “what works” to guide program improvement?
- **To what extent are there differences in experiences and impacts among key subpopulations of *FIRST* participants?** In particular, are there differences in impacts for young women, youth of color, low-income youth, and youth from urban or rural communities? If there are differences, what can we learn about why those differences occur and their implications for the program in the future?

To address these questions, the *FIRST* Longitudinal Study has been tracking 1,273 students (822 *FIRST* participants and 451 comparison students) over an eight-year period beginning with entry of the *FIRST* participants into the program. Team members were recruited to the study from a nationally representative sample of “veteran” teams from the *FIRST* LEGO League Challenge, *FIRST* Tech Challenge, and *FIRST* Robotics Competition programs over a two-year period spanning the 2012-13 and 2013-14

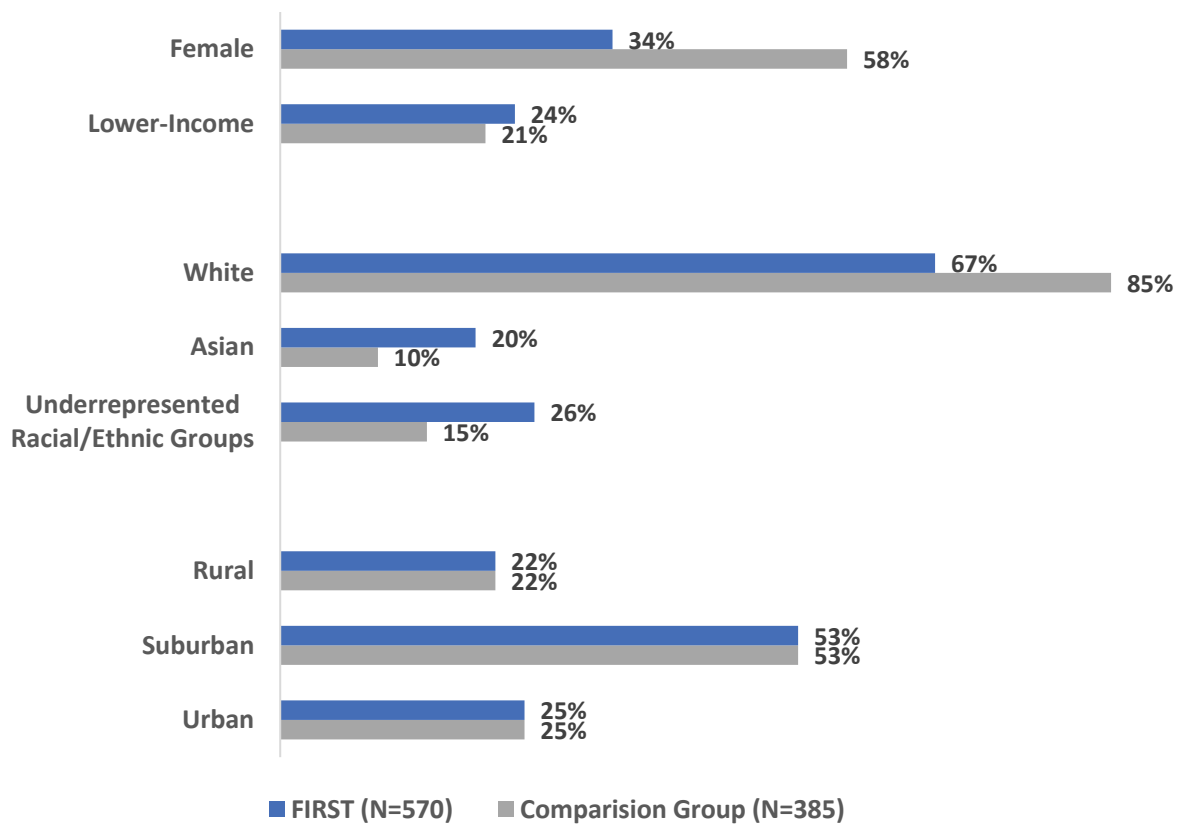
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<sup>1</sup> <http://www.firstinspires.org/about/at-a-glance>

school years. Comparison group students were recruited from math and science classes in the same schools and organizations where the *FIRST* teams were located. Once recruited into the study, team members and comparison students were surveyed at baseline and post-program in their first year, with annual follow-up surveys each spring thereafter. A baseline survey of parents provided additional background information on the family context for team members and comparison students, and Coach/Mentor surveys at the end of the first year of team involvement in the study provided additional contextual data on the *FIRST* teams. In several study years, team member surveys have also been supplemented by interviews and focus groups with team members and comparison group students.

Below we show the baseline characteristics at the 96 months follow-up survey for the *FIRST* participant and comparison groups. Overall, both groups match well. The comparison group has more female students and more White respondents than we find among the *FIRST* participants. We control for all these differences in our analyses.

### Participant Characteristics at 96 months



<sup>i</sup> This report is based on data from the eight’s round of follow-up surveys, which were administered approximately 96 months after students entered the study (baseline).

<sup>ii</sup> Of the 570 *FIRST* participants responding to the 96-month follow-up survey, most (486 had graduated high school, 4 left without a high school degree) were no longer eligible for *FIRST*. Eighty respondents were still in high school but no longer active in the program and 16 among them were still active in *FIRST*.

<sup>iii</sup> Note: Throughout this summary, “impact” refers to the differences in outcomes between *FIRST* participants and corresponding members of the comparison group, after controlling for differences between the two groups on key

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measures at baseline. For example, impacts for *FIRST* participants as a whole are based on the difference in outcomes between all *FIRST* participants and all comparison group members; impacts for female *FIRST* participants are based on the comparison with female members of the comparison group. Impacts that are “statistically significant” are those that are large enough to be unlikely to have occurred by chance (less than a 5% probability).

<sup>iv</sup> Based on “Linear Mixed Models” analysis (“Mixed”). The “mixed” analysis estimates average differences for participants vs. comparison students taking into account differences between the groups at baseline and using data from all available points in time (baseline, post-program, and follow-ups). In this instance, the “mixed” results measure whether the average levels for *FIRST* participants were greater than those experienced by comparison students and whether the differences were large enough to be statistically significant. The effect size (omega squared -  $\omega^2$ ) was “large” for the impact on STEM interest and “medium” for the other STEM outcome measures. Control variables are gender, race, any honors course, parental income, and parental support for STEM.

<sup>v</sup> Based on “Logistic Regression” analysis (“Logit”). Logit analysis estimates the relative probability that participants and comparison students will achieve a particular outcome, after controlling for differences between the groups at baseline, including gender, race, any honors course, parental income, parental support for STEM, and interest in STEM at baseline. In this case, the Logit analysis measures whether *FIRST* participants are more (or less) likely than comparison students to show an increase from baseline to follow-up on each STEM-related measure (such as STEM interest) and whether those differences are statistically significant (i.e., unlikely to occur by chance). The “odds ratio” is the measure of the relative likelihood that *FIRST* participants will achieve that outcome (for example, “2.0 times more likely to show higher levels in STEM interest than comparison students”).