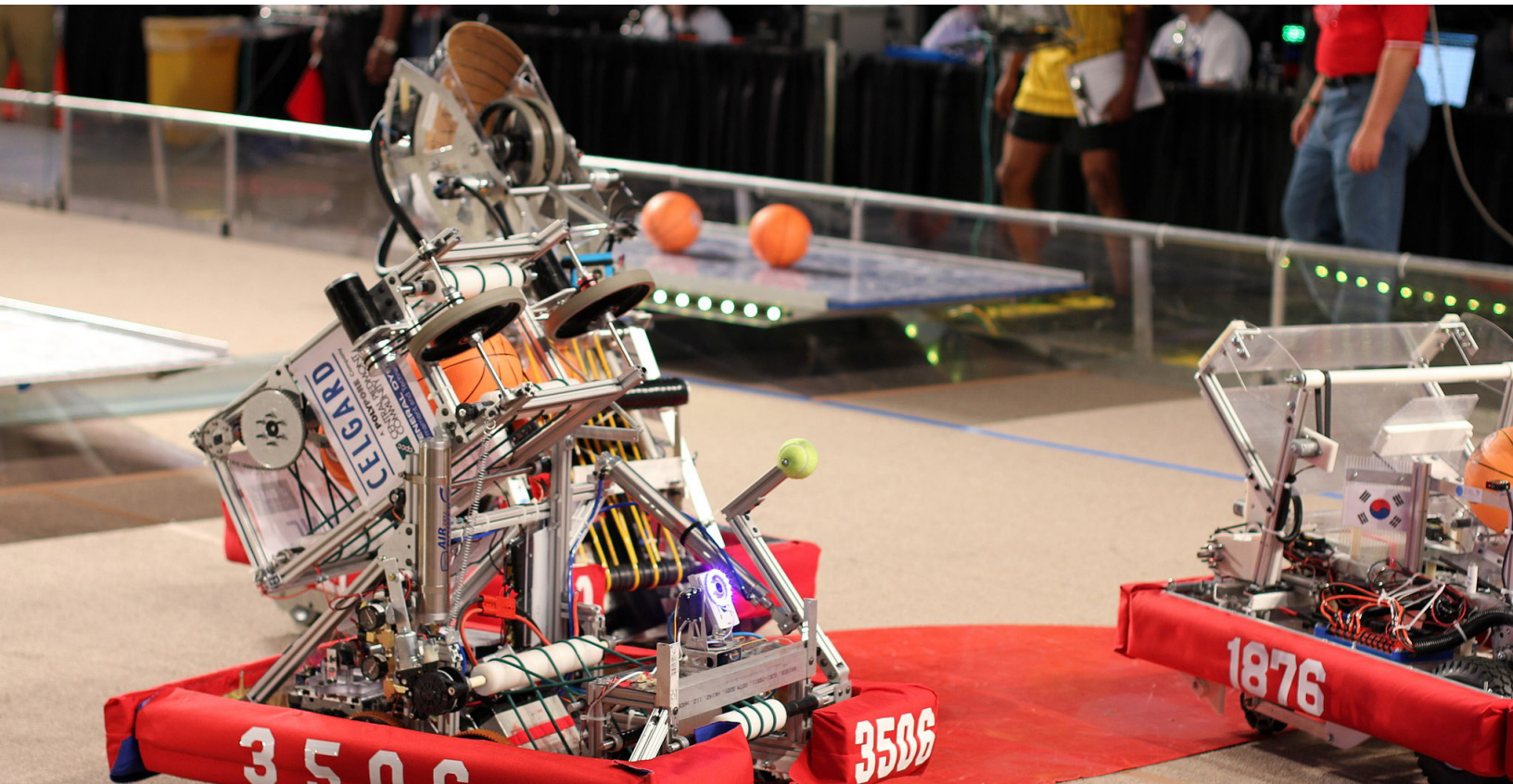


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# Results from Evaluating the U.S. *FIRST*-Washington Data and Program



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## **ABOUT THE ERDC**

The research presented here utilizes data from the Education Research and Data Center, located within the Washington Office of Financial Management. ERDC works with partner agencies to conduct powerful analyses of learning that can help inform the decision-making of Washington legislators, parents, and education providers. ERDC's data system is a statewide longitudinal data system that includes de-identified data about people's preschool, educational and workforce experiences.

