



SCHOOL BOARD ACTION REPORT

DATE: August 19, 2019
FROM: Denise Juneau, Superintendent
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For Introduction: August 28, 2019
For Action: September 4, 2019

1. TITLE

Approval of Grant from Amazon Future Engineer to support Science, Technology, Engineering and Math (STEM) education activities.

2. PURPOSE

The purpose of this Board action is to approve a one-time grant from the Amazon Future Engineer program in an amount not to exceed \$300,000 to support STEM education activities.

3. RECOMMENDED MOTION

I move that the Board authorize the Superintendent to accept the grant from the Amazon Future Engineer program in an amount not to exceed \$300,000.

4. BACKGROUND INFORMATION

a. Background

Amazon is supporting up to 30 schools in the district to launch their Amazon Future Engineer program with FIRST Washington Robotics, establishing and running a FIRST Washington robotics club during the 2019-2020 school year. Launched in November, 2018, Amazon Future Engineer is a four-part childhood-to-career program intended to inspire, educate, and prepare children and young adults from underrepresented and underserved communities to pursue careers in the fast-growing field of computer science. Each year, Amazon Future Engineer aims to inspire students to explore computer science. FIRST is a hands-on learning program designed to expose underserved students to problem solving through real-world applications of computer science and engineering. Students are taught how to work together and they compete at events by performing cooperative robotics tasks with other teams and presenting their ideas to adult-industry mentors. This proposed support will help the district promote STEM education, particularly to students furthest from educational justice as the participating schools generally have large numbers of historically underserved students of color, and thus this effort aligns with the district's strategic plan.

This proposed partnership also aligns well with the district's Career and Technical Education (CTE) plan in specific ways. SPS's CTE department is working to expand and develop STEM programs in middle and high schools to prepare students for high demand

careers. The CTE department believes that offering STEM opportunities in elementary schools will increase interest and enrollment in STEM classes in middle and high schools. Specifically, this program introduces coding, iterative design, and real-world problem solving needed for computer science and all STEM starting in 4th grade through middle school and high school. In addition, to support students' exploration of careers, these participating schools will be the top priority for Amazon employee engagement, endeavoring to provide each team with mentors who look like them and can authentically speak to the question of why this learning is important.

This proposed initiative involves helping the participating schools launch sustainable robotics clubs and providing them a field trip experience to see robotics in action. Amazon Future Engineer will provide funding directly to FIRST Washington to help cover competition registration, equipment, advisor training, travel and accommodations and the advisor's stipend. Amazon is committed to fully funding the clubs in this way for the 2019-20, 2020-2021 and 2021-22 school years.

Amazon Future Engineer is also offering this cohort of schools an additional, one-time grant of \$10,000 for the school to promote STEM activities and computer science education determined by the building administration in close consultation with the district College and Career Readiness team.

Prior to this partnership, *FIRST* Robotics' presence in SPS elementary and middle schools was minimal. Some schools may have had students who participated on teams at nearby community centers, but there were no known teams sponsored by the school administration. However, nearly every comprehensive high school in SPS had a *FIRST* Robotics team in the last few years. West Seattle High School, Rainier Beach High School, and Chief Sealth High School have had these teams in prior years, but not in 2018-19.

All schools meeting the Title 1 threshold for Free and Reduced Lunch and/or containing the largest population of students furthest from educational justice were approached about the opportunity to participate in this partnership in-line with the district strategic plan. Of the 30 schools approached, 27 have decided to participate in the program thus far. While *FIRST* Robotics could take place as part of the school day, currently, all schools in this partnership plan to run the *FIRST* Robotics program after school. The average elementary school team for competition will have 8 students with a maximum of 10 students. The average middle school team for competition will have 10 students with a maximum of 15 students. In both cases, schools can decide whether they want to allow students to participate on the team without engaging in the formal competition.

Schools currently confirmed to participate are as follows:

High schools – Rainier Beach High School

Middle schools and K-8 schools – Broadview Thomson K-8 School, Denny Middle School, Licton Springs K-8 School, South Shore PreK-8 School, Washington Middle School

Elementary schools – Bailey Gatzert Elementary School, Beacon Hill International Elementary School, Captain Stephen E. Sanislo Elementary School, Concord International Elementary School, Dearborn Park International Elementary School, Dunlap Elementary School, Emerson Elementary School, Hawthorne Elementary School, Highland Park Elementary School, John Muir Elementary School, Kimball Elementary School, Leschi Elementary School, Lowell Elementary School, Madrona Elementary School, Martin Luther King Jr. Elementary School, Olympic Hills Elementary School, Sand Point Elementary School, Thurgood Marshall Elementary School, Van Asselt Elementary School, West Seattle Elementary School, Wing Luke Elementary School

- Please note that we have confirmed the participation of 27 schools and we are still working to confirm an additional three schools.

b. Alternatives

Do not approve this action. This is not recommended since it will prevent the participating schools from having access to additional funding to support this partnership with Amazon Future Engineer and FIRST Washington and to promote STEM education more broadly in their schools.

