FIRST® Longitudinal Study:
Findings at 72 Month Follow-Up

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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 5-18 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 Discover (ages 4-6), Explore (ages 6-10) and 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 that over 660,000 young people will participate in its programs in 2019-20 on more than 79,000 teams and will compete in more than 3,600 events worldwide.[2]

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

KEY FINDINGS AT 72 MONTH FOLLOW-UP

- *FIRST* participants continue to show positive impacts on STEM-related interests and attitudes six years (72 months) after they entered the program. Impacts include increased interest in STEM, involvement in STEM-related activities, STEM identity, STEM knowledge, and interest in STEM careers. *FIRST* team members are approximately twice as likely to show gains on STEM-related measures as comparison students.

- Participants from all major population groups and community types show positive impacts, including both males and females, multiple racial and ethnic groups, lower and higher income youth, and youth 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 third year of college, *FIRST* alumni:
    - continue to show significantly greater gains on STEM-related attitudes than comparison students;
    - are significantly more likely to be interested in majoring in computer science and engineering;
    - are more than twice as likely to take computer science and engineering courses; and
    - are significantly more likely to declare a major in computer science, engineering, or a STEM-related field than comparison students. Through the 3rd year of college, 81% of *FIRST* alumni had declared a STEM major; 69% were majors in computer science or engineering.
    - Female *FIRST* alumni continue to pursue STEM-related courses and majors at a high rate through the 3rd year of college. By the 3rd year, female *FIRST* alumni were majoring in engineering at the same rate (51%) as male alumni.

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[1] This report is based on data from the sixth round of follow-up surveys, which were administered approximately 72 months after students entered the study (baseline).

[2] http://www.firstinspires.org/about/at-a-glance

majors and careers, and development of 21st 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?[3]

- **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 a six-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 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.

Impacts at 72 Month Follow-Up

This report presents a summary of the impact findings based on six years of data, including survey data from baseline and post-program surveys and five rounds of annual

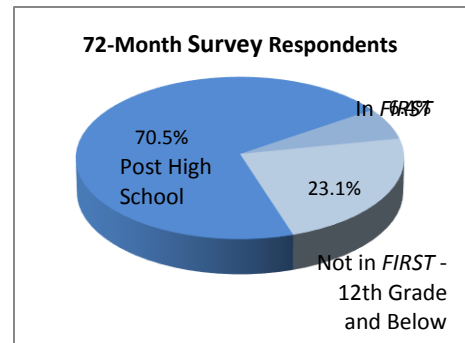**Data Collection through 72 Month Follow-Up**

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
FIRST Participants	822	677	665	636	611	602	550
Comparison Group	451	259*	411	409	406	397	386
Total	1273	936	1076	1045	1017	999	936

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

follow-up surveys. As such, it reflects the impacts of participation in *FIRST* six years after study participants entered the program. Of the 1,273 students who began the study, 936 students (74%) completed the 72-month follow-up survey, including 550 *FIRST* participants (67% of those at baseline) and 386 comparison students (86% of those at baseline). Of the *FIRST* participants responding to the follow-up survey, 35 (6.4%) were still active in the program.[4]

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[3] To be addressed in a separate report.

[4] Of the 550 *FIRST* participants who responded to the 72-month follow-up, 515 were no longer active in the program. Of those 388 had graduated high school and were no longer eligible for *FIRST*; 127 were still in high school but no longer active in the program. Overall, 21.6% of those eligible to participate in *FIRST* were still active in the program after 6 years.

The findings from the 72-month follow-up surveys extend the positive impact findings from the prior (2015-2019) annual impact reports: ***FIRST* participants continue to show significantly *greater average gains* on STEM-related attitudes and interests than comparison students and are statistically significantly *more likely* to show gains in STEM-related 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).[5]

72-Month Survey Respondents

70.5% Post High School

23.1%

In *FIRST*

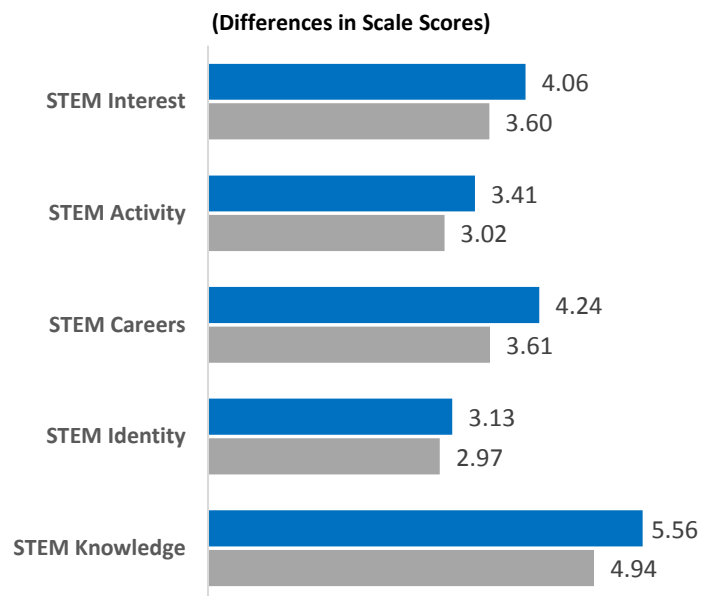Not in *FIRST* - 12th Grade and Below

Data on students in their first three years of college also point to positive, statistically significant long-term impacts. **Through their third 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 (computer science, engineering, 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 third year of college, of the FIRST alumni who had declared a major, 81% 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 72 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 gains on STEM-related measures six years after entering the program as students in the comparison group.

- ***FIRST* participants continue to show significantly greater average gains than members of the comparison group on all of the measures of STEM-related interests and attitudes.** 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.[6] The STEM-related measures include:

STEM-Related Interests and Attitudes at 72 Months
(Differences in Scale Scores)

STEM Interest	4.06 / 3.60
STEM Activity	3.41 / 3.02
STEM Careers	4.24 / 3.61
STEM Identity	3.13 / 2.97
STEM Knowledge	5.56 / 4.94

Note: All results are statistically significant at p≤.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.

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[5] 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 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).
[6] Based on "Linear Mixed Models" analysis ("Mixed"). The "mixed" analysis estimates average gains for participants vs. comparison students taking into account differences between the groups at baseline and using data from all

- *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," "I can use math and science to make a difference in the world).