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## Introduction

The U.S. FIRST program in Washington collaborated with the Education Research and Data Center (ERDC) to conduct an evaluation study by matching their participant records to data contained in ERDC's longitudinal data warehouse, which contains student records from Washington public schools and postsecondary institutions. The purpose of the study was to explore whether FIRST participation had an effect on high school STEM course-taking, college enrollment, and college STEM course taking and major choice.

## Findings

More data is needed to produce reliable conclusions.

The conclusions of this study hint that the FIRST program may have a valuable impact on students' choices to take STEM courses and to pursue STEM majors in college, but it is not possible to reliably draw these conclusions with certainty using the data available. This illustrates how vitally important it is to collect quality data when evaluating program outcomes. We hope and expect that course-taking data and program participation data will continue to improve in the coming years. There are at least two data-related factors that call into question the results of this study.

### **FIRST program data was incomplete**

First, we were not able to identify all FIRST program participants. Only those who registered online for the FIRST program were identified in this study. For this reason, only an estimated 50-60 percent of program participants' information was collected. In other words, around half of FIRST program participants were not included, or perhaps included in the comparison group.

To illustrate this, among approximately 250 school districts, only 82 districts had records of FIRST participants in 2015 (and only 85 in 2016). We have no idea if this is because some districts had higher selection criteria, or if their data was not collected by the FIRST Online Survey system. There may be potential selection bias from online registration and program availability across sites/school districts.

## Course-taking data was incomplete

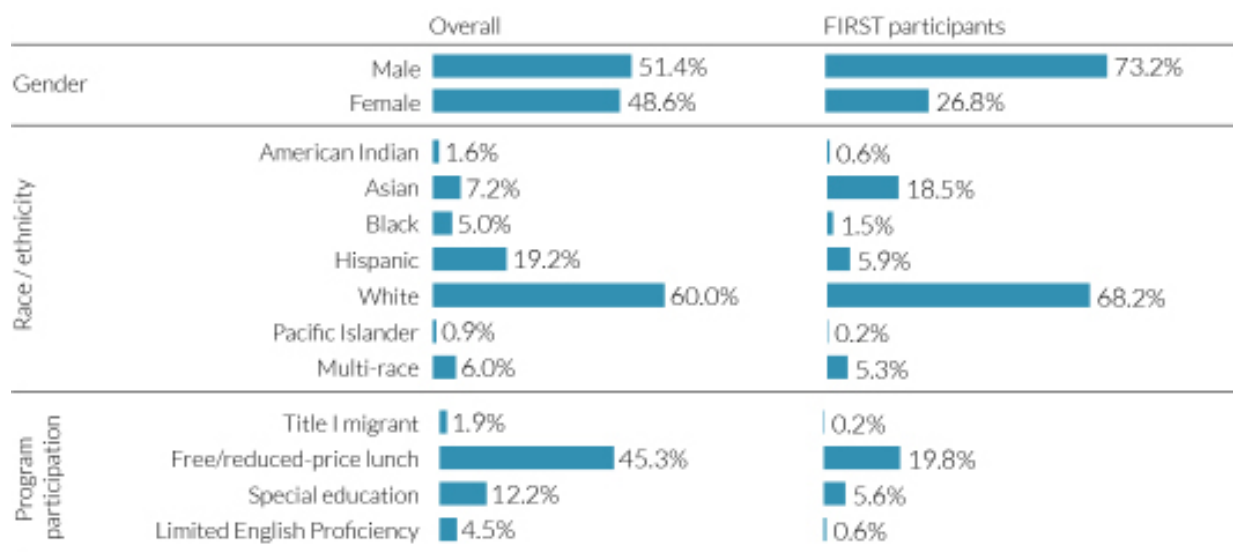
Second, course-taking data from high school is incomplete. Although the quality of this data is improving over time, only recently has the data been good enough to conduct analyses of this sort. This limits the number of years we can include in the study, and the number of students we could include in the cohort.

For example, when looking at high school course-taking, only students who were enrolled in 2013-2016, and who had course-taking records both before and after program participation, were included in the analysis. This limited the sample size to 3,252 FIRST program participants. And when looking at post-secondary outcomes, we could include only students who graduated in 2014, which made it possible to explore two years of post-secondary outcomes. This meant that only 588 FIRST program participants were compared with 30,503 of their peers.

FIRST participants were less likely to be members of at-risk groups.

Despite the limitations of the data, some interesting patterns were observed. Table 1 shows FIRST participants are more likely to be male, White, Asian, and from a higher-income family. They are less likely to be placed in Limited English Proficiency and special education programs. This indicates that FIRST participants were less likely to be members of at-risk groups, and more likely to be members of demographic groups already more prone to take science and math courses, enroll in college, and pursue STEM majors.

Figure 1. Demographics and program participation of FIRST participants. ("Overall" refers to students in same grade level and school year.) See also Table 1.

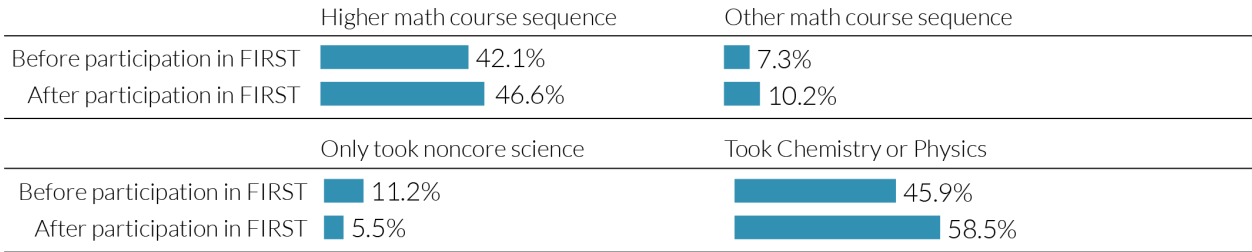


FIRST participants took more and higher math and science courses after program participation.

Overall, FIRST participants took more and higher math courses after program participation. However, the difference was only statistically significant for female participants (but not male participants), and for White and Asian participants. Among those from a low-income household (FRPL eligible), former FIRST participants took fewer lower math courses, but there was no corresponding increase in higher math courses. Students from higher-income household were slightly more likely to take more and higher math courses after participating in FIRST.

In addition, FIRST participants were less likely to take only non-core science courses and slightly more likely to take more and higher science courses after they participated, and as above, these differences were consigned mainly to White and Asian students (though it did not differ by gender or income group). Non-low-income students are also less likely to take non-core science course after program participation.

Figure 2: High school math and science course-taking of FIRST participants. See also Table 3a and Table 3b.



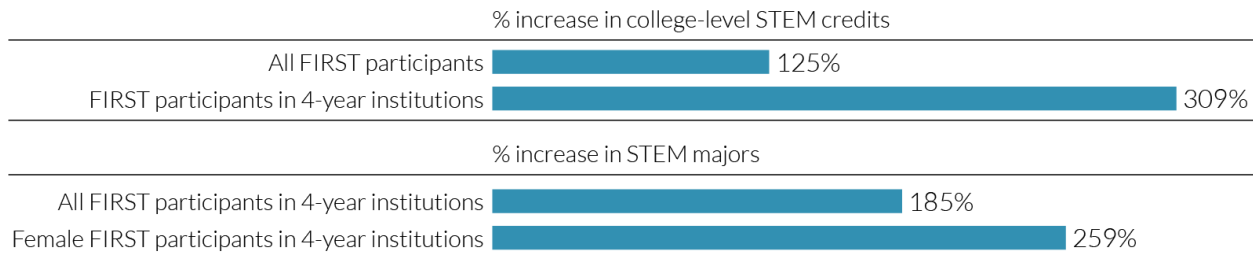
FIRST participants were more likely to take STEM credits or choose a STEM major in college.

While FIRST participants were proportionally more likely to enroll in college than non-FIRST participants (who belonged to the same graduating cohort), this difference disappeared when we controlled for demographic variables. However, when controlling for demographic variables, of those who did enroll in college, FIRST participants were far more likely (125 percent) to earn STEM credits their first year, especially among 4-year students (309 percent). This effect was not statistically significant among females, however.

By the end of their second year of college, FIRST participants who enrolled in 4-year institutions were much more likely (185 percent) to declare themselves to be a STEM major than non-FIRST participants who enrolled in 4-year institutions. The effect is

larger among females (259 percent) than males (165 percent). It should be noted that our sample size at this point was fairly small and varied tremendously across the two study groups (only 588 in the FIRST group, while 30,503 in the comparison group).

Figure 3. College coursetaking and STEM majors among FIRST participants. See also Table 4.



## Recommendation for data collection

Based on the discussion of data limitations above, ERDC has recommendations for FIRST program's future data collection, to more effectively conduct research in the future:

- If the research applies only to students enrolling in WA public K-12 schools, in addition to the current data elements, the following data should be considered:
  - All participants including those do not register online;
  - Age as of program enrollment;
  - Average hours of program participation per week;
  - Traveling time between home and site (or if the site is within the same zipcode or school district);
  - Measures of program outcomes (This needs some thought from the FIRST program, to determine the dependent variables that would best evaluate the program).
- If the research involves students from independent schools or community based teams, besides those data elements are already collected and those listed above, the following data should be considered: gender, race/ethnicity, and family income level.



Table 1. Difference in student characteristics and academic performance between non-FIRST and FIRST participants among high school students from WA public schools in 2013-2016.

	FIRST Program	Non-participants	Overall
N	14,616	1,432,673	1,447,289
Female	26.8%	48.9%	48.6%
Male	73.2%	51.1%	51.4%
American Indian	0.6%	1.6%	1.6%
Asian	18.5%	7.2%	7.3%
Black/African American	1.5%	5.0%	4.9%
Hispanic	5.9%	19.2%	19.0%
White	68.2%	60.0%	60.1%
Pacific Islander	0.2%	0.9%	0.9%
Multi-race	5.3%	6.0%	6.0%
Title I migrant	0.2%	1.9%	1.9%
Eligible for free/reduced-price lunch	19.8%	45.3%	45.0%
In special education	5.6%	12.2%	12.1%
Limited English Proficiency program	0.6%	4.5%	4.5%
Mean Annual GPA	3.3	2.6	

Table 2. Mean annual GPA of FIRST participants, before and after FIRST participation.

	Total	FIRST participation	
		Before	After
All FIRST participants	3.25	3.28	3.24+
Female	3.42	3.42	3.42
Male	3.19	3.23	3.16+
American Indian	2.75	2.82	2.67
Asian	3.55	3.61	3.49
Black/African American	3.14	3.09	3.18
Hispanic	3.08	3.10	3.05
White	3.20	3.22	3.18
Pacific Islander	3.18	3.21	3.15
Multi-Race	3.28	3.28	3.27
FRPL eligible	2.97	2.97	2.98
Non-FRPL	3.35	3.38	3.31*

Note: N=3,252. Using t-test on mean, the significance level is demonstrated by:  
 +: p-value <0.1; \*: p-value <0.05; \*\*: p-value <0.01

Table 3a. The percentage of math course sequence before and after FIRST program participation, by student characteristics.

Math course sequence	Total	FIRST participation	
		Before	After
<b>All</b>			
Other math	9.1%	7.3%	10.2%**
Low	14.5%	16.7%	13.2%
Intermediate	31.5%	33.9%	30.0%
High	44.9%	42.1%	46.6%*
<b>Female</b>			
Other math	9.3%	6.3%	11.1%**
Low	12.7%	15.3%	11.1%
Intermediate	29.9%	35.7%	26.5%
High	48.1%	42.7%	51.3%**
<b>Asian</b>			
Other math	15.6%	15.5%	15.6%
Low	4.2%	6.8%	2.7%
Intermediate	23.9%	28.0%	21.7%
High	56.4%	49.7%	60.0%+
<b>White</b>			
Other math	6.9%	5.1%	8.0%*
Low	16.6%	18.2%	15.6%
Intermediate	33.9%	35.5%	32.8%
High	42.7%	41.2%	43.5%
<b>FRPL eligible</b>			
Other math	10.1%	6.7%	12.4%
Low	24.8%	30.8%	20.9%*
Intermediate	36.7%	35.3%	37.6%
High	28.4%	27.2%	29.1%
<b>Non-FRPL eligible</b>			
Other math	8.8%	7.6%	9.5%*
Low	11.3%	11.9%	10.9%
Intermediate	29.8%	33.4%	27.7%
High	50.1%	47.1%	51.9%*

Note: Sample size less than 10 is not reported. For space, only disaggregations with statistically significant differences are reported.

Multinomial logistic regression analