The *FIRST*® Longitudinal Study

2023 Survey Results (10 year follow-up data)

Brandeis | THE HELLER SCHOOL FOR SOCIAL POLICY AND MANAGEMENT
Center for Youth and Communities

FIRST®

FIRST® LEGO® LEAGUE

FIRST® TECH CHALLENGE

FIRST® ROBOTICS COMPETITION

Brandeis | THE HELLER SCHOOL FOR SOCIAL POLICY AND MANAGEMENT
Center for Youth and Communities

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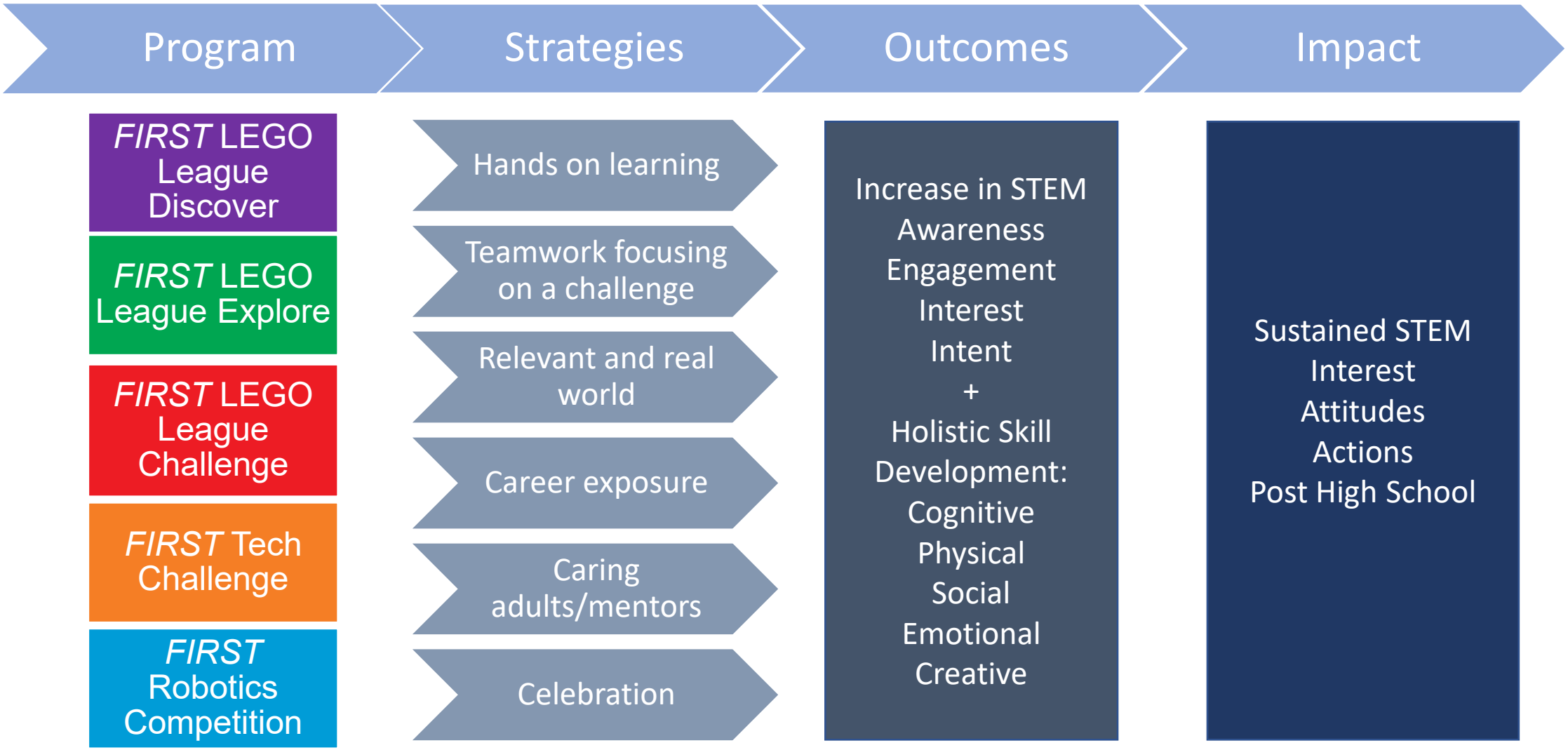
FIRST Theory of Change



Assessing Impact: Longitudinal Study

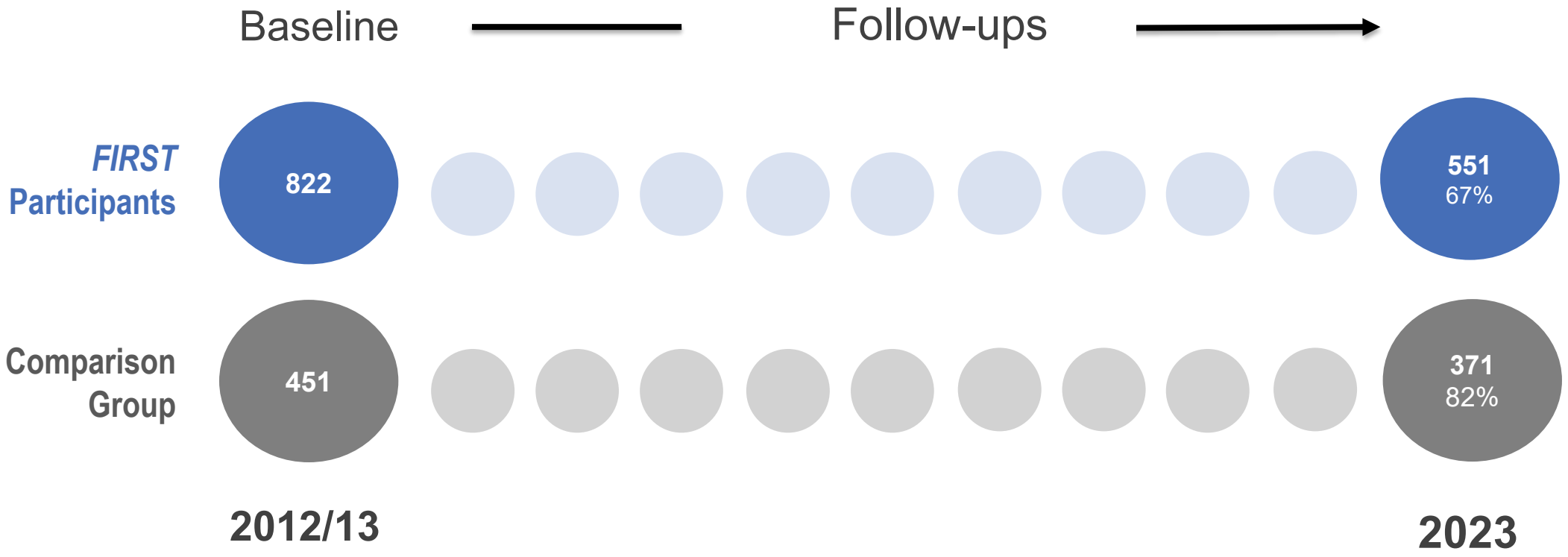
- Started in 2011 with a year of planning
- 3 stakeholder groups informed the evaluation plan: sampling, data collection, analysis, and dissemination of findings
- Annual data collection started in the fall 2012 with a pre-participation survey, followed by **10 years of annual follow-up data**

- Guiding Research Questions
  - **What are the short- and long-term impacts on participants?**
  - **How does program experience influence impact?**
  - **Are outcomes consistent across demographic groups?**
  - **What are the longer- term impacts on post-high school participants?**
    - ➢ In other words, are *FIRST* programs effective in achieving the anticipated outcomes (theory of change), and are we reaching our goals?

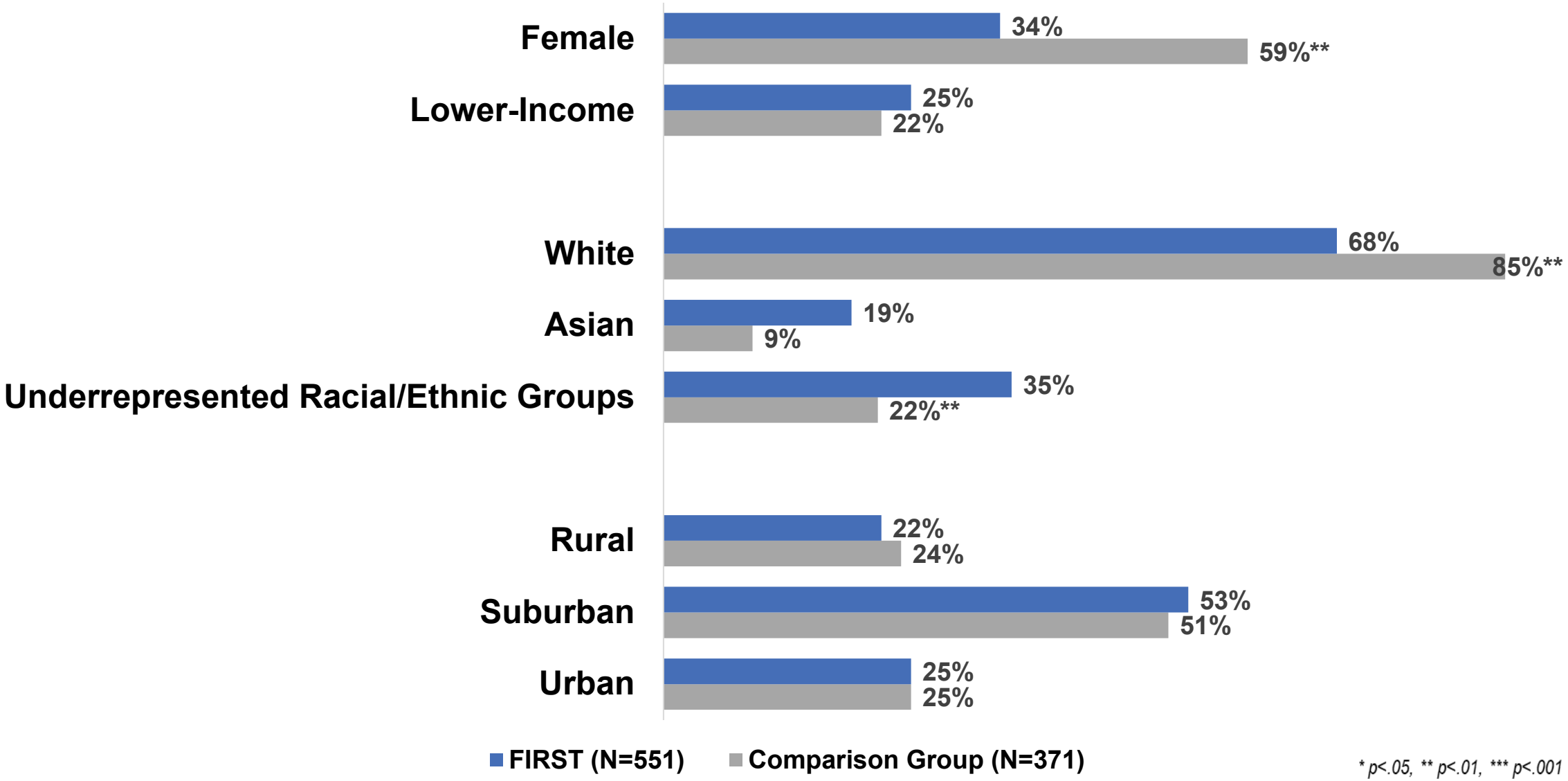
10 Years of Follow-up Data in the *FIRST* Longitudinal Study

Survey responses continue to be strong

Overall, 72% of participants remain in the study.



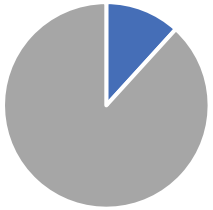
Participant Characteristics at the 10 Year Follow-up



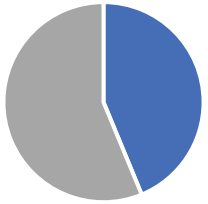
** p<.05, ** p<.01, *** p<.001*

Participant Characteristics: The majority of study participants are out of high school and in college, graduate school, or employed

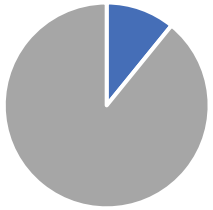
At 8 Years



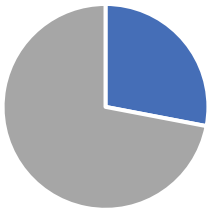
12% in High School



44% in College

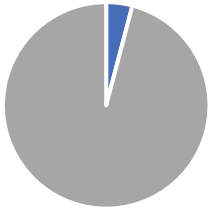


11% in Graduate School



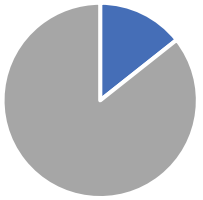
28% Employed

At 9 Years

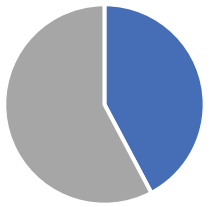


4% in High School

29% in College

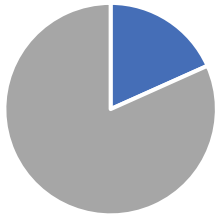


14% in Graduate School

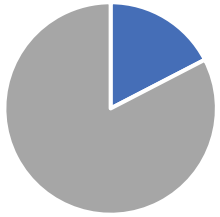


42% Employed

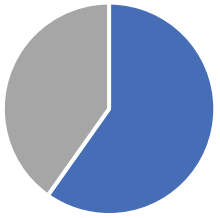
At 10 Years



18% in College



17% in Graduate School



60% Employed

Key Outcome Measures in 2 Domains

STEM-Related Interest and Attitude Scales	Behavioral Measures
• **STEM Interest** (interest in science, technology, engineering and mathematics)	• STEM Course-Taking (High School) – (No longer analyzed due to no one at this level)
• **STEM Activity** (involvement in non-school STEM activities)	• **Interest in STEM Majors** in College/Declared Majors
• **STEM Careers** (interest in STEM-related careers)	• **STEM-Related College Course-taking**
• **STEM Identity** (extent to which students see themselves as science, math or technology people)	• **Involvement in College STEM-Activities (Clubs, competitions, internships, summer jobs)**
• **STEM Knowledge/ Understanding** (awareness of applications of STEM in real world, interest in learning more about STEM)	• **STEM-related College Grants and Scholarships**
	• **Early Career Outcomes**

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STEM-Related Interest and Attitude Scales

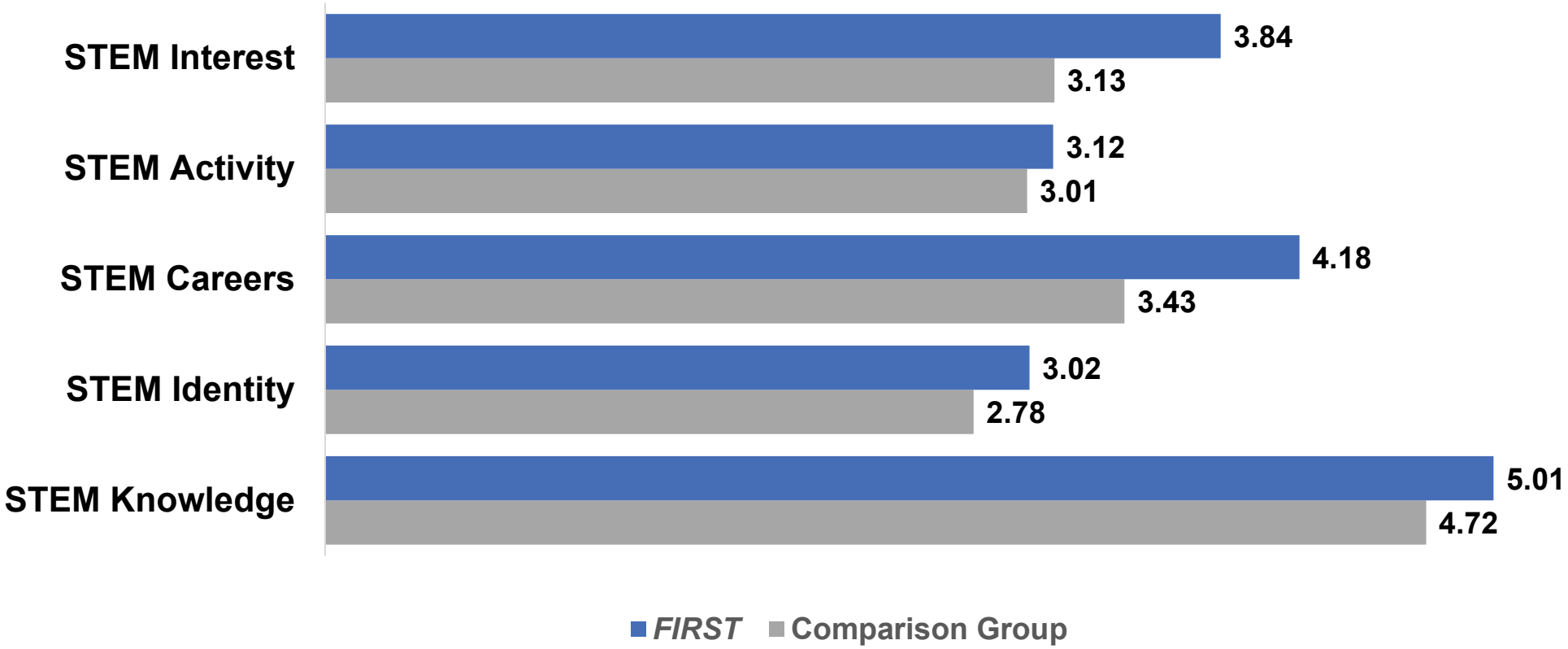
Analytic Methods STEM Attitudes

Two Approaches

1. Mixed Methods Analysis: provide average estimates for *FIRST* members and comparison students controlling for differences at baseline. The estimates provide a measure of differences in the gains (or declines) for *FIRST* team members versus comparison students.

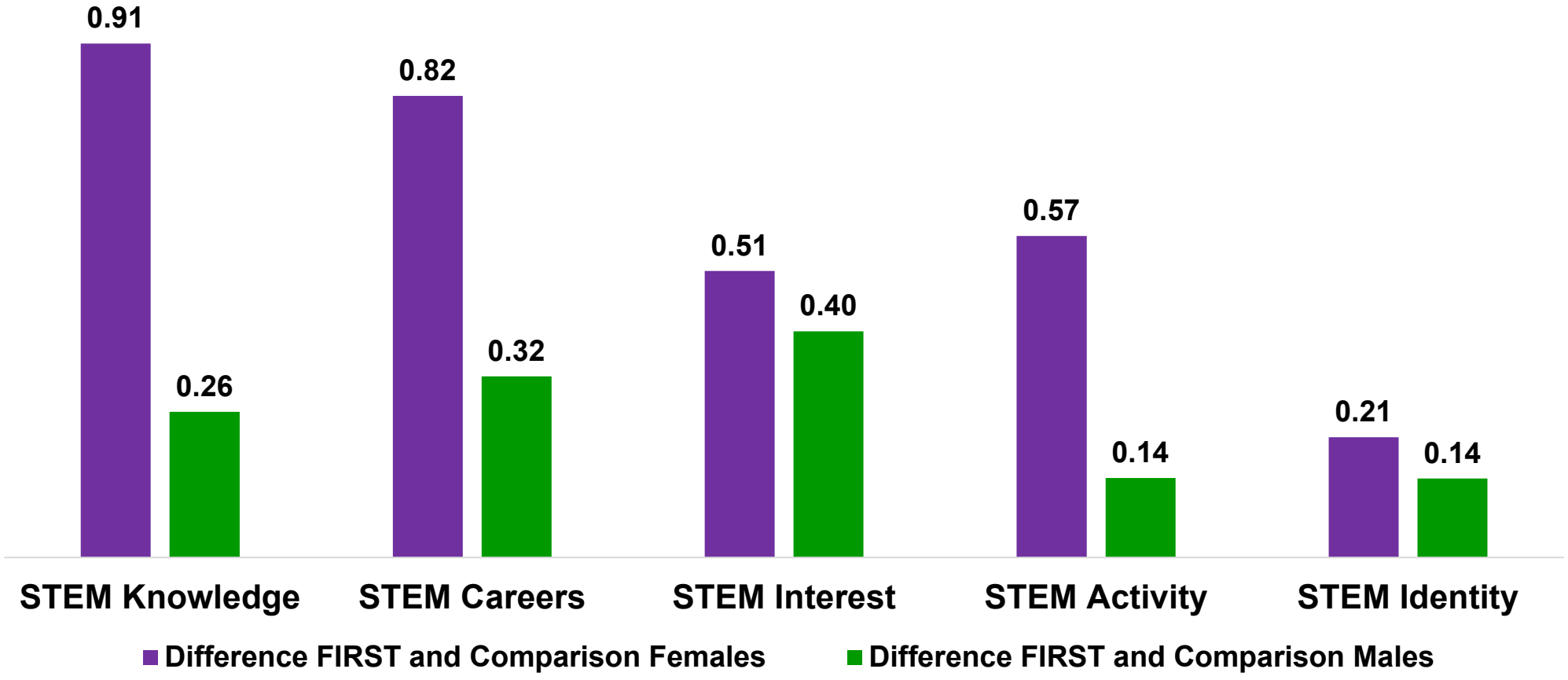
2. Logistic Regression Analysis: measures whether *FIRST* participants are significantly more (or less) likely than comparison students to show an increase from baseline to the 10 year follow-up on the various scale score measures.

STEM-Related Interests and Attitudes at 120 Months
(Averages in Scale Scores, Mixed Methods)



All results are statistically significant at p≤.005. Estimated impacts are based on the difference between STEM scale scores at baseline and through the 120 months of follow-up data. Controlling for Gender, Race, Honors Courses, Family Income, and Parental Support for STEM.

Differences on STEM-Related Outcomes by Gender



All results are statistically significant at p≤.005. Estimated impacts are based on the difference between STEM scale scores at baseline and 120 months. Controlling for Gender, Race, Honors Courses, Family Income, and Parental Support for STEM.

Positive significant differences for underrepresented communities in STEM

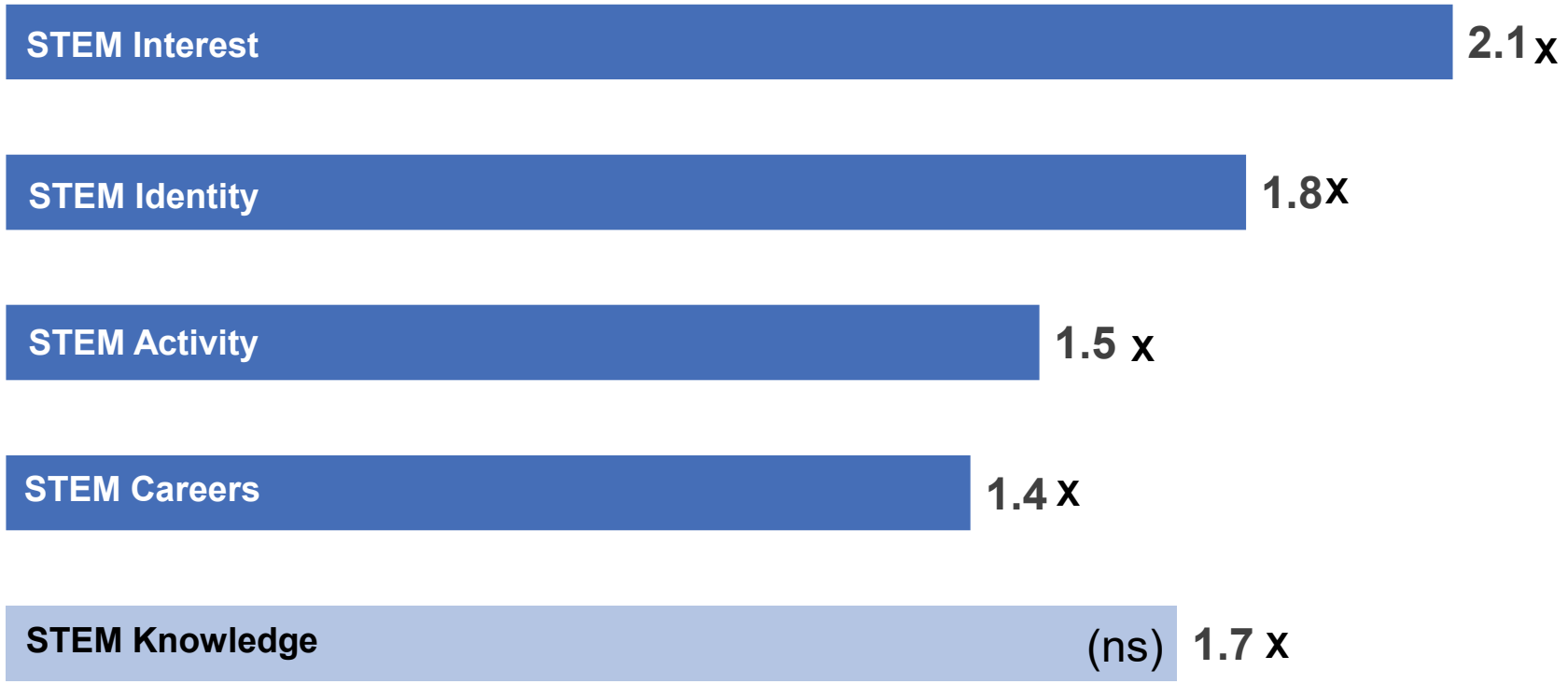
Outcomes	Economically Disadvantaged	Underrepresented Racial/Ethnic Groups	Urban	Rural
STEM Interest	+	+	+	+
STEM Activity	+	+*	+	+
STEM Careers	+	+	+	+
STEM Identity	+	(+)	+	+
STEM Knowledge	+	+*	+	+

Note: Plus mark "+" indicates a positive, significant impact at p≤ .05. With asterisk "+*" indicates a positive, significant impact at p≤ .10. (+) indicates a positive but not statistically significant impact.

Impacts are relative to comparable subgroups in the comparison population. Low income is defined as those whose family income is below $50,000. Underrepresented racial groups includes Black or African-American, Native American, Hawaiian/Pacific Islander, multi-racial, and Latinx.

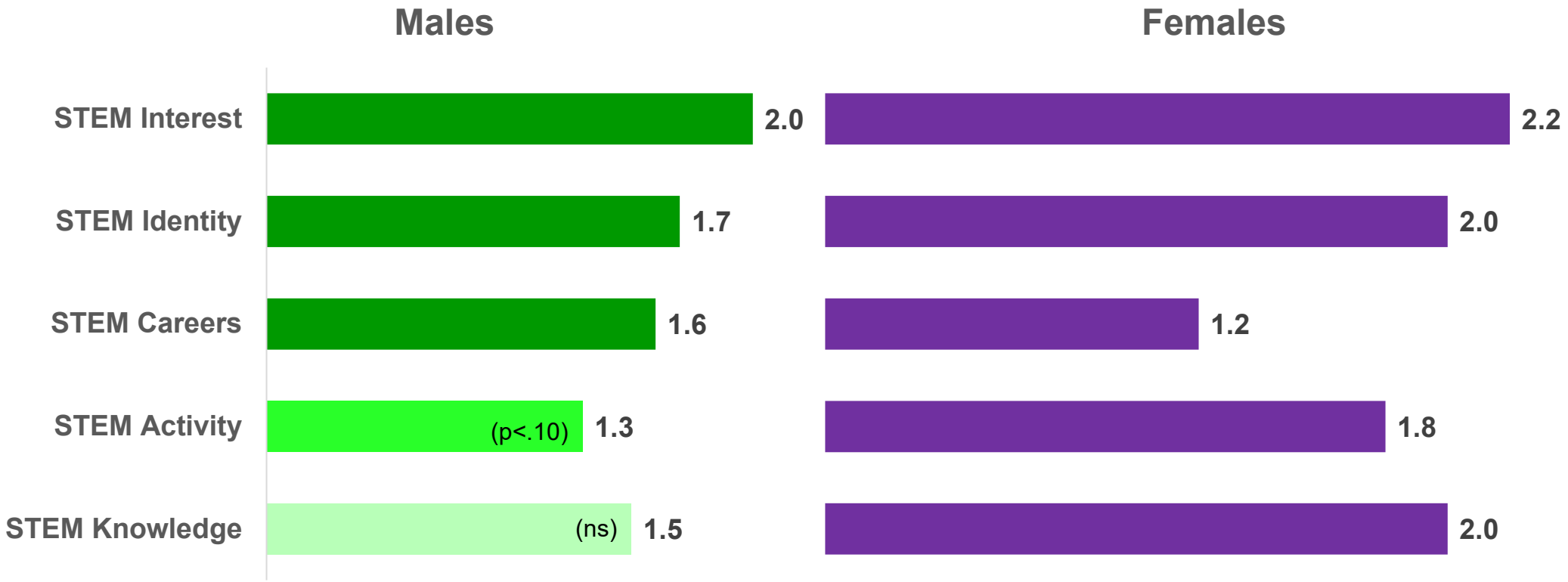
Controlling for Honors Courses, Family Income, and Parental Support for STEM, and Gender, Race where appropriate.

In the logistic regression analyses, *FIRST* participants continue to be 1.5 to 2 times more likely to report higher scores in STEM-related attitudes than comparison group students (logistic regressions)



All results except STEM Knowledge are statistically significant at p≤.05, (ns)=not significant. Estimated impacts are based on the difference between STEM scale scores at baseline and 120 months. Controlling for Gender, Race, Honors Courses, Family Income, and Parental Support for STEM.

Except for *FIRST* males scores on STEM Knowledge, all comparisons are statistically significant. Other than for STEM careers, we find stronger differences on all STEM attitudes measures for *FIRST* female participants than for *FIRST* male participants.

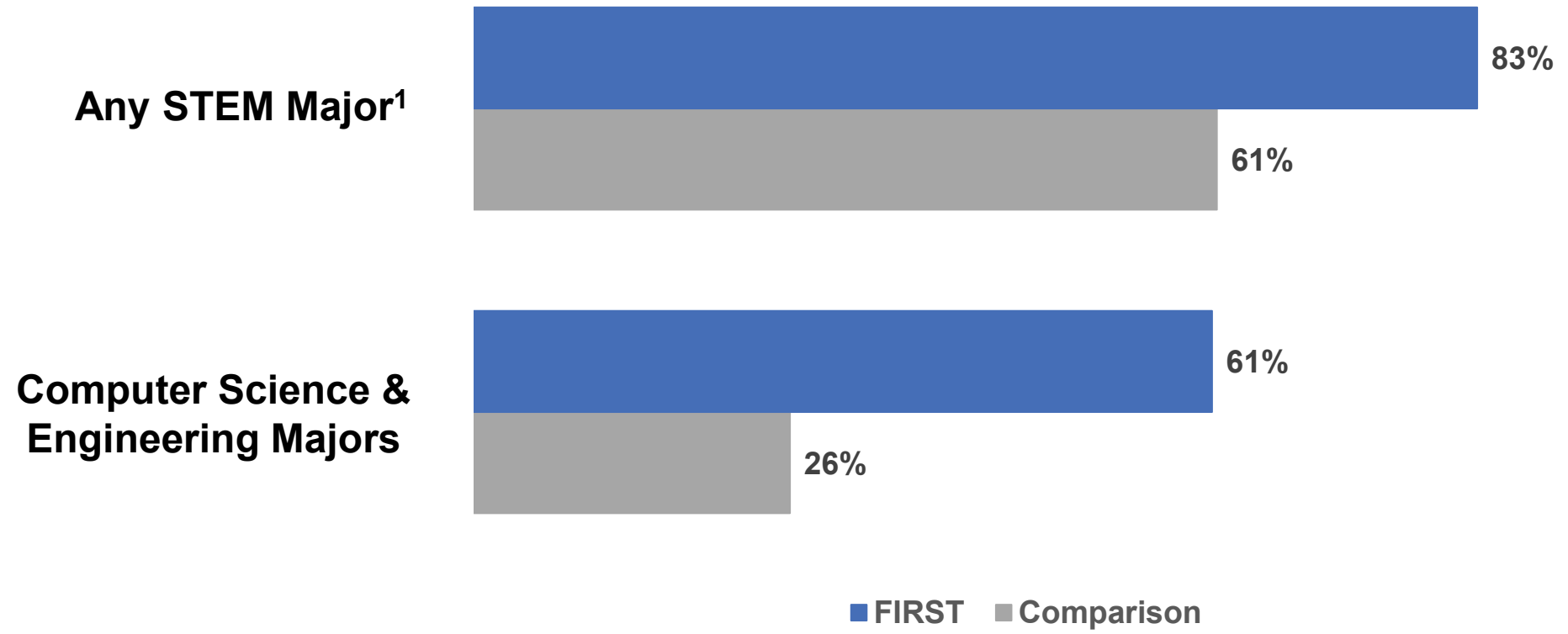


All results are statistically significant at p≤.05, apart from STEM Knowledge and Activity for males, (ns)=not significant. Estimated impacts are based on the difference between STEM scale scores at baseline and 120 months. Controlling for Race, Honors Courses, Family Income, and Parental Support for STEM.