c. Research

In a 2011 article, researchers Anita Welch and Douglas Huffman documented the positive effects of robotics competitions on high school students' attitudes toward science. In addition, FIRST's own program research in 2018 has shown that participation in these programs have inspired underrepresented students, including students of color, to pursue STEM and computer science in both high school and in college. Data from a 5-year longitudinal study of FIRST by Brandeis University shows competitive FIRST robotics programs have benefits for youth from a wide variety of backgrounds. Across all demographic groups (gender, race, economic status and geography), FIRST students show significant gains in STEM knowledge, STEM interest, STEM career interest, STEM identity, and STEM activity compared to their peers who do not participate. For example, FIRST students are more likely to major in tech-focused science fields in college. The impact on young women in FIRST is particularly profound. By their first year of college, female alumnae of FIRST are 3.6 times more likely to take an engineering course, and 1.9 times more likely to take a computer science course than female comparison students.

In addition, the Bureau of Labor Statistics projects that by 2020 there will be 1.4 million computer-science-related jobs available and only 400,000 computer science graduates with the skills to apply for those jobs. Computer science is the fastest-growing profession within the STEM field, but only 8% of STEM graduates earn a computer science degree. More locally, the Washington Business Roundtable has reported that hundreds of thousands of new jobs being generated in the Seattle area will be STEM-related. Moreover, the Puget Sound Business Journal stated in their January 6, 2016 edition that Washington is not producing enough qualified workers to supply talent-starved tech companies.

5. FISCAL IMPACT/REVENUE SOURCE

Fiscal impact to this action will be that up to 30 schools will receive a one-time grant of \$10,000 to support STEM education activities. Thus, the total one-time grant for the district is up to \$300,000 in the 2019-20 school year.

Expenditure: One-time Annual Multi-Year N/A

Revenue: One-time Annual Multi-Year N/A

In addition, with respect to the financial sustainability of the FIRST Washington Robotics program, Amazon Future Engineer will cover nearly all of the costs during the 2019-2020, 2020-2021, and 2021-22 school years. FIRST will work with Amazon and other partners to fund these clubs after the third year and beyond, but there is currently no guarantee as to how much funding will be made available. After initial equipment purchases during the first year, each elementary club requires \$850 and each middle and high school club requires approximately \$4,000 annually for operational costs. That said, representatives from FIRST Washington have indicated an interest in helping schools secure more grant money through Amazon and other partnerships after the three years of funding have concluded. FIRST Washington has shared that they plan to provide this help in the following ways:

- FIRST Washington Grant. All school and community teams are eligible and encouraged to apply for the FIRST Washington grant. This grant opens May-September and helps teams cover their team registration costs. It is a competitive grant process with priority given to most disadvantaged teams.
- Training teams, school PTSA how to fundraise. FIRST will work side-by-side with teams and their group of adults in how to build a case for support and go out to the local community. FIRST has experience teaching school-based teams to raise annual funding.
- Identifying industry mentors that come with matching dollars for volunteer opportunities. Many of FIRST's teams are sustainable because of their mentors who are affiliated with Boeing and Microsoft who have generous volunteer matching programs. FIRST will begin as soon as necessary to help schools identify individuals affiliated with these companies.
- OSPI iGrant: FIRST Washington has 3 iGrants dedicated to support FIRST Lego League (FLL), FIRST Tech Challenge (FTC), and FIRST Robotics Competition (FRC) public school teams. This year's funding is over \$1 million with maximum funding by team of: FLL-\$2,500, FTC-\$5,000 and FRC-\$12,000. This is a reimbursement building grant where funds go directly to the district and school where the team is located. Funds can be used for anything that is supporting the team including: teacher stipends, travel, team registration fees, robot parts and professional development. FIRST Washington will work with the district's CTE team to determine how to best to execute this opportunity.

Finally, the district may have to cover substitute costs related to the professional development training for FIRST Washington. It is anticipated that the district College and Career Readiness and CTE budgets will be able to cover this cost. The following table breaks down the projected costs which could total \$25,025.

Projected Substitute Teacher Costs for FIRST WA Team Advisor Training
(The district will cover this cost if training occurs during school hours)

FIRST Team Type	# of Schools	Days of Training	Estimate Substitute Cost including benefits per day	Total Cost
FIRST Lego League	4	4	\$275	\$4,400
FIRST Tech Challenge	25	3	\$275	\$20,625

6. COMMUNITY ENGAGEMENT

With guidance from the District’s Community Engagement tool, this action was determined to merit the following tier of community engagement:

- Not applicable
- Tier 1: Inform
- Tier 2: Consult/Involve
- Tier 3: Collaborate

The district College and Career Readiness team and representatives from the FIRST Washington Robotics program reached out to this cohort of schools to discuss the opportunity to participate in this program and the possibility of receiving this additional grant funding to support STEM education. Based on multiple conversations with the district College and Career Readiness team this spring, there is strong school community support for the launch for the FIRST Washington Robotics program in this cohort of schools, including involvement from a number of schools’ Parent Teacher Student Associations (PTSA).

7. EQUITY ANALYSIS

The following is a summary of the analysis conducted in reviewing this partnership and the potential grant funding using the four steps of the district’s Racial Equity Analysis Tool as part of School Board Policy No. 0030.

STEP 1: Set Outcomes, Identify and Engage Stakeholders

In consultation with the SPS Racial Equity Analysis Tool, an explicit focus on racial equity is critical to the collective effort to improve education outcomes for students of color. As noted above, this proposed partnership is aligned with the goals of the district’s strategic plan in that it is meant to support students furthest from educational justice. Also noted above, FIRST’s own program research has shown that they inspire underrepresented students to pursue STEM and computer science in both high school and in college. The mission of FIRST is to inspire young people to be science and technology leaders and innovators by engaging them in exciting mentor-based programs that build science, engineering, and technology skills to students in grades K-12. Data from a 5-year longitudinal study of FIRST by Brandeis University shows competitive FIRST robotics programs has benefits for students across all racial groups. Across all demographic groups (gender, race, economic status and geography), FIRST students show significant gains in STEM knowledge, STEM interest, STEM career interest, STEM identity, and

STEM activity compared to their peers who do not participate. FIRST students are more likely to major in tech-focused science fields in college.

STEP 2: Engage Stakeholders in Analyzing Data

The district CTE team and representatives from the FIRST Washington Robotics program reached out to this cohort of schools to discuss the opportunity to have support for this program. There is strong school community support for the launch of the FIRST Washington Robotics program in this cohort of schools, including involvement from a number of schools' PTSAs. This PTSA involvement has helped us engage with communities of color at the participating schools.

STEP 3: Ensuring educational and racial equity /Determine Benefit or Burden

As noted above, this initiative with Amazon Future Engineer and FIRST Washington Robotics will focus on serving SPS students furthest from educational justice. In particular, making a special effort to invite the thirteen schools in the district with largest number of African American male students to participate.

STEP 4: Evaluate Success Indicators and/or Mitigation Plans

Each year, race and socioeconomic demographic information will be used in disaggregating program data to understand the impact and implications of this initiative.

8. STUDENT BENEFIT

Students in Seattle Public Schools benefit from having access to programs that enable them to develop STEM-related skills and learn about STEM-related careers.

9. WHY BOARD ACTION IS NECESSARY

- Amount of contract initial value or contract amendment exceeds \$250,000 (Policy No. 6220)
- Amount of grant exceeds \$250,000 in a single fiscal year (Policy No. 6114)
- Adopting, amending, or repealing a Board policy
- Formally accepting the completion of a public works project and closing out the contract
- Legal requirement for the School Board to take action on this matter
- Board Policy No. _____, [TITLE], provides the Board shall approve this item
- Other: _____

10. POLICY IMPLICATION

This action is being proposed pursuant to the following policies:

Per Policy No. 6114, Gifts, Grants, Donations & Fundraising Proceeds, any grant over \$250,000 must be brought to the Board for approval.

11. BOARD COMMITTEE RECOMMENDATION

This motion was discussed at the Audit & Finance Committee meeting on August 19, 2019. The Committee reviewed the motion and moved this item forward to the full Board with a recommendation for approval.

12. TIMELINE FOR IMPLEMENTATION

Upon approval of this motion, the District will accept the one-time grant funding.

13. ATTACHMENTS

- FIRST Longitudinal Study (for reference)



FIRST Longitudinal Study

Findings at 48 Month Follow-Up (Year 5 Report)

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For questions and more information about this document, please contact the following:

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This document describes the findings where 1,273 students were tracked over a 5 year period (822 *FIRST* participants and 451 comparison students). The following is the study's conclusion:

Four years after entering *FIRST*, program participants continue to show consistently greater gains on STEM-related interests and attitudes than comparable students in the comparison group. Positive impacts from participation in *FIRST* are evident across all three *FIRST* programs in the study and across all of the major population groups. *FIRST*'s impacts are particularly strong for female participants who generally show significantly greater gains than those experienced by males in the program. Data on students in their first year of college shows *FIRST*'s positive impacts continue into

postsecondary education, with FIRST alumni continuing to show impacts on STEM-related attitudes, as well as impacts on interest in technology-related majors, engineering course-taking, and STEM-related activities (internships, clubs, competitions, and summer jobs). 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.

***FIRST* Longitudinal Study:
Findings at 48 Month Follow-Up
(Year 5 Report)**

Prepared by:

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April 2018

FIRST Longitudinal Study: Findings at 48 Month Follow-Up¹

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 6-18 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, that inspire innovation, and that foster well-rounded capacities including self-confidence, communication, and leadership. The sequence of *FIRST* programs in the United States begins with the *FIRST*® LEGO® League Jr. program serving elementary school-aged youth (ages 6-9), followed by the *FIRST*® LEGO® League program serving primarily middle school-aged youth (ages 9-14), the *FIRST*® Tech Challenge serving grades 7-12, and *FIRST*® Robotics Competition, serving high school-aged youth (grades 9-12). In 2017-18, *FIRST* estimates that over 515,000 young people will participate in its programs on more than 59,000 teams and will compete in more than 2,900 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, *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 21st century personal and workplace-related skills?

KEY FINDINGS AT 48 MONTH FOLLOW-UP

- Follow-up data show *FIRST* continues to have a positive impact on participants on key STEM-related measures at 48 months, including interest in STEM, involvement in STEM-related activities, STEM identity, STEM knowledge, and interest in STEM careers. *FIRST* team members are 1.6 to 3.0 times more likely to show gains on STEM-related outcomes than students in the comparison group.
- The data show positive impacts for participants from all three *FIRST* programs in the study (*FIRST* LEGO League, *FIRST* Tech Challenge, and *FIRST* Robotics Competition), and for all major population groups and community types. Girls in *FIRST* continued to show significantly greater impacts than their male counterparts. Impacts persist for team members even after they leave the program.
- Impacts on STEM-related attitudes and interests persist into college. Among first-year college students *FIRST* alumni:
 - continue to show significantly greater gains on STEM-related attitudes than comparison students.
 - report significantly higher interest in majoring in computer science, engineering, and robotics.
 - are 2.3 times more likely to take an engineering course in their freshman year; girls are 3.4 times more likely to take engineering courses.
 - are more likely to be engaged in STEM-related activities, including STEM internships, computer and engineering clubs, engineering competitions, having STEM-related summer jobs; and receiving engineering-related grants.

¹ This report is based on data from the fourth round of follow-up surveys, which were administered approximately 48 months after students entered the study (baseline).

² <http://www.firstinspires.org/about/at-a-glance>

- **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, non-white youth, low-income youth, and youth from urban 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 is tracking 1,273 students (822 *FIRST* participants and 451 comparison students) over a five-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, *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 Team Leader surveys at the end of the first year of team involvement in the study provided additional contextual data on the *FIRST* teams. In each year of the study, team member surveys have also been supplemented by interviews and focus groups with team members and comparison group students.

Impacts at 48 Month Follow-Up

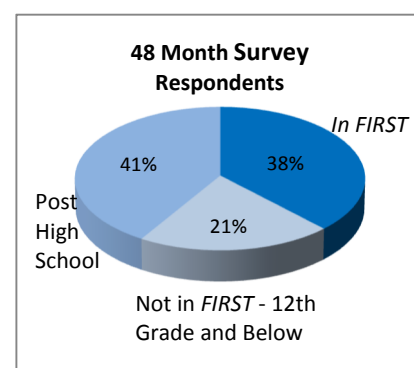
This report presents a summary of the impact findings based on four years of data, including survey data from baseline and post-program surveys and three rounds of annual follow-up surveys. As such, it reflects the impacts of participation in *FIRST* four years after study participants entered the program. Of the 1,273 students who began the study, 1,017 students (80%) completed the 48 month follow-up survey, including 611 *FIRST* participants (74% of those at baseline) and 406 comparison students (90% of those at baseline). Of the *FIRST* participants responding to the follow-up survey, 231 (38%) were still active in the program.³

The findings from the data from the 48 month follow-up surveys extend the positive impact findings from the 2015-2017 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 from all three

Data Collection through 48 Month Follow-Up

GROUP	Baseline	12 Month Follow-Up (Post-Program)	24 Month Follow-Up	36 Month Follow-Up	48 Month Follow-Up
<i>FIRST</i> Participants	822	677	665	636	611
Comparison Group	451	259*	411	409	406
Total	1273	936	1076	1045	1017

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



³ Of the 380 *FIRST* participants no longer active in the program at the 48 month follow-up, 252 had graduated high school and were no longer eligible for *FIRST*; 128 were still in middle or high school but no longer active in the program. Overall, 64.3% of those eligible to participate in *FIRST* were still active in the program.

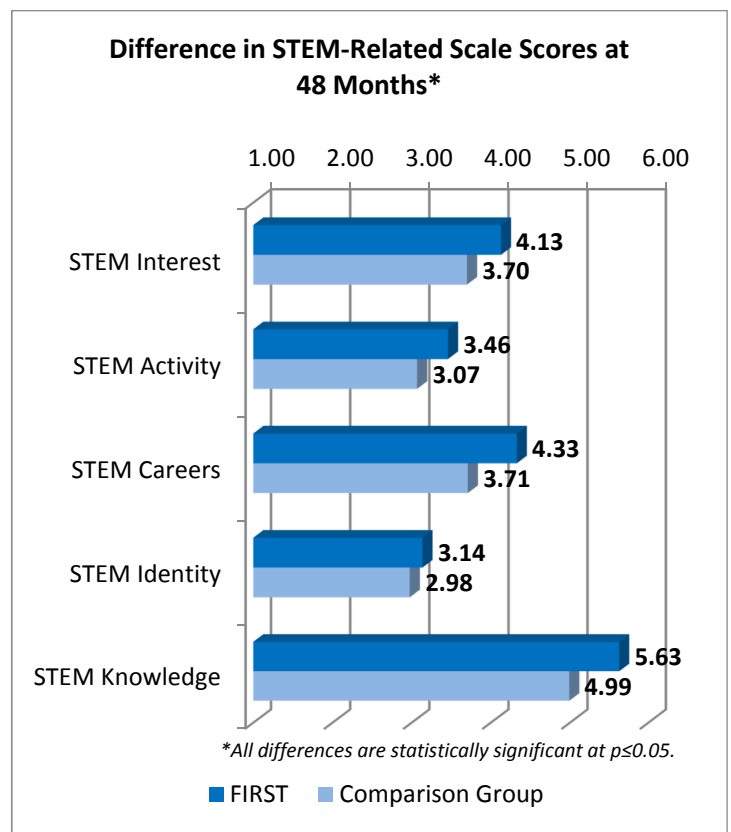
major *FIRST* programs (*FIRST* LEGO League, *FIRST* Tech Challenge, and *FIRST* Robotics Competition), across key demographic groups, and for those living in different types of communities (urban, rural, suburban).⁴ Data on students in their first year of college also point to positive, statistically significant longer-term impacts. In their first year of college, *FIRST* alumni continue to 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 courses during their freshman year; and are more likely to be engaged in other STEM-related activities. In most cases, these college impacts are evident for both male and female *FIRST* alumni. Major findings are summarized below.

Impacts on STEM-Related Attitudes (All Participants)

At 48 months, *FIRST* continues 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 1.6 to 3.0 times more likely to show gains on STEM-related measures four years after entering the program than 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.⁵ 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,” “I can use math and science to make a difference in the world).



⁴ 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).

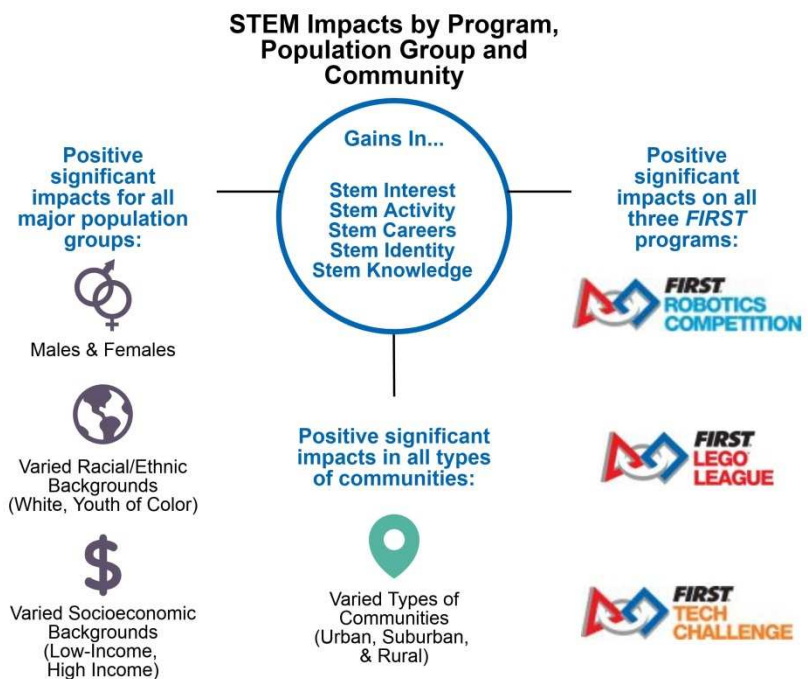
⁵ Based on “Repeated Measures Linear Mixed Models” analysis (“Mixed”). The “mixed” analysis estimates average gains for participants vs. comparison students taking into account differences between the groups at baseline and using data from all available points in time (baseline, post-program, and follow-ups). 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 was “large” for the impact on STEM interest and “medium” for the other STEM outcome measures.

- **FIRST participants are also significantly more likely to show an increase on STEM-related measures than comparison students between baseline and the 48 month follow-up.**⁶ After adjusting for differences in baseline characteristics and baseline scale scores, *FIRST* participants were:
 - 3.0 times more likely than comparison students to show gains on *STEM interest*;
 - 2.2 times more likely to show gains in involvement in *STEM activity*;
 - 3.0 times more likely to show gains on interest in *STEM careers*;
 - 1.6 times more likely to show gains in *STEM identity*; and
 - 2.4 times more likely to show gains in *STEM knowledge/understanding of STEM*.

In sum, despite entering *FIRST* with a strong initial interest in STEM, *FIRST* participants were still significantly more likely than comparison students to show continued gains in STEM interest and involvement over time.

- **The 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 in all three *FIRST* programs show significantly greater gains on STEM-related measures than comparison students.

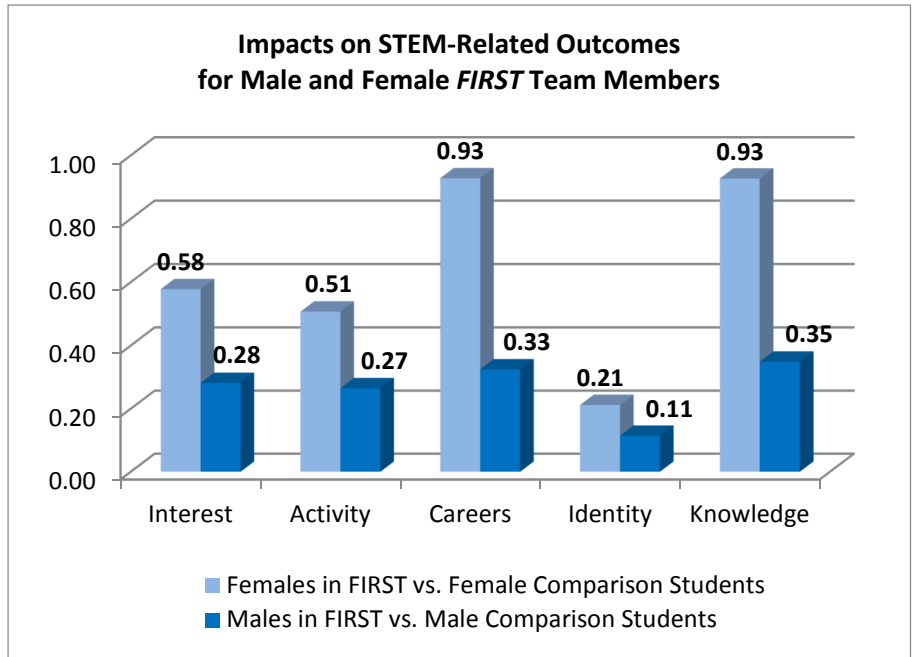
- **STEM-related impacts are also evident across all major population groups and among students from different types of communities (compared to similar students in the comparison group).** Each of the following groups – males and females, lower and higher income students (family incomes below and above \$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.



⁶ 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, “3.0 times more likely to show a gain in STEM interest than comparison students”).

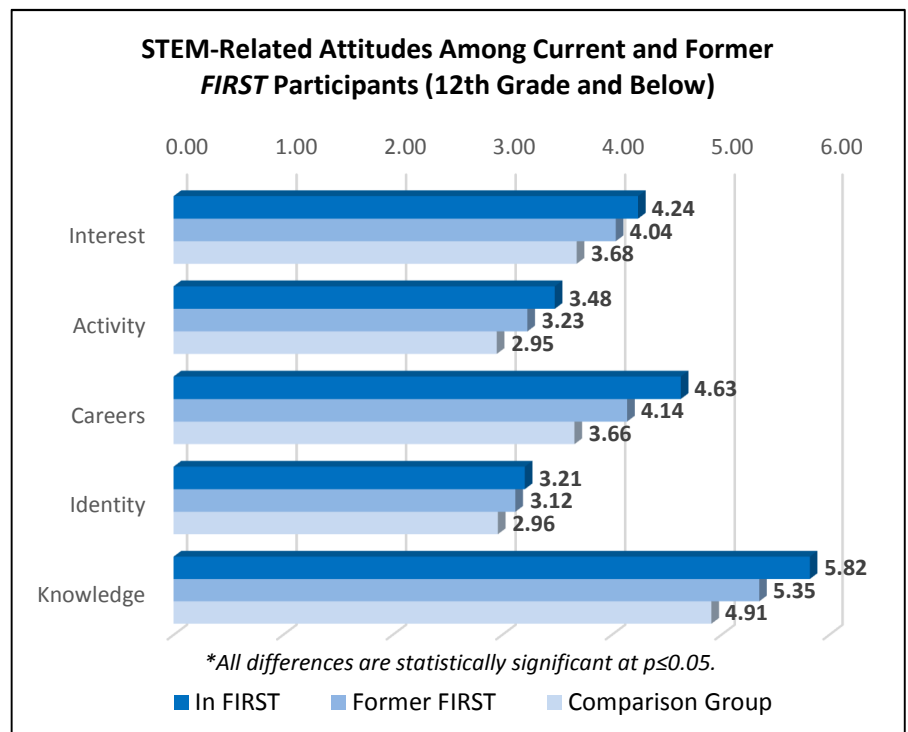
- **While the data show positive impacts for both males and females in FIRST, females continue to show greater impacts than males on all of the STEM-related measures.**

The chart to the right shows the differences in outcomes for females in FIRST compared to females in the comparison group, and for males in FIRST, compared to comparison group males. While all of the differences between FIRST participants and comparison students are statistically significant, the impacts for females in FIRST on each measure are also significantly greater than those for males.



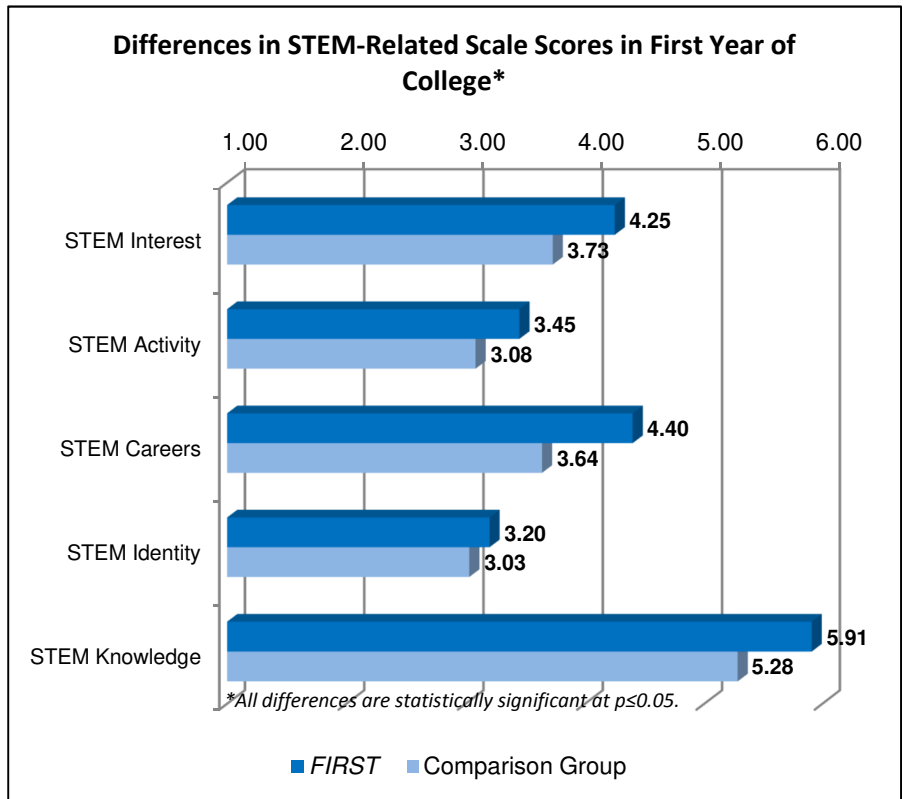
Note: Values on the chart represent the differences in outcomes (estimated scale scores) between FIRST participants and students of the same gender in the comparison groups (i.e., the difference in scores between males in FIRST and males in the comparison group and between females in FIRST and female comparison students). All differences are statistically significant at $p \leq 0.05$. The impacts for females are statistically significantly greater than those for males.

- **FIRST's impacts persist.** Additional analyses show that impacts on STEM-related attitudes persist for FIRST team members even after they have left the program. Among study participants still in secondary school (12th grade and below), both current and former FIRST participants show statistically significant gains on STEM measures as compared to students in the comparison group. Team members still active in FIRST show the greatest gains, but those who have left the program continue to show significantly greater gains than comparison students. Similarly, students who participate in FIRST for only one year continue to show positive impacts relative to comparison students at 48 months.



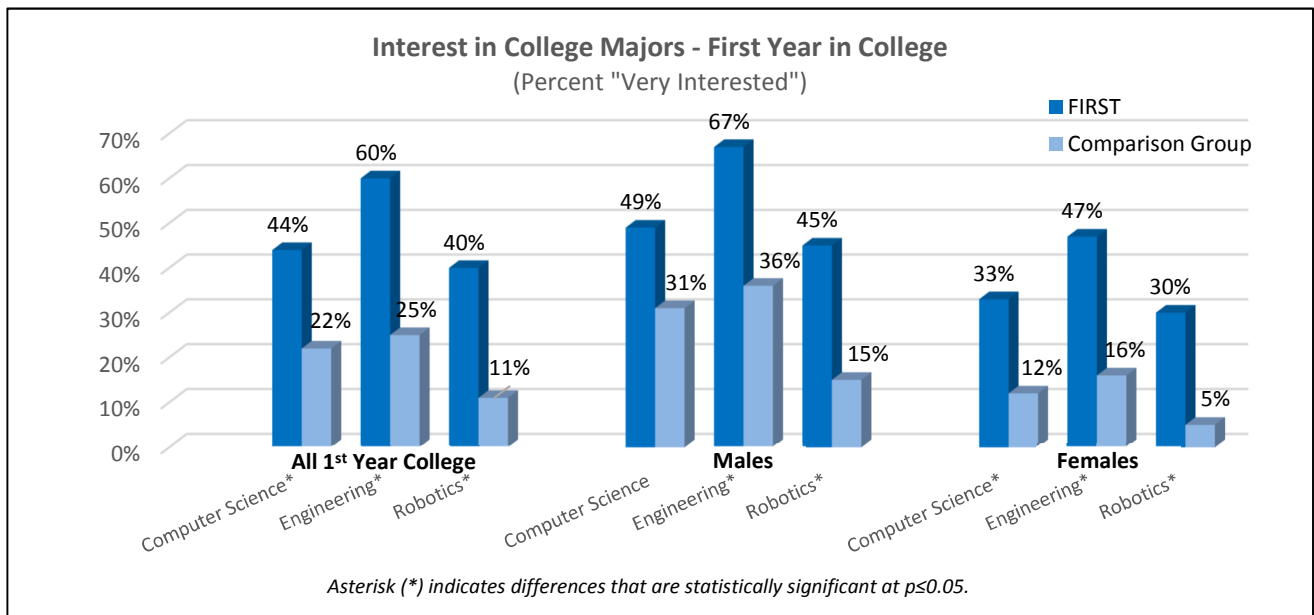
First-Year College Outcomes

- FIRST alumni continue to show positive, statistically significant impacts on STEM-related attitudes in the first year of college.** Among first-year college students, FIRST alumni continue to show greater gains than comparison students on measures of STEM-related interest, activity, interest in careers, identity, and STEM knowledge and understanding. Both male and female alumni show significant impacts; however, female FIRST alumni continue to show significantly larger gains than males.

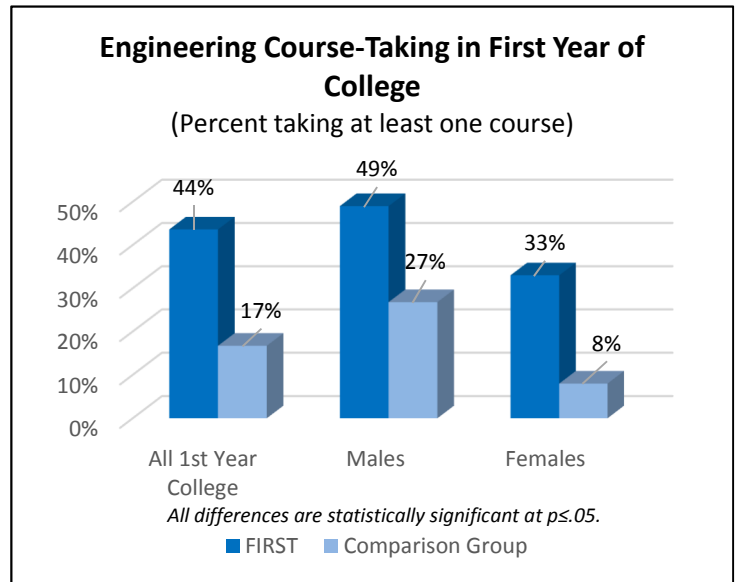


- FIRST alumni also report significantly stronger interest in majoring in computer**

science, engineering, and robotics in the first year of college than comparison students (below). FIRST alumni are nearly twice as likely (1.8 times) to be interested in majoring in computer science, 2.3 times more likely to be interested in engineering, and 3.9 times more likely to be interested in majoring in robotics than comparison students. Each of those differences is large enough to be statistically significant. The impacts of FIRST are particularly notable among female students: female FIRST alumni are more than 3 times more likely to want to major in computer science and engineering and 5 times more likely to want to major in robotics than female comparison students. In contrast, comparison group students are significantly more likely to be interested in majoring in two non-technology STEM fields: biology and health professions.



- FIRST alumni are also more likely to take an engineering course during their first year in college than comparison students.** *FIRST* alumni were more than twice as likely (2.3x) as comparison students to take an engineering course in their freshman year; overall 44% of *FIRST* alumni reported taking engineering in their first year of college. Among women, the differences are larger: female *FIRST* alumni are 3.4 times more likely to take an engineering course than female comparison students. Thirty-three percent (33%) of female *FIRST* alumni took an engineering course compared to 8% of female comparison students.



- Female FIRST alumni were also five times more likely than women in the comparison group to take computer science courses in their first year of college.** Overall, 40% of *FIRST*'s female alumni took a computer science class in their freshman year vs. 11% of comparison women.

- Finally, FIRST alumni were also significantly more likely to be engaged in STEM-related activities during their first year at college than comparison students.** As the table below shows, *FIRST* alumni were more likely to have a

STEM-related internship, join a computer or engineering club, participate in an engineering competition, receive an engineering-related grant or scholarship. *FIRST* alumni were less likely overall to have a summer job than comparison students (perhaps because of their internships), but more likely to have a summer job that was STEM-related.

STEM Activities in the First Year at College

Activity	FIRST	Comparison
STEM-Related Internship*	19.0%	9.2%
Joined Computer Club*	16.3%	7.4%
Joined Engineering Club*	30.8%	12.3%
Participate in an Engineering Competition*	11.8%	5.6%
Received Engineering-Related Grant or Scholarship*	8.7%	3.1%
STEM-Related Summer Job*	15.6%	7.2%
Non-STEM Summer Job	40.1%	57.5%
No Summer Job	44.4%	35.3%

Asterisk (*) indicates differences that are statistically significant at $p < 0.05$.

Conclusion

Four years after entering *FIRST*, program participants continue to show consistently greater gains on STEM-related interests and attitudes than comparable students in the comparison group. Positive impacts from participation in *FIRST* are evident across all three *FIRST* programs in the study and across all of the major population groups. *FIRST*'s impacts are particularly strong for female participants who generally show significantly greater gains than those experienced by males in the program. Data on students in their first year of college shows *FIRST*'s positive impacts continue into postsecondary education, with *FIRST* alumni continuing to show impacts on STEM-related attitudes, as well as impacts on interest in technology-related majors, engineering course-taking, and STEM-related activities (internships, clubs, competitions, and summer jobs). 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.