- ***FIRST participants are also significantly more likely to show an increase on STEM-related measures than comparison students.***[7] After controlling for differences in baseline characteristics and baseline scale scores, *FIRST* participants at 72 months were still:
  - 2.4 times more likely than comparison students to show gains on *STEM interest*;
  - 2.1 times more likely to show gains on interest in *STEM careers*;
  - 2.0 times more likely to show gains in *STEM identity*.
  - 1.8 times more likely to show gains in involvement in *STEM activity*; *and*
  - 1.7 times more likely to show gains in STEM *knowledge/understanding of STEM;*

- ***The 72-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, FIRST Tech Challenge, FIRST Robotics Competition).*** Participants from all three *FIRST* programs (program at entry into *FIRST*) show significantly greater gains on STEM-related measures than comparison students from the same age/grade span.

- ***STEM-related impacts continue to be evident across all major population groups and among students from different types of 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 youth of color, and urban, suburban, and rural youth – shows significantly greater gains for *FIRST* participants than for comparison students from the same group or community type.

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available points in time (baseline, post-program, and follow-ups). In this instance, the "mixed" results measure whether the average gains 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 - ω^2) was "large" for the impact on STEM interest and "medium" for the other STEM outcome measures.

[7] 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. 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 relatively likelihood that *FIRST* participants will achieve that outcome (for example, "2.0 times more likely to show a gain in STEM interest than comparison students").
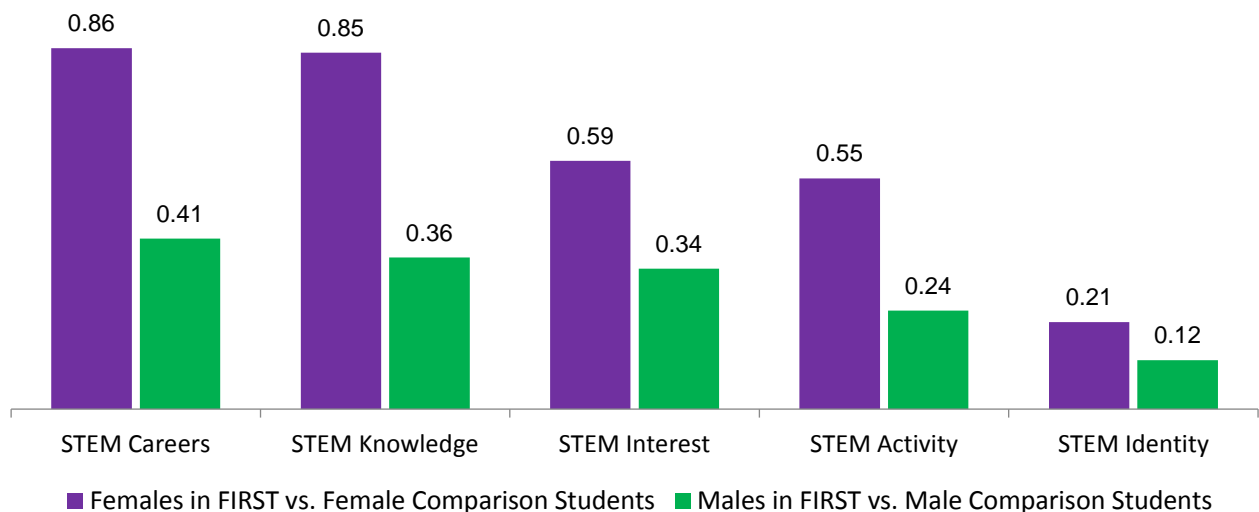
Impacts on STEM-Related Attitudes for Major Population Groups

Outcomes	Males	Females	Low Income	High Income	White	Youth of Color	Urban	Suburban	Rural
STEM Interest	+	+	+	+	+	+	+	+	+
STEM Activity	+	+	+	+	+	+	+	+	+
STEM Careers	+	+	+	+	+	+	+	+	+
STEM Identity	+	+	+	+	+	+	+	+	+
STEM Knowledge	+	+	+	+	+	+	+	+	+

Note: Plus mark (+) indicates a positive, significant impact at p≤ .05. Impacts are relative to comparable subgroups in the comparison population (for example, male FIRST participants compare to male comparison group members). Low income is defined as those whose family income is below $50,000. Youth of color group includes Asian, Black or African-American, Native American, Hawaiian/Pacific Islander, and multi-racial. 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 participants in FIRST, female participants continue to show significantly greater impacts than male participants on all of the STEM-related attitudinal measures.* The chart below 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.
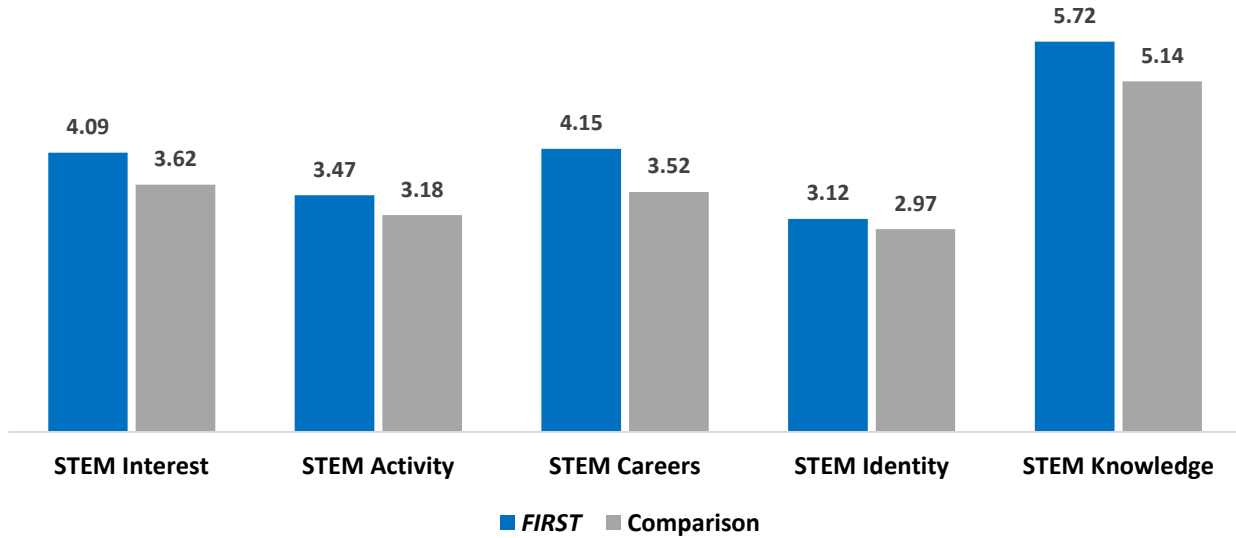
Impacts on STEM-Related Outcomes
for Male and Female *FIRST* Team Members
(Scale Scores)

	STEM Careers	STEM Knowledge	STEM Interest	STEM Activity	STEM Identity
Females in FIRST vs. Female Comparison Students	0.86	0.85	0.59	0.55	0.21
Males in FIRST vs. Male Comparison Students	0.41	0.36	0.34	0.24	0.12

■ Females in FIRST vs. Female Comparison Students ■ Males in FIRST vs. Male Comparison Students

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≤.05.

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

STEM-Related Interests and Attitudes in 3rd Year of College

Note: All results are statistically significant at p≤.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.

Impacts on STEM-Related Interests and Attitudes in 3rd Year of College, by Gender
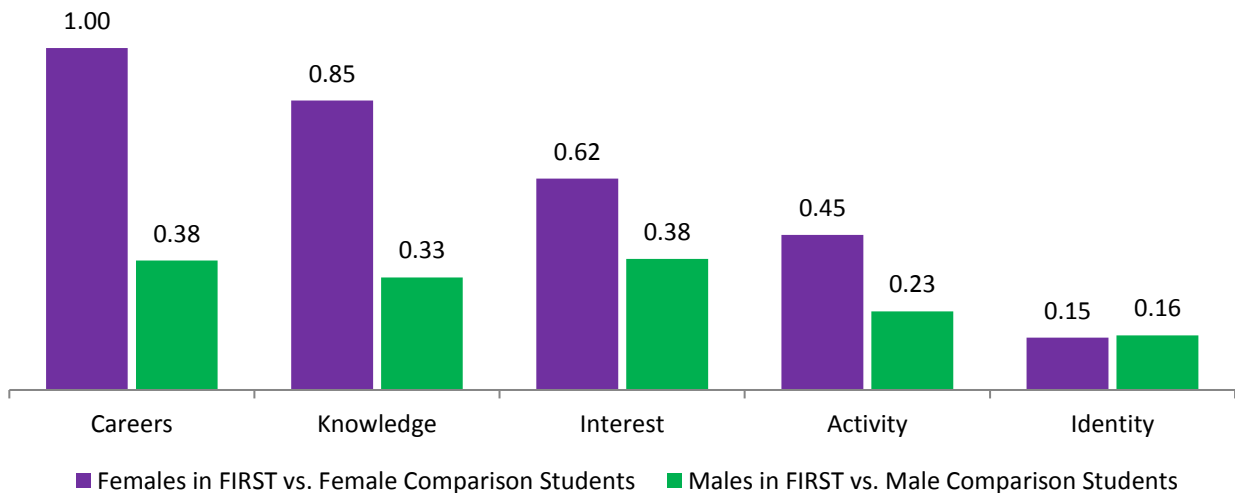

Note: Values on the chart represent the differences in outcomes (estimated scale scores) between FIRST alumni and students of the same gender in the comparison groups (i.e., the difference in scores between males in FIRST and males in the comparison group and between females in FIRST and female comparison students). All differences are statistically significant at p≤.05. The impacts for female alumni are statistically significantly greater than those for male alumni for all measures except STEM identity.

Impacts on College Pathways through the First Three 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. Through their third year of college, *FIRST* alumni are significantly more interested in majoring in computer science and engineering 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 third year of college, of the *FIRST* alumni who had declared a major, 81% were majoring in a STEM-related field compared to 58% of comparison students; 69% had declared a major in computer science or engineering vs. 26% for comparison students. In most cases, these differences held for both male and female *FIRST* alumni.

- ***FIRST alumni report significantly stronger interest in majoring in computer science and engineering than comparison students through the first three years college***. *FIRST* alumni were significantly more likely than comparison students to be "very interested" in majoring in computer science and engineering than comparison students throughout the first three years of college. In computer science, the gap in interest between *FIRST* alumni and comparison students widened from Year 1 through Year 3. *FIRST* alumni were more than 2.4x more likely to be interested in majoring in computer science than comparison students in Year 1, 2.7 times more likely in Year 2, and 3.1 times more likely in Year 3. In engineering, the difference in interest was also statistically significant in all three years, though the gap narrowed slightly by Year 3. In Year 1, *FIRST* alumni were more than 3.2 times as likely to be interested in majoring in engineering than comparison students; 2.5 times more likely in Year 2, and 2.1 times more likely in Year 3.[8]
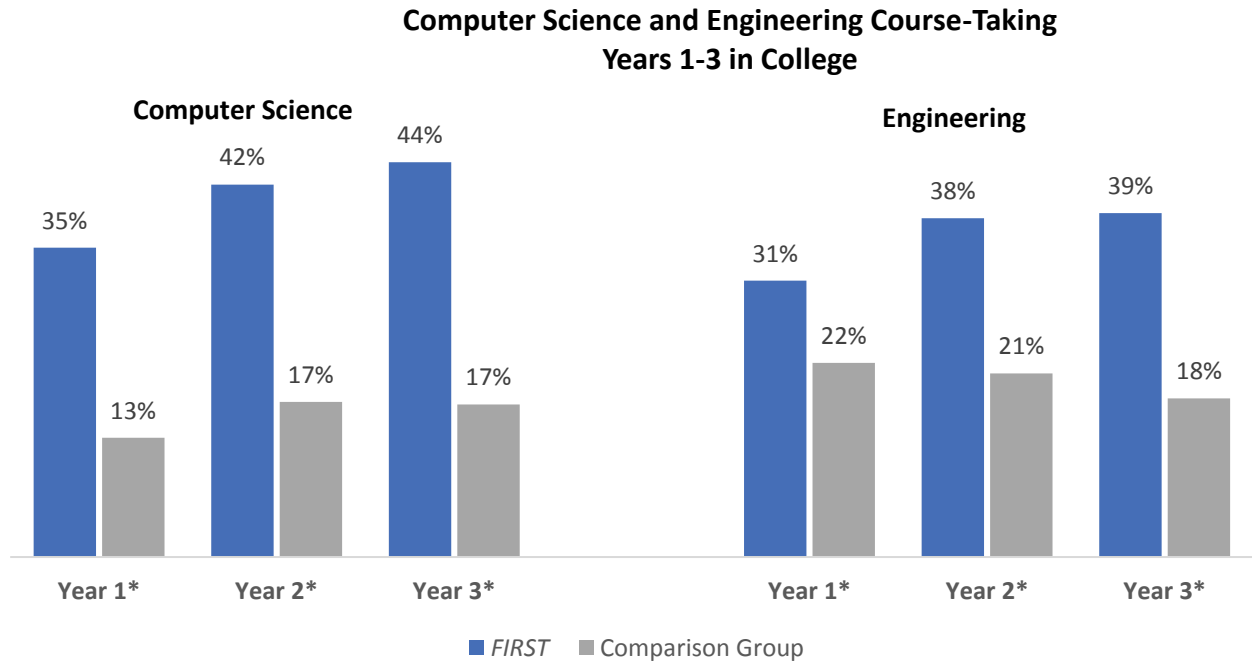
Interest in Computer Science and Engineering Majors - 3rd Year in College
(Percent "Very Interested")
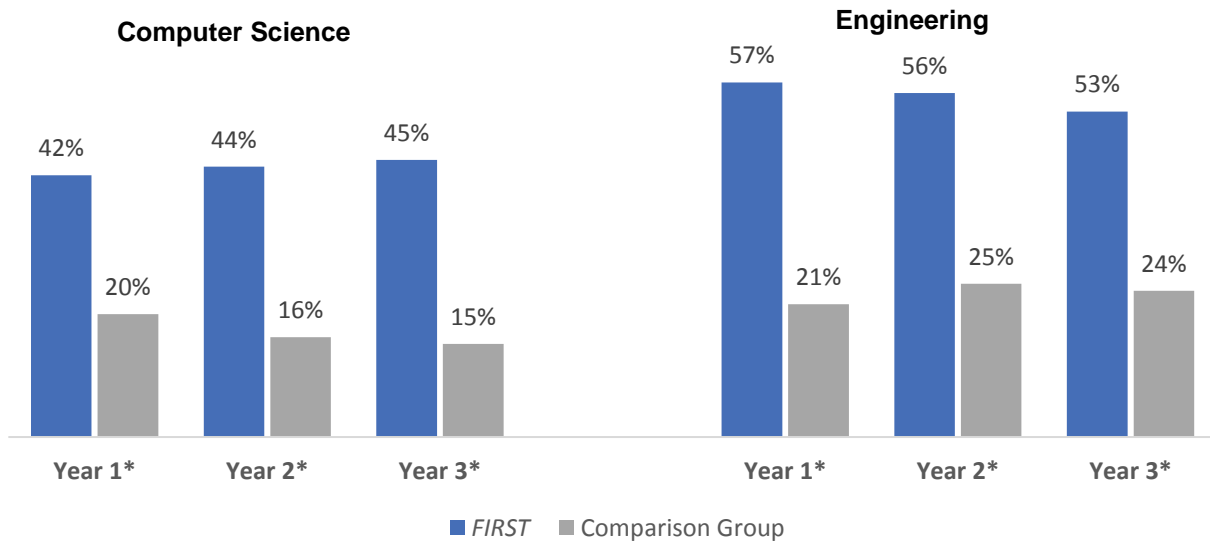
Note: Based on a question asking students to rate their interest in majoring in each of the listed subjects. Values shown are percent of students who are "very interested" in the specified major (i.e., reporting 6, 7 or "already declared" on a scale from (1) "Not Interested at All" to 7 "Very Interested"). Asterisk (*) indicates statistically significant at p ≤ .05. FIRST alumni also showed significantly stronger interest in majoring in Robotics (not shown) in all three years.

[8] In the discussion of college outcomes, the percentages used represent raw, "unadjusted" percentages. The relative likelihood of an outcome (example, 3.2 times more likely to be interested in an engineering major) and analysis of statistical significance are based on Logistic Regression analysis adjusting for differences in baseline characteristics.

- ***FIRST alumni are also significantly more likely to take engineering or computer science courses during their first three years in college than comparison students***. In their first year of college, *FIRST* alumni were more than twice as likely (2.3 times) to take an engineering course and 1.5 times more likely to take computer science than comparison students. The differences in course-taking continued into the second year of college: *FIRST* alumni were roughly twice as likely to take engineering and computers science courses (2.1 times for both) as comparison students. By the second year of college, 45% of *FIRST* alumni reported taking at least one engineering class and 38% reported taking at least one computer science course compared to 19% of comparison students.

Computer Science and Engineering Course-Taking
Years 1-3 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 ≤ .05.

- **Consistent with their greater interest in computer science and engineering 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 during the first three years of college. They are also significantly more likely than comparison students to declare a major in a STEM field generally by the end of their third of college**.

  - *Computer science majors*: In all three years of college, *FIRST* alumni declared a major in computer science at a significantly higher rate than comparison students: 13% *vs*. 7% in the first year of college, 29% *vs*. 12% in Year 2, and 28% *vs*. 17% in Year 3. Overall, in Year 3, *FIRST* alumni were nearly twice as likely (1.9 times) as comparison students to major in computer science.

  - *Engineering majors*: *FIRST* alumni were also significantly more likely to declare a major in engineering through the first three years of college than comparison students: 25% *vs*. 6% in the first year of college, 44% *vs*. 16% in Year 2, and 51% *vs*. 24% in Year 3. In Year 3, *FIRST* alumni were more than 2.6 times as likely to major in engineering as comparison students.
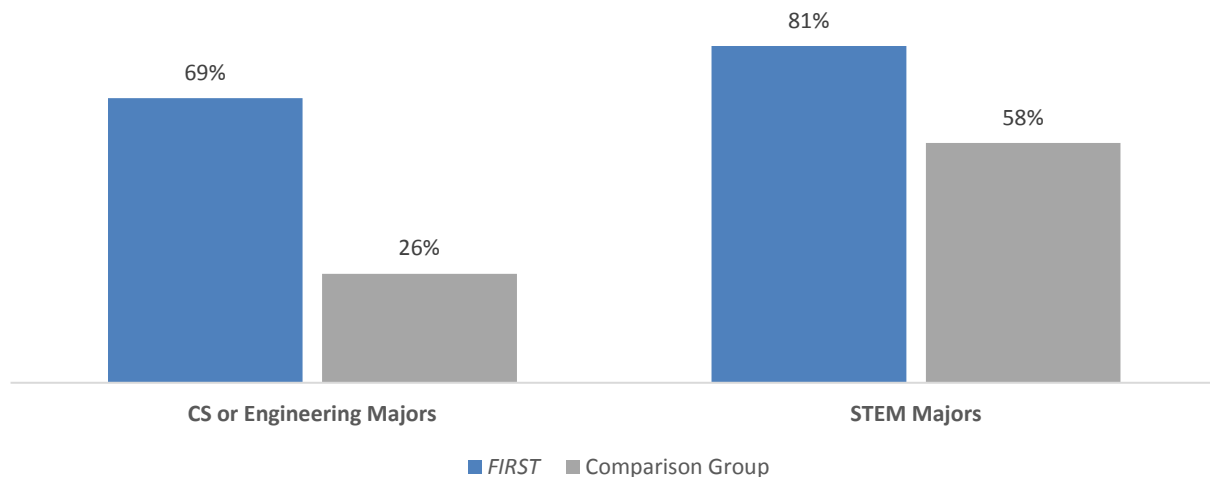
Computer Science and Engineering Majors
in Years 1-3 of College
(Percent of those who declared majors)

Computer Science

Engineering

■ *FIRST*   ■ Comparison Group
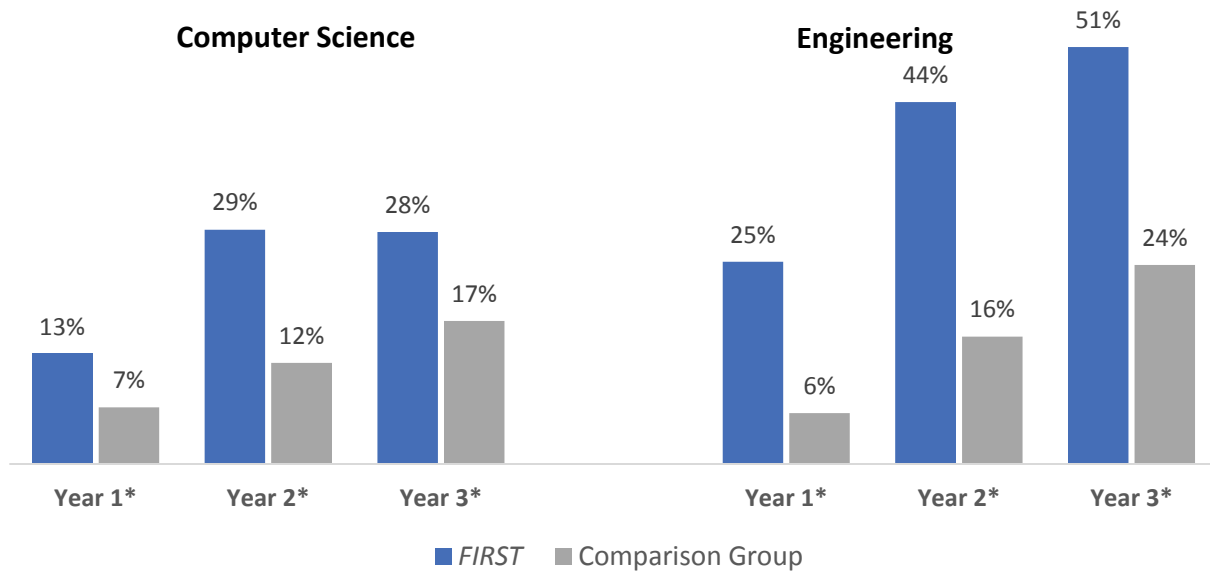
Note: Percent of students who declared a major in specified fields as a percentage of all those who declared a major in that year. Asterisk (*) indicates statistically significant at p ≤ .05.

- *Computer Science or Engineering*: By Year 3, 69% 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 3 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.

Computer Science and Engineering Majors and STEM Majors - Year 3

■ *FIRST*   ■ Comparison Group

Note: Data represents percentages of those who declared a major in years 1-3 of college. All differences are statistically significant, p ≤ .05. STEM fields include: Biology, Computer Science, Engineering, Health Professions, Mathematics, Physical Sciences, vocational/ technical fields, and Robotics.

- **In addition to the greater likelihood of taking courses and majoring in STEM fields, *FIRST* alumni were also significantly more likely to be engaged in STEM-related activities during their first and second year at college than comparison students.** As the table to the right shows, in most years *FIRST* alumni were more likely to have a STEM-related internship, join a computer or engineering club, participate in a computer or engineering competition, receive an engineering-related grant or scholarship, and have a STEM-related summer job than comparison students. The exceptions were participation in computer science competitions in Year 3, where a smaller percentage of *FIRST* alumni participated than in prior years, and in STEM-related summer jobs in Year 3, where the difference in percentages was still substantial (21% *vs*. 14%) but not statistically significant.

STEM-Related Activities in Year 1-3 of College

Activity		FIRST	Comparison
STEM-Related Internship	Yr1*	16.8%	6.7%
	Yr2*	23.9%	13.7%
	Yr3*	31.8%	20.0%
Joined Computer Club	Yr1*	15.8%	5.1%
	Yr2*	18.1%	5.8%
	Yr3*	17.1%	6.7%
Joined Engineering Club	Yr1*	27.7%	9.9%
	Yr2*	26.1%	7.1%
	Yr3*	26.4%	8.5%
Participate in a Computer Competition	Yr1*	7.8%	3.6%
	Yr2*	6.9%	2.7%
	Yr3	4.8%	3.0%
Participate in an Engineering Competition	Yr1*	10.7%	4.0%
	Yr2*	10.2%	3.1%
	Yr3*	8.9%	3.6%
Received Engineering-Related Grant or Scholarship*	Yr1*	8.0%	4.4%
	Yr2*	8.0%	2.2%
	Yr3*	9.7%	2.4%
STEM-Related Summer Job	Yr1*	13.6%	6.6%
	Yr2*	14.6%	8.5%
	Yr3	20.7%	13.5%

*Note: Asterisk (*) indicates differences that are statistically significant at p≤0.05. Significance tests do not include adjustments for baseline differences.*

Gender Differences in College Pathways

In general, the impacts on college pathways were shared by both male and female *FIRST* alumni. By the third year of college, both male and female *FIRST* alumni were significantly more likely to have majored in computer science or engineering and in STEM majors generally than males and females in the comparison group. At the same time, the college outcome data show somewhat different patterns of impact between males and females during the first three years of college. In general, the gap between *FIRST* and comparison group males in interest in computer science and engineering majors, computer science and engineering course-taking, and declared majors in engineering and computer science narrowed over time, largely through increased involvement of comparison students in computer science and engineering. In contrast, the gap between female *FIRST* alumni and comparison students continued to widen through the first three years of college, with female *FIRST* alumni significantly more likely to be interested in computer science and engineering, to take computer science and engineering courses, and to major in engineering. Female *FIRST* alumni also majored in computer science through all three years, though the differences with young women in the comparison group were not statistically significant. The section that follows presents 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 the first three 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 3, the difference in interest was no longer significant. (Male *FIRST* alumni continued to be significantly more interested in computer science majors through all three years.) Female *FIRST* alumni, in contrast, were significantly more interested in both engineering and computer science majors through the first three years of college, with the difference in computer science growing more substantial over time.

Percent "Very Interested" in Engineering and Computer Science Majors in Years 1-3 of College - Males
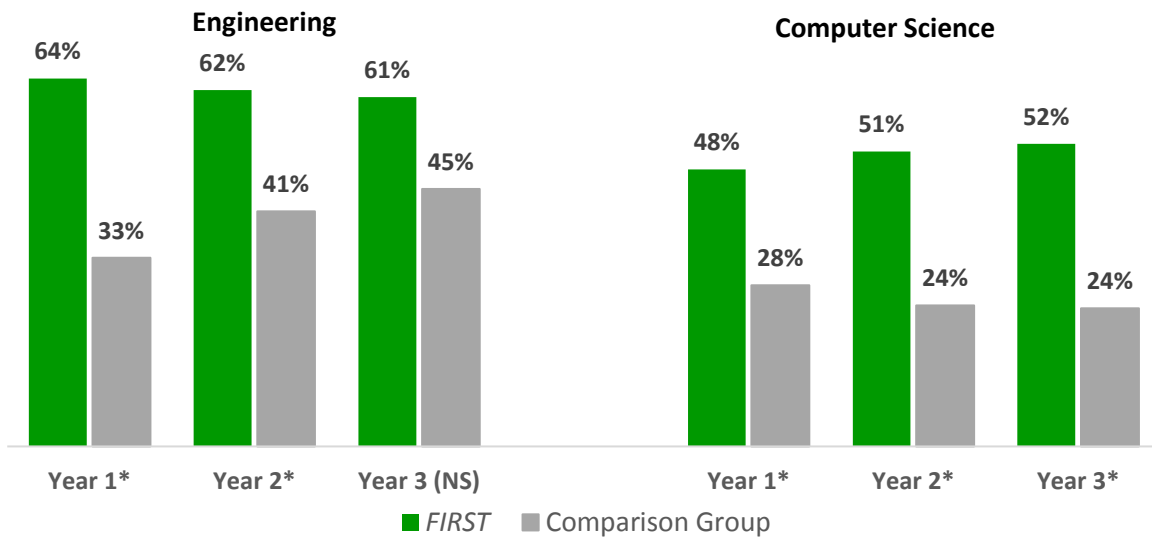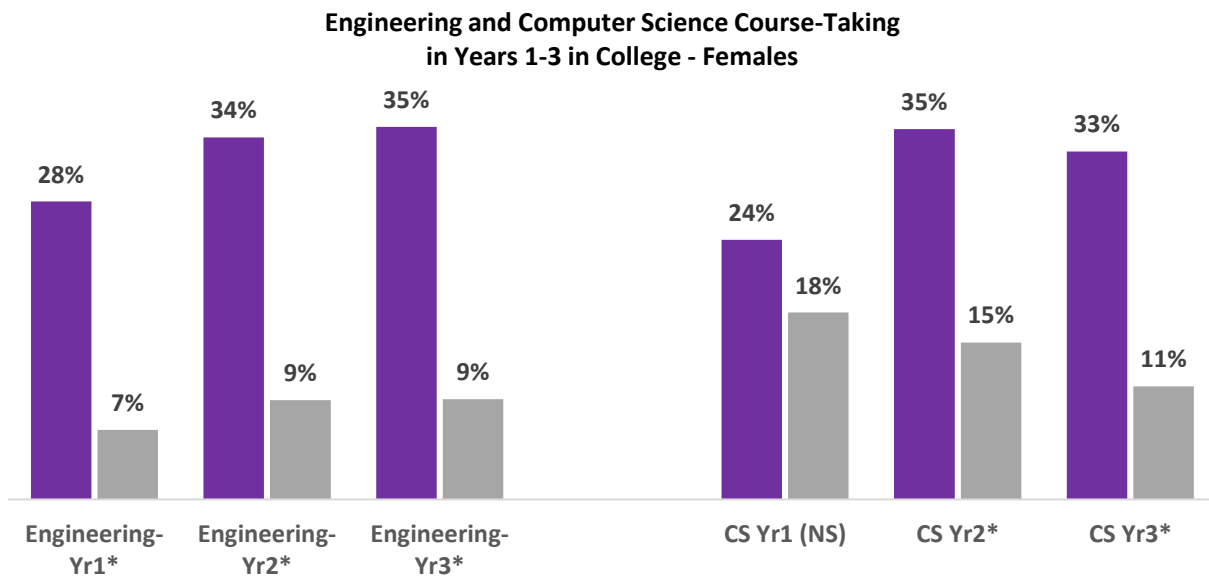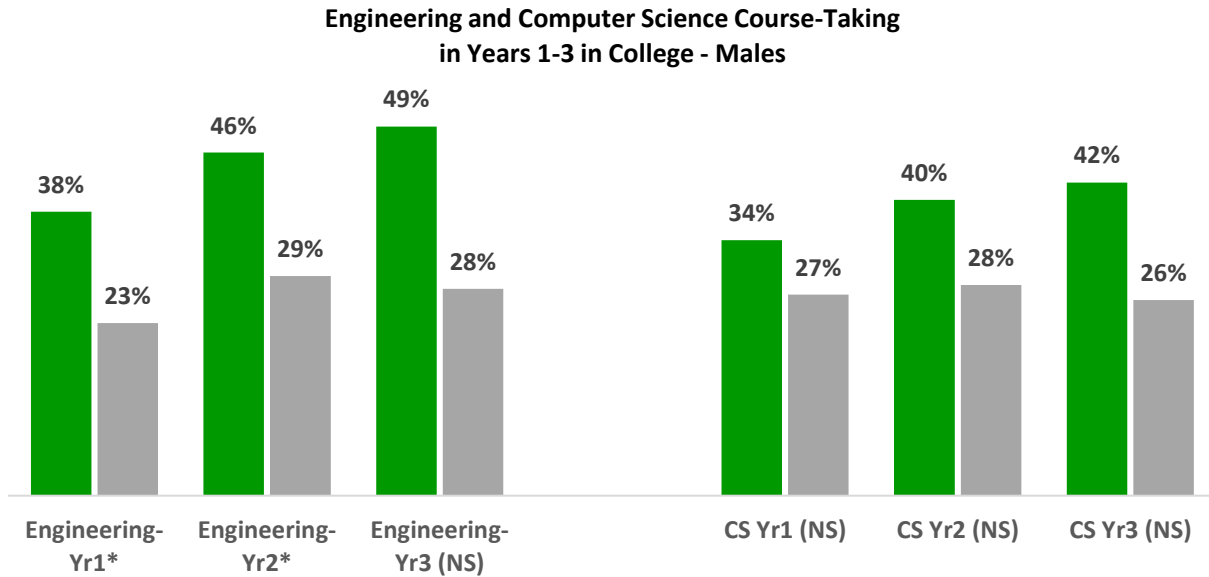

Percent "Very Interested" in Engineering and Computer Science Majors in Years 1-3 of College -Females
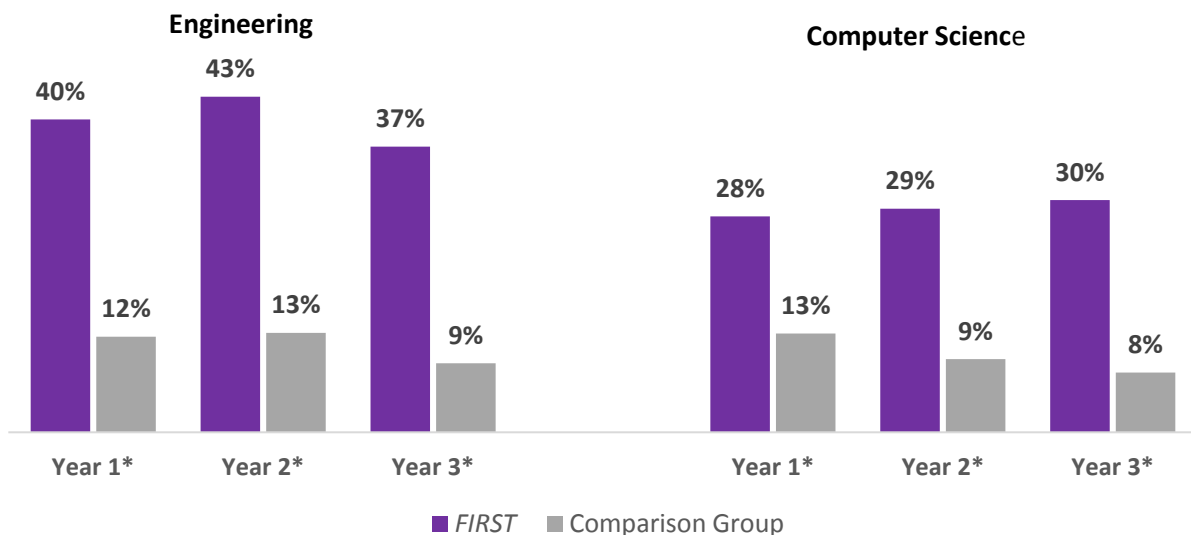
Note: Values shown are percent of students who are "very interested" in the specified major (i.e., reporting 6, 7 or "already declared" on a scale from (1) "Not Interested at All" to 7 "Very Interested"). Asterisk (*) indicates statistically significant at p ≤ .05. NS indicates that differences are not statistically significant.

- *Over the first 3 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 3, 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 (35% *vs*. 9% in engineering and 33% *vs*. 11% in computer science).

Engineering and Computer Science Course-Taking in Years 1-3 in College - Males

Engineering and Computer Science Course-Taking in Years 1-3 in College - Females
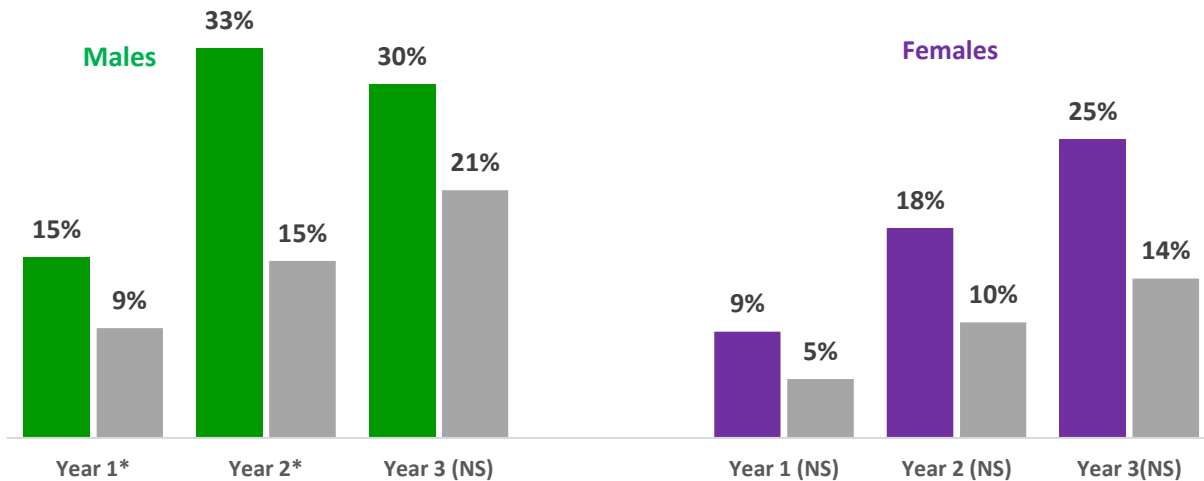

Note: Percentage of full-time students who reported taking at least one course in Engineering and/or Computer Science. Asterisk (*) indicates statistically significant at p ≤ .05. NS indicates that differences are not statistically significant.

- **In terms of declared majors, the gap in declared majors in engineering between male *FIRST* alumni and comparison males narrowed substantially over the first three years of college, largely as a result of a substantial increase in engineering majors among comparison males**. By Year 3, the difference between male *FIRST* alumni and male comparison group members was no longer significant.

- A**mong 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 3, 51% of female *FIRST* alumni had declared majors in engineering, a rate comparable to that of their male counterparts.

- **In computer science, the pattern was similar**: by Year 3, 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.

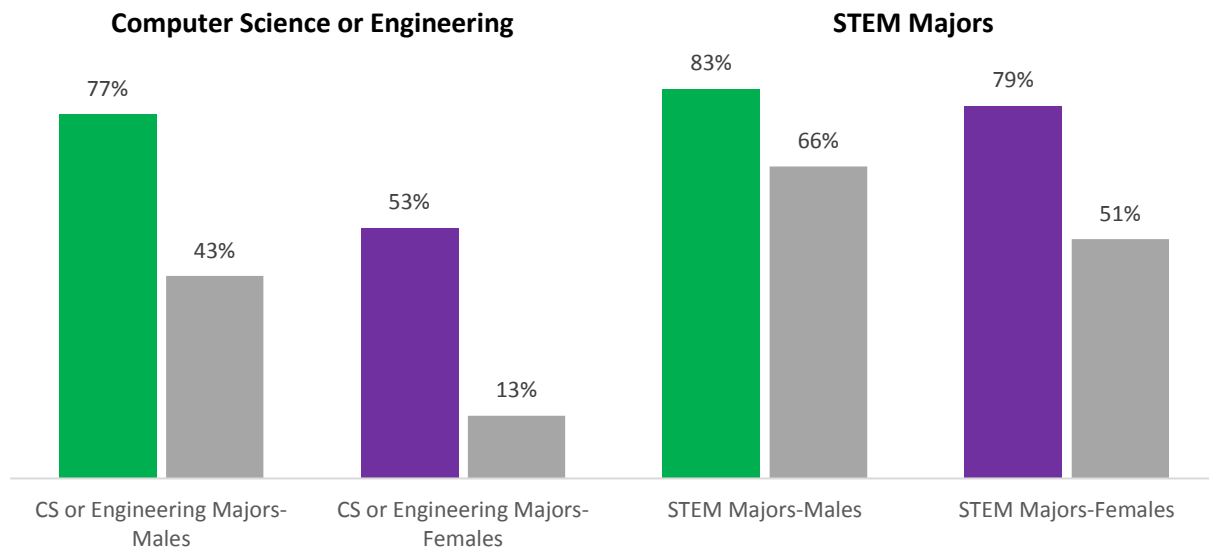**Declared Majors in Engineering, Years 1-3**
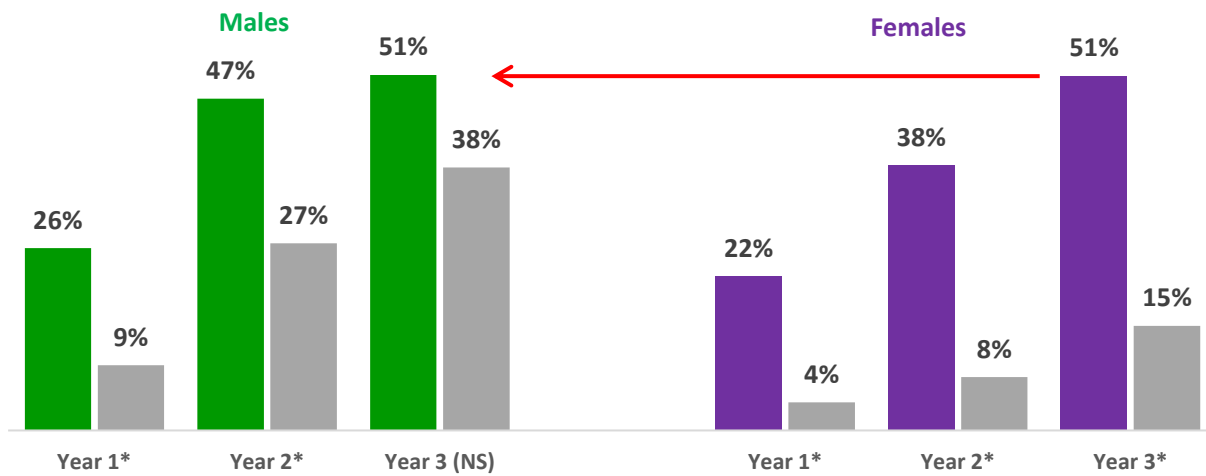
Declared Majors in Computer Science, Years 1-3

Percent of students who declared a major in specified field as a percentage of all those who declared a major in that year. Asterisk (*) indicates statistically significant at p ≤ .05. NS indicates that differences are 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, 77% of male and 53% of female *FIRST* alumni declared a major in engineering or computer science by the third year of college (compared to 43% and 13% of comparison students respectively; 83% of male and 79% of female *FIRST* alumni declared a major in a STEM-related field, compared to 66% of male and 51% of female comparison group members.

Computer Science and Engineering Majors and STEM Majors - Year 3, by Gender

Note: Data represents percentages of those who declared a major in years 1-3 of college. All differences are statistically significant, p ≤ .05. STEM fields include: Biology, Computer Science, Engineering, Health Professions, Mathematics, Physical Sciences, vocational/ technical fields, and Robotics.

Conclusion

Six years after entering *FIRST,* program participants continue to show consistently greater gains on STEM-related interests and attitudes than similar 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 gains than those experienced by male program participants. Data on students through their first three years of college shows *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 third year of college.

For those in college, the data from the study also show that *FIRST* has a positive impact on student's engagement in college pathways in engineering, computer science, and STEM-related fields in general. Through the third year in college, *FIRST* alumni are significantly more likely to be interested in technology-related majors, take courses in computer science and engineering, and declare majors in computer science, engineering, 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. While the study will continue to follow students to and through postsecondary education, 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.