Behavioral Outcome Measures in College:

Taking STEM Classes and Majoring In STEM

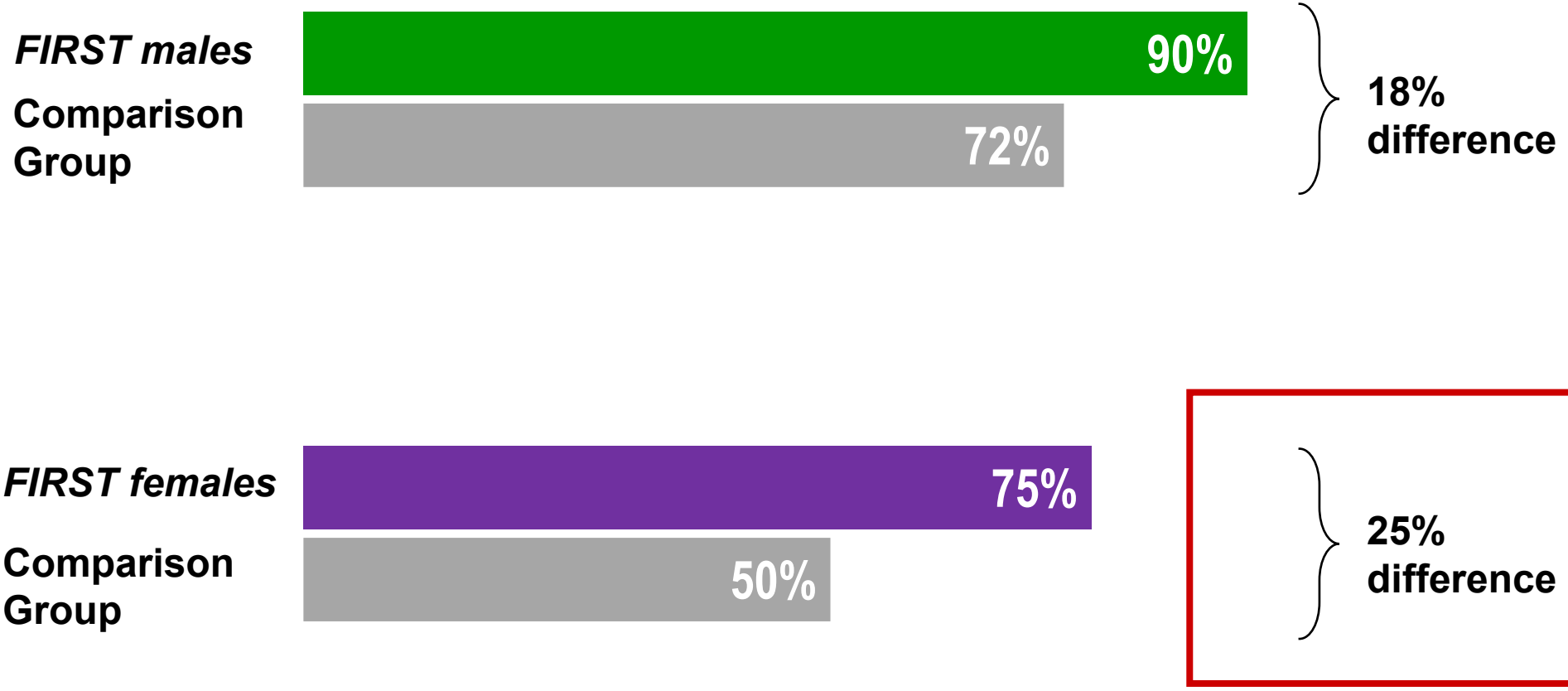
By the end of Year 4 in college, of the *FIRST* alumni who had declared a major, most chose a STEM field. Nearly two thirds selected computer science or engineering.



[1]STEM fields include: Biology, Computer Science, Engineering, Health Professions, Mathematics, Physical Sciences, Vocational/ Technical fields, and Robotics.

All differences statistically significant, p ≤ .05.
Controlling for Gender, Race, Honors Courses, Family Income, and Parental Support for STEM.

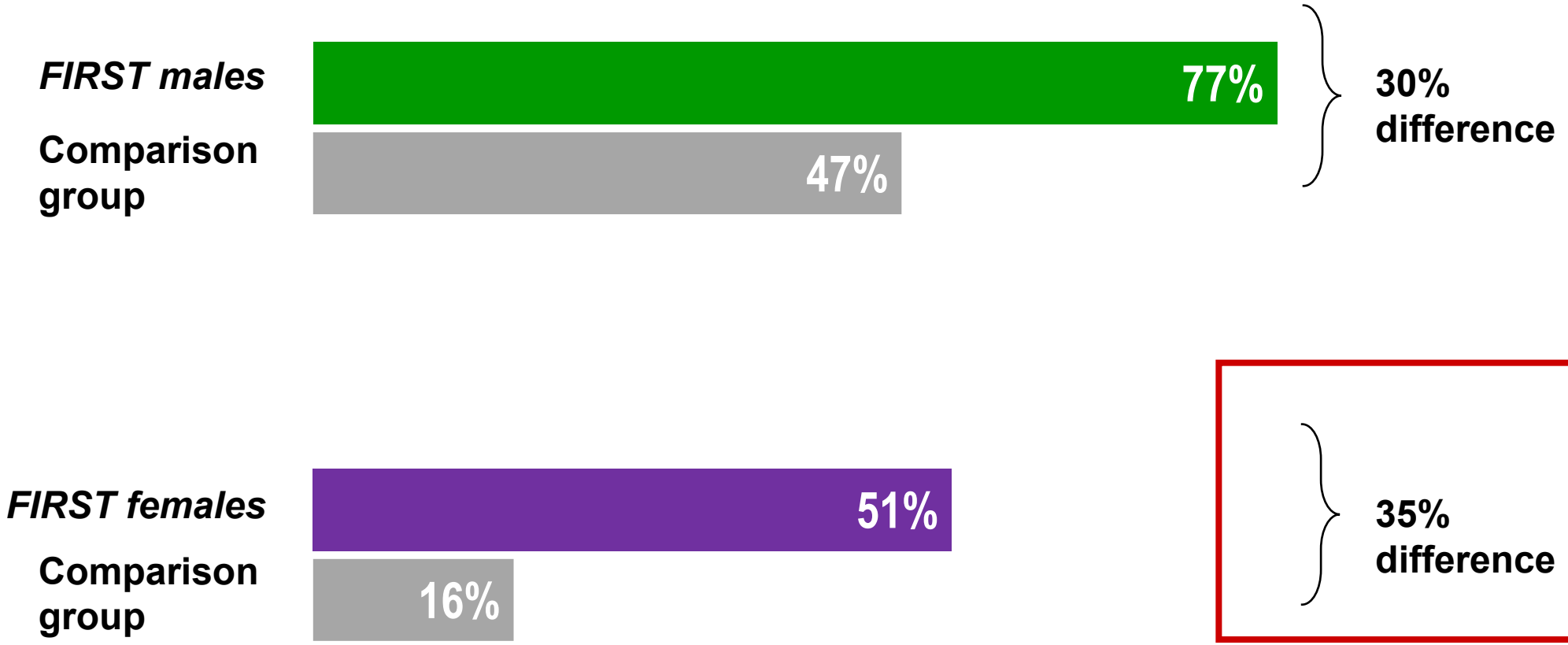
Both *FIRST* male and female alumni declared any STEM Major[1] at greater rates than the comparison group, any time during college, with greater differences for female alumni



[1]STEM fields include: Biology, Computer Science, Engineering, Health Professions, Mathematics, Physical Sciences, Vocational/Technical fields, and Robotics.

Data represents those who declared a major years 1-4 of college.
All differences statistically significant, p ≤ .05.

Both *FIRST* male and female alumni declared **Majors in Engineering or Computer Science** at greater rates than the comparison group, at any time in college, with greater differences for **female alumni**



Data represents those who declared a major years 1-4 of college.
All differences statistically significant, p ≤ .05.

By their 4th year of college, compared to the comparison group, *FIRST* alumni are twice as likely or more:

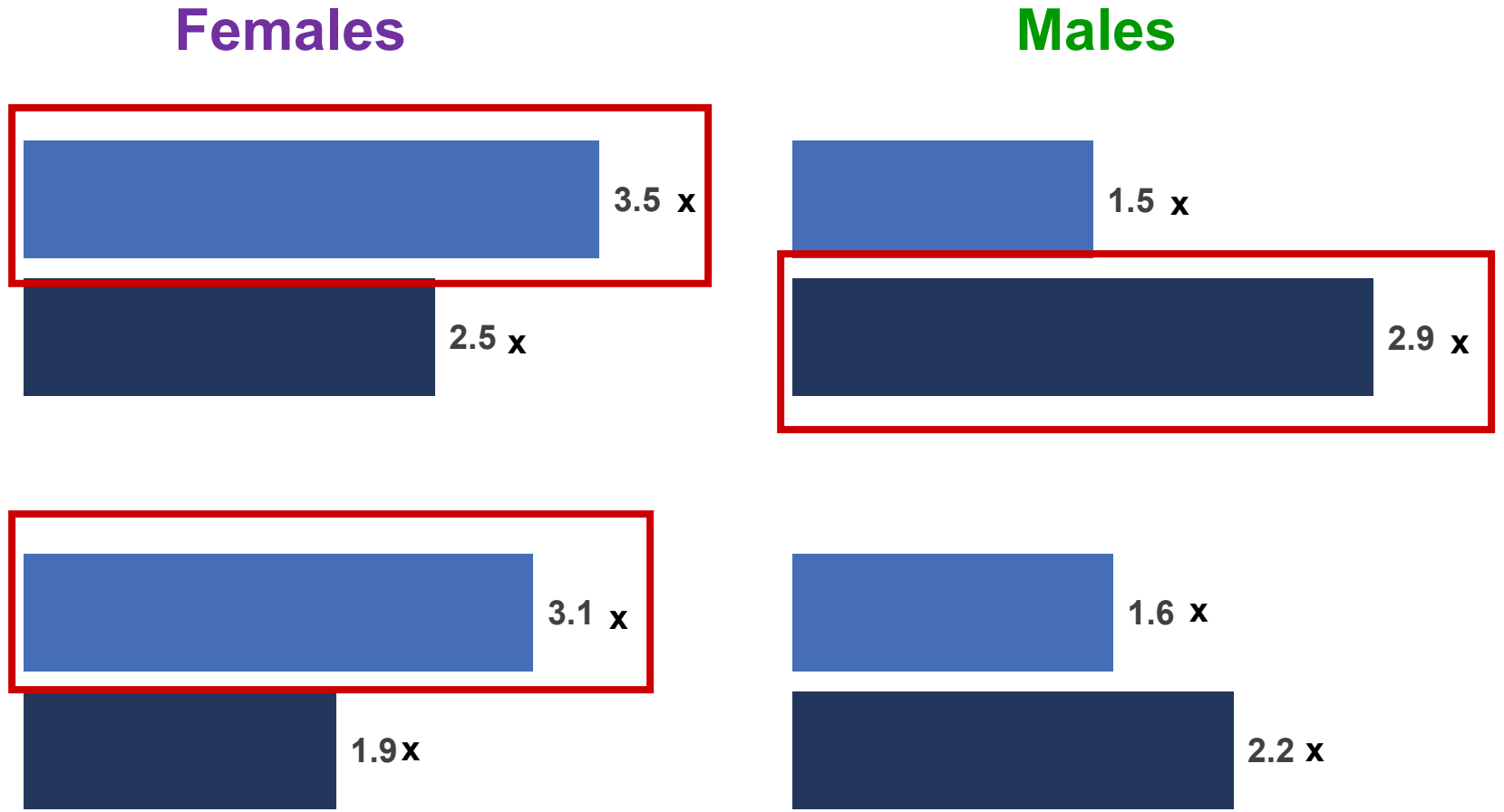
to take **Engineering** and **Computer Science** courses

to have declared a major in **Engineering** or **Computer Science**

All differences statistically significant, p ≤ .05. Controlling for Gender, Race, Honors Courses, Family Income, and Parental Support for STEM.

FIRST Impacts are Consistently Greater for Young Women in College

By their 4th year of college, *FIRST* female and male alumni are:



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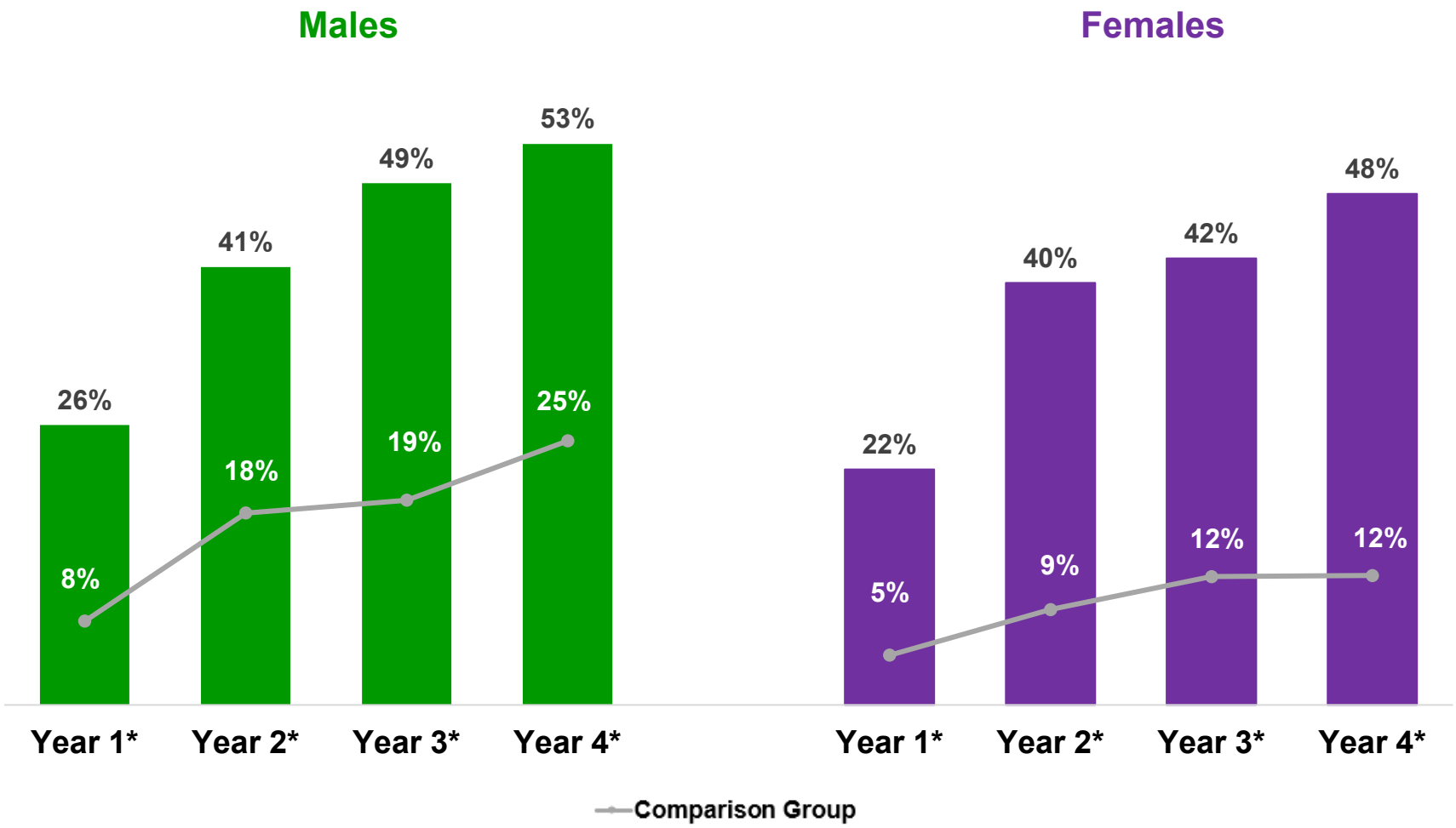
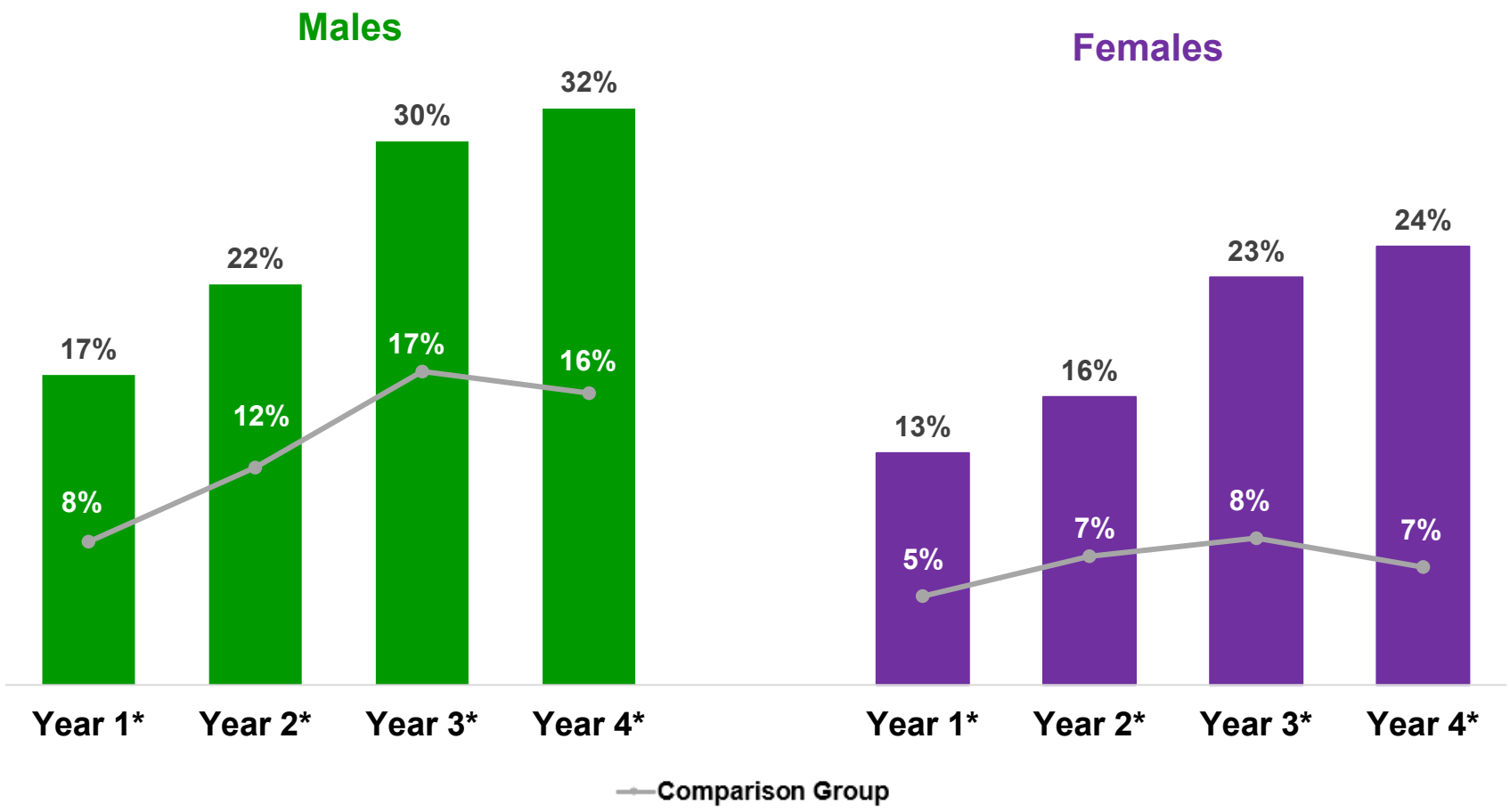
Over the 4 years in college, the **gap in Engineering Majors** grew from roughly **20% to 30% for males** and from **17% to 36% for females**



Asterisk (*) indicates statistically significant at p ≤ .05. NS indicates not statistically significant. Controlling for Race, Honors Courses, Family Income, and Parental Support for STEM.

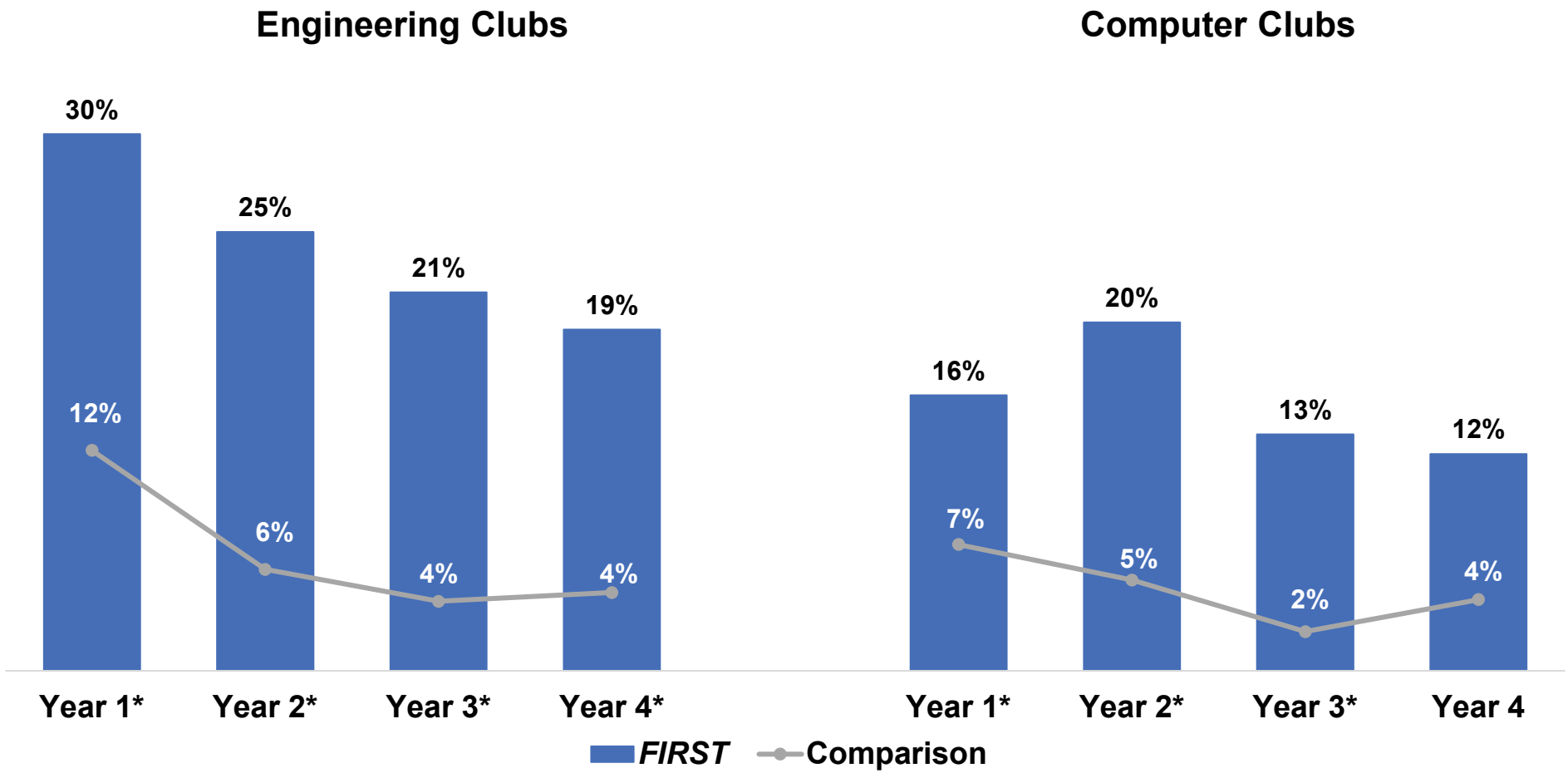
With more *FIRST* alumni majoring in **Computer Science** each year, **the gap between FIRST male and female respondents and their comparisons was largest by year 4 in College**



Asterisk (*) indicates statistically significant at p ≤ .05. NS indicates not statistically significant. Controlling for Gender, Race, Honors Courses, Family Income, and Parental Support for STEM.

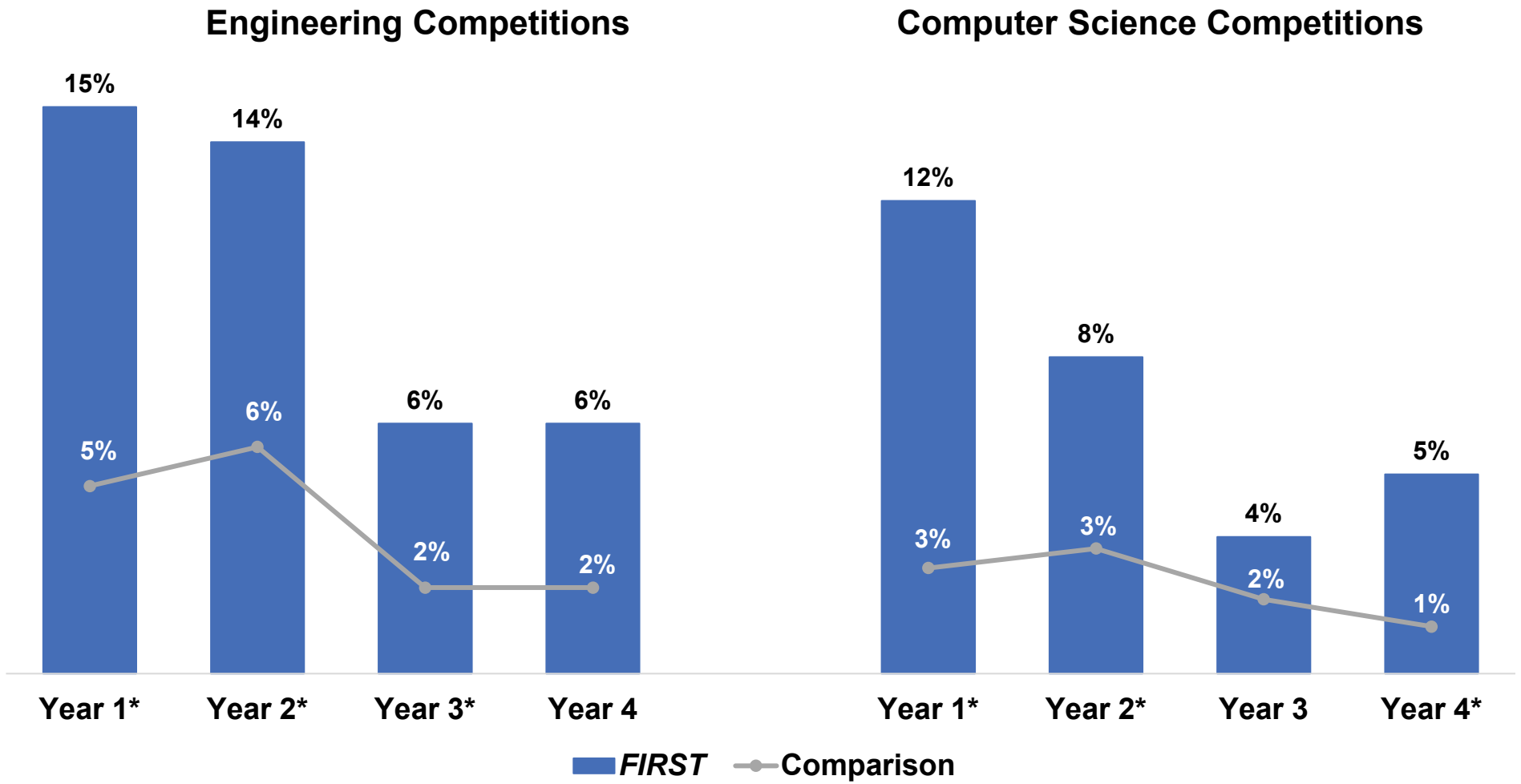
STEM Related Activities in College

Participation in clubs is consistently significantly higher for *FIRST* alumni



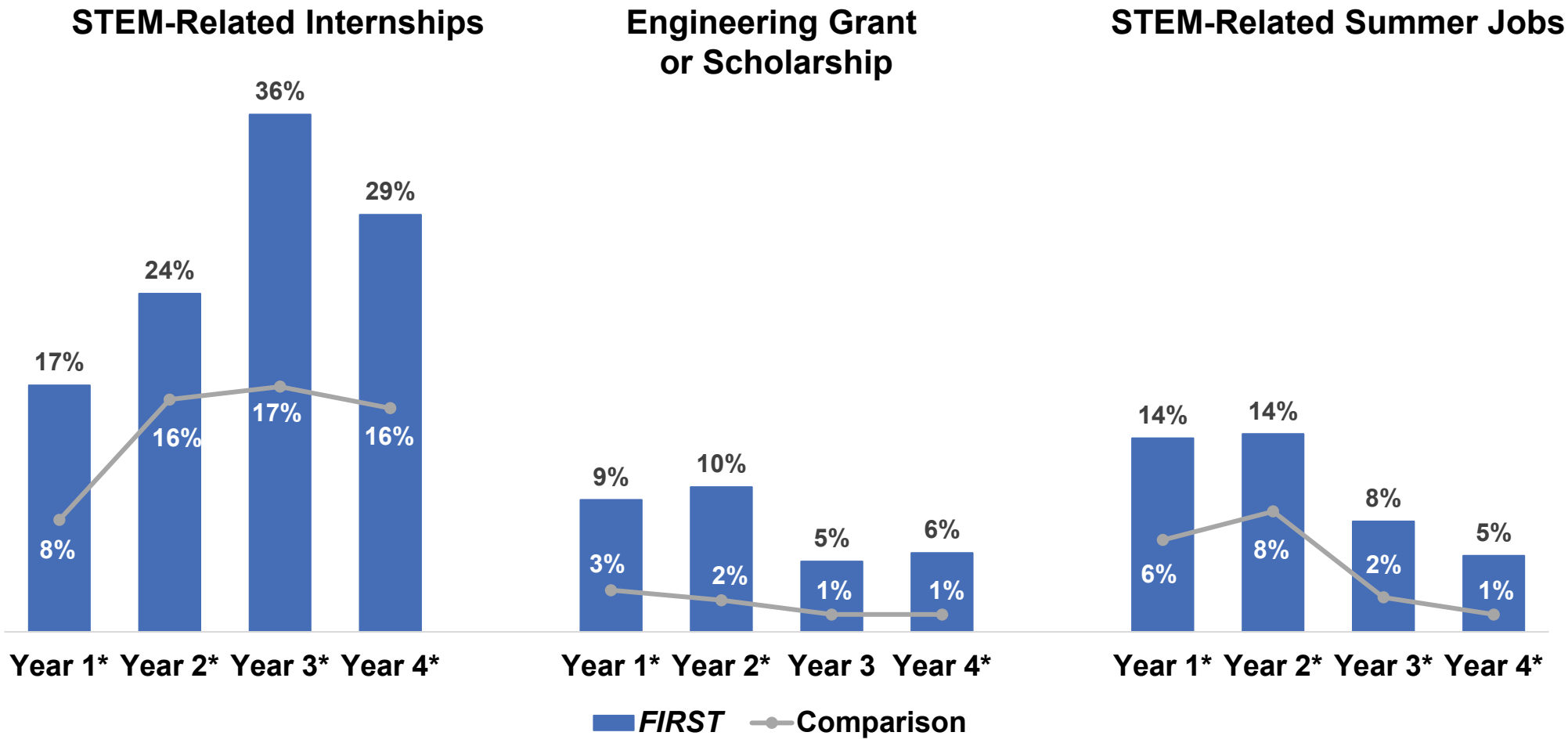
* All differences (except Year 4 for computer clubs are statistically significant, p ≤ .05.

Participation in competitions is significantly greater for *FIRST* alumni



* All differences (except Year 4 engineering and Year 3 computer science competitions) are statistically significant, p ≤ .05.

Receipt of STEM-related scholarships and jobs is significantly greater for *FIRST* alumni in all 4 college years



* All differences (except Year 3 grant/scholarships) statistically significant, $p \leq .05$.

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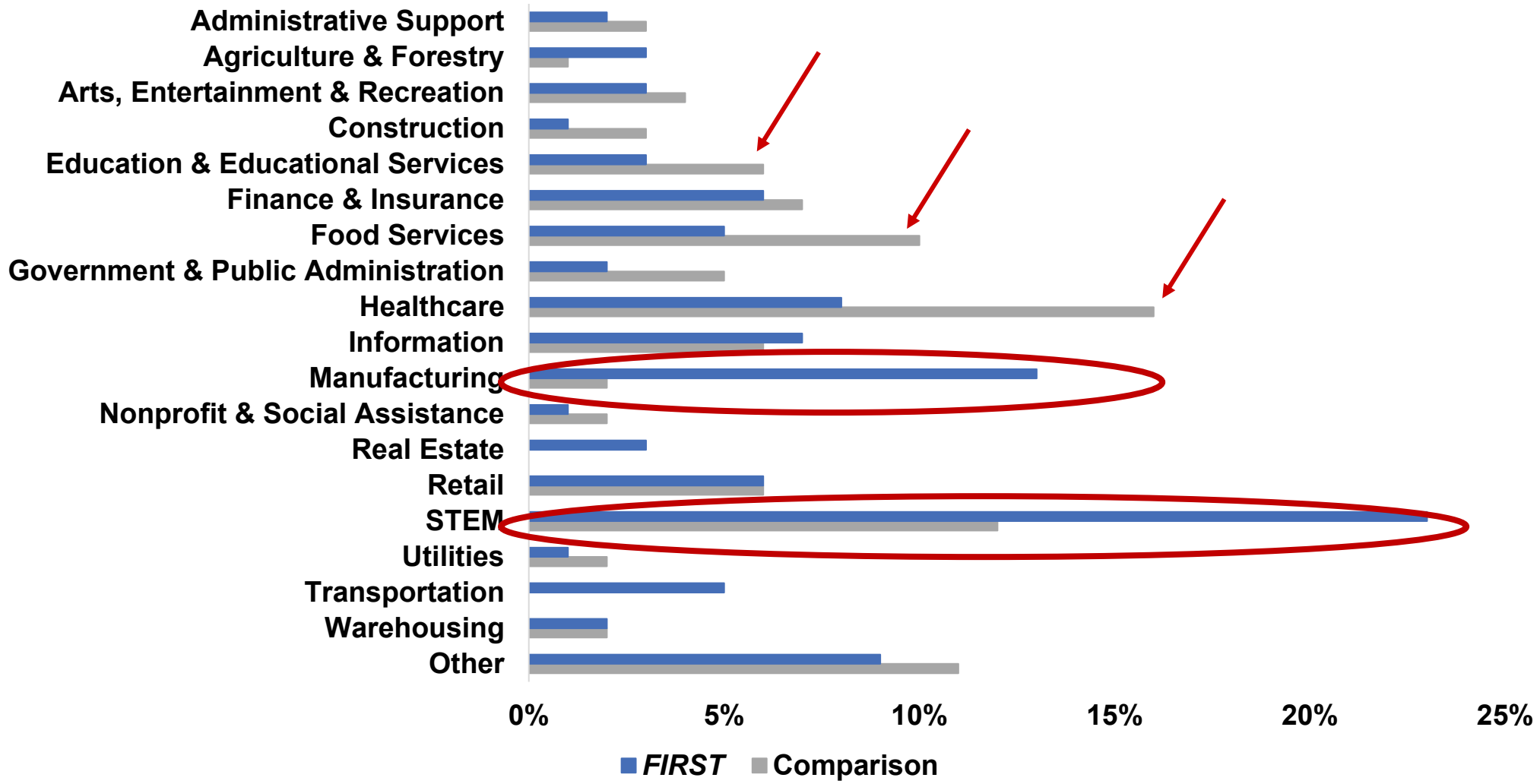
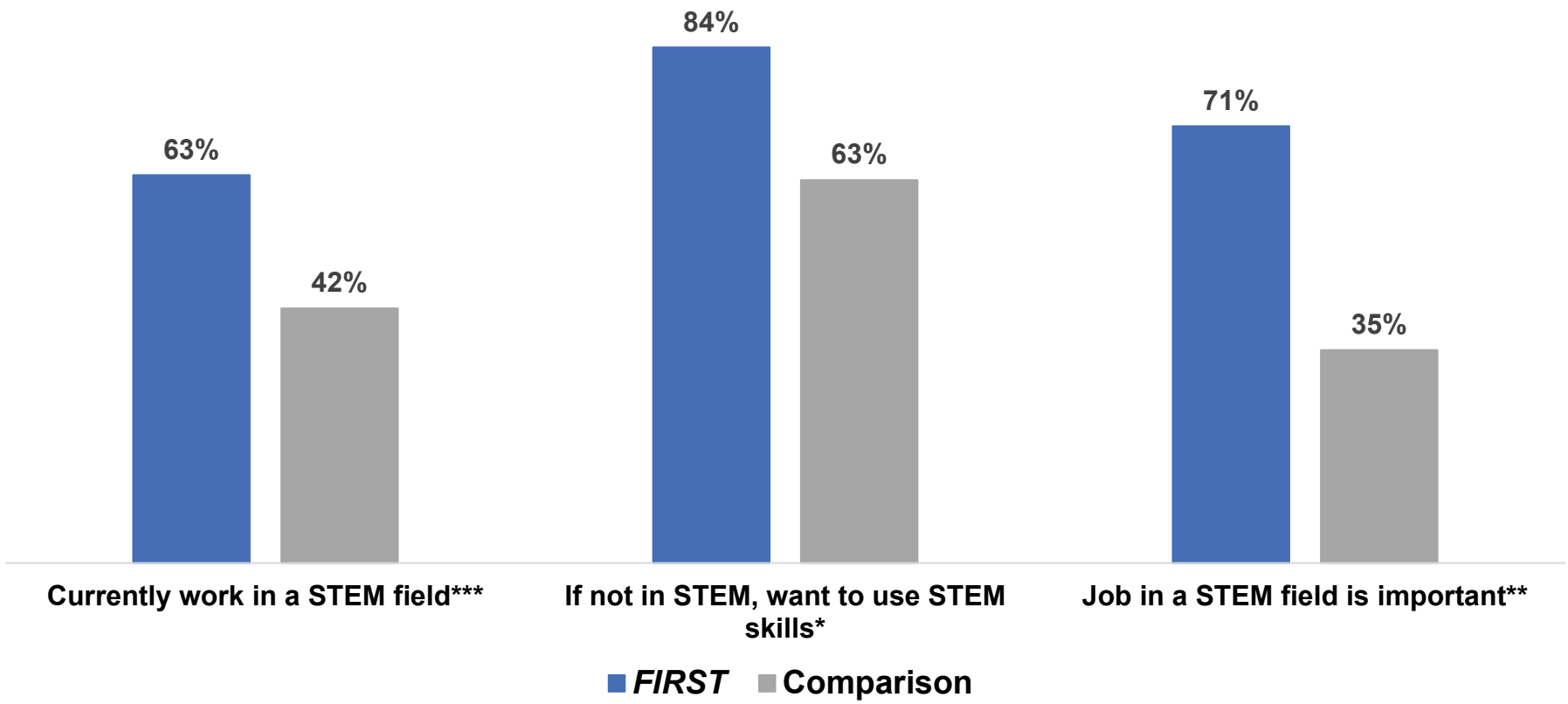
Early Career Outcomes

Industry (Self-Identified)



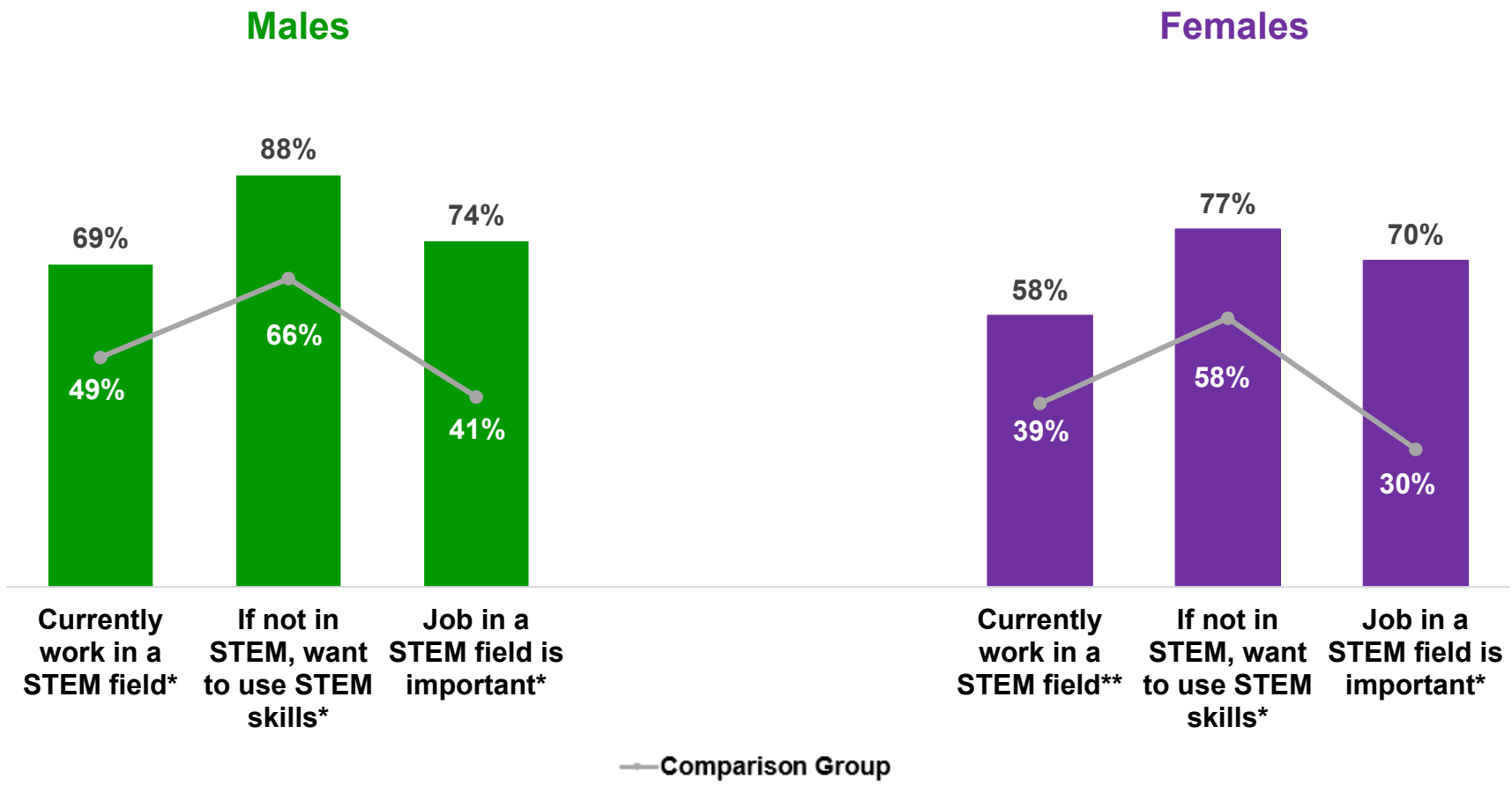
STEM industries include Professional, Scientific, and Technical Services (incl. engineering, accounting, computer systems, research).

Employment in STEM: *FIRST* alumni are significantly more likely to engage in STEM-related careers, and consider STEM jobs and pertinent skills to be important



Note: Asterisk (*) indicates statistically significant at p ≤ .05. Asterisks (**) indicates statistically significant at p ≤ .01. Asterisks (***) indicates statistically significant at p ≤ .001

Employment in STEM: *FIRST* males and females are significantly more likely to engage in STEM-related careers, and consider STEM jobs and pertinent skills to be important



Note: Asterisk (*) indicates statistically significant at p ≤ .05. Asterisks (**) indicates statistically significant at p ≤ .01.

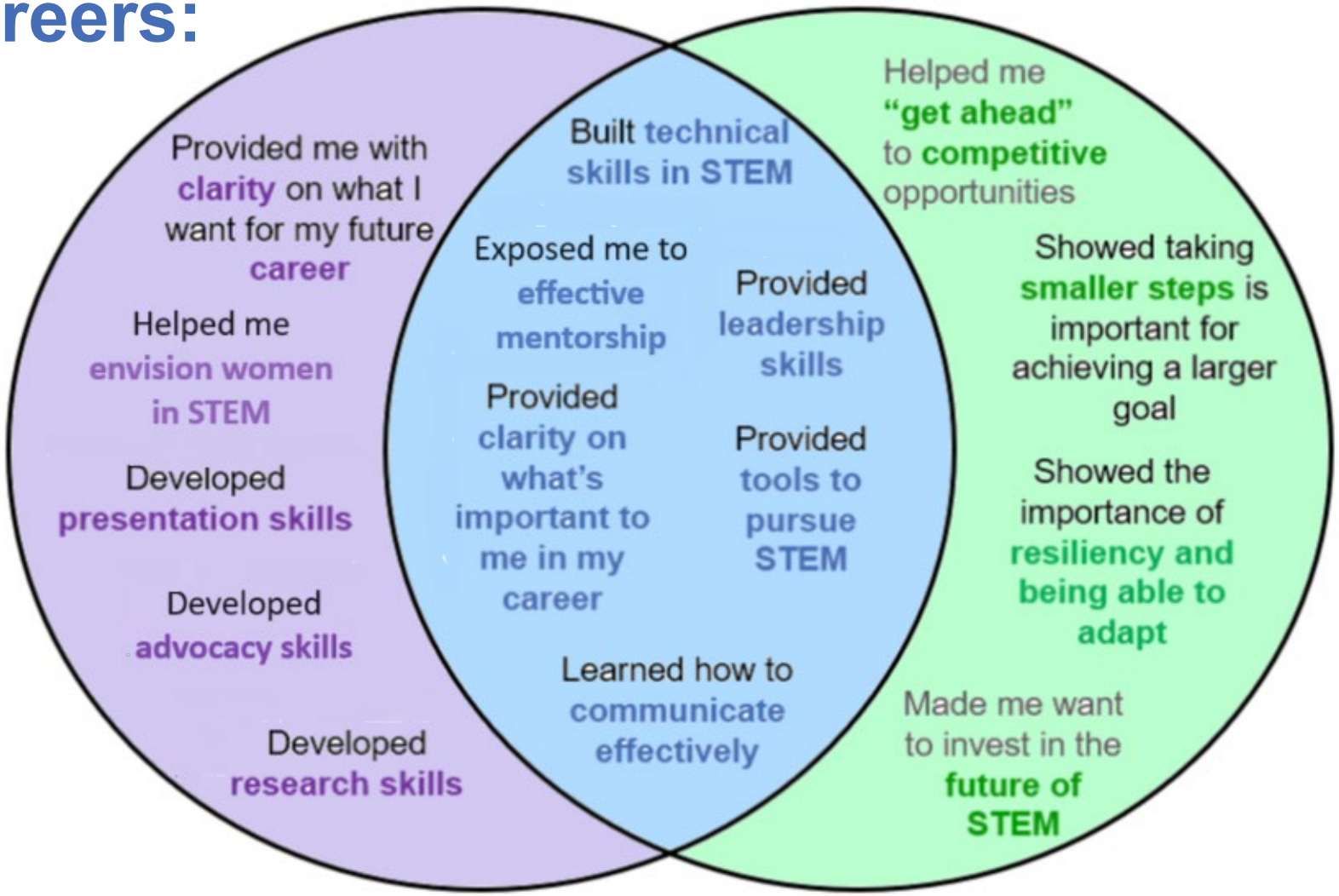
Median annual salaries are significantly higher for *FIRST* female alumni

* Statistically significant, $p \leq .05$.

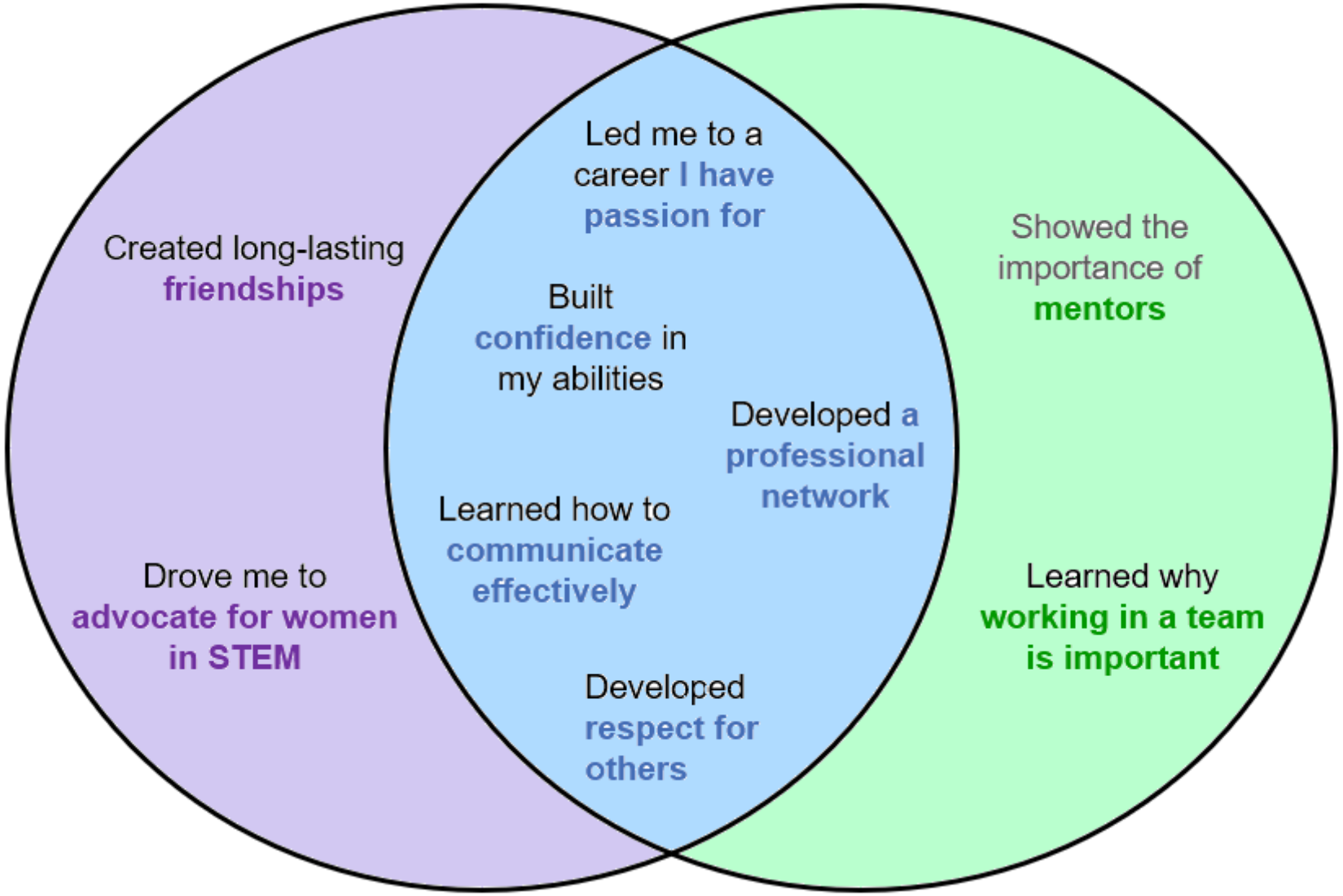
Participant Experiences:

In what ways has your experience in *FIRST* helped you in planning for your career?

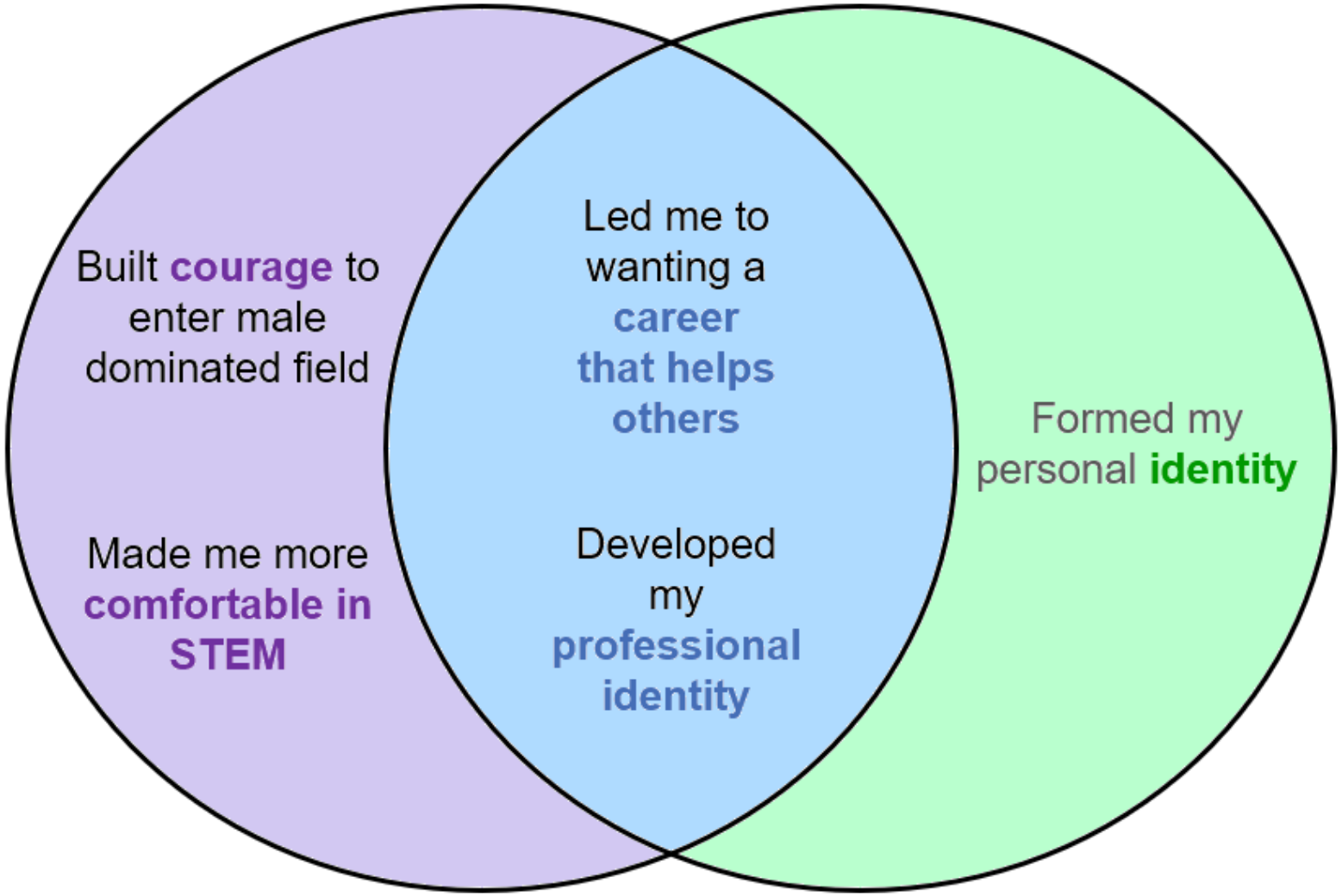
Young women and men on how their *FIRST* experience made lasting impacts on skills related to their careers:



Young women and men on how their *FIRST* experience made lasting impacts on their interpersonal skills:



Young women and men on how their *FIRST* experience made lasting impacts on their identity:



Interviews with *FIRST* female alumni

FIRST female alumni discussed

- The skill sets they developed in *FIRST* that they still draw on, ranging from technical skills, presentation and leadership skills, to social emotional learning through *FIRST*'s core approaches of Gracious Professionalism and Coopertition.
- The challenges of being female in a male dominated field, from participating in *FIRST* to the workplace, and the range of strategies women developed to address these challenges.
- The importance of good mentors, including serving as role models when successful or as negative examples when not.
- The influence of parental expectations on participating in *FIRST* and careers.

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Linking *FIRST* Program Experiences with STEM Interest and Attitudes and College Majors

Relationship between FIRST Program Participation Components and STEM Outcomes

All *FIRST* Participants	STEM Interest	STEM Activity	STEM Careers	STEM Identity	STEM Knowledge
Building	+	+	+	+	+
Programming		+			
Team Support	+	+	+	+	+
Quality Scale	+	+	+	+	+
Time in Program (>1 year)			+	+	
Mentor Scale	+	+	+	+	+
Participated in Competitions (7+)	+	+			+

Note: Controlling for gender, race, any honors course, parental income, and parental support for STEM, +=statistically significant

Relationship between FIRST Program Participation Components and STEM Outcomes, by Gender

MALES	STEM Interest	STEM Activity	STEM Careers	STEM Identity	STEM Knowledge
Building	+	+	+	+	+
Programming		+			
Team Support	+	+	+	+	+
Quality Scale	+	+	+	+	+
Time in Program (>1 year)			+		
Mentor Scale	+	+	+	+	+
Participated in Competitions (7+)					
FEMALES					
Building	+	+	+	+	+
Programming					
Team Support					
Quality Scale	+	+	+	+	+
Time in Program (>1 year)			+		
Mentor Scale		+	+		+
Participated in Competitions (7+)		+			

Note: Controlling for race, any honors course, parental income, and parental support for STEM, +=statistically significant

Relationship between FIRST Program Participation Components and STEM Outcomes, by FIRST Program

- For all three programs (FLL, FTC, FRC), the results are close to identical, underscoring the importance of
  - being involved in building the robot,
  - providing team support,
  - experiencing a quality mentor relationship, and
  - rating the program at high quality

  in promoting higher STEM attitudes and interests.

- Time in Program was significantly correlated with higher STEM Identity for all three programs.

Relationship between FIRST Program Participation Components and Declared Majors

	Declared Majors Year 4 in College		
All Participants	**Computer Science**	**Engineering**	**Robotics**
Building	+	+	
Programming	+		+
Team Support			
Quality Scale	+	+	
Time in Program (>1 year)			
Mentor Scale			
Participated in Competitions (7+)	+	+	

Note: Controlling for gender, race, any honors course, parental income, and parental support for STEM, +=statistically significant

Relationship between FIRST Program Participation Components and Declared Majors, by Gender

	Declared Majors Year 4 in College		
MALES	**Computer Science**	**Engineering**	**Robotics**
Building	+	+	
Programming	+		
Team Support			
Quality Scale	+		+
Time in Program (>1yr)			
Mentor Scale			
Participated in Competitions (7+)	+	+	
FEMALES			
Building		+	
Programming			+
Team Support			
Quality Scale		+	
Time in Program (>1yr)			
Mentor Scale			
Participated in Competitions (7+)		+	

Note: Controlling for race, any honors course, parental income, and parental support for STEM, +=statistically significant

FIRST Longitudinal Study
Next Steps

End of Study Activities

- Analyses of full 10 year data linking *FIRST* participation to outcomes (presented today)
- Comparison to national trends, using restricted data from the National Center for Education Statistics (ongoing)
- Qualitative study with *FIRST* female participants (report completed)
- Taking the results on the road to share with different audiences
  - *FIRST* Community Conference (June 2024)
  - Society for the Study of Social Problems (SSSP) and American Sociological Society (ASA) (August 2024)
  - Proposals out to:
    - Society for Research on Educational Effectiveness (SREE)
    - American Evaluation Association (AEA)
    - Association for Public Policy Analysis and Management (APPAM)

Looking ahead

- Planning for the Longitudinal Study V2
  - Broad *FIRST* stakeholder inputs
  - Finalize goals/target groups
  - Review/finalize measures
  - Determine comparison group
  - Explore/finalize implementation sites
- Exit survey launched seeking feedback on strong participation in the 10 year study

The Center for Youth and Communities

We are a research, policy, and program assistance center based at the Heller School for Social Policy and Management, at Brandeis University.

We focus on: youth, education, workforce and community development.

Center for Youth and Communities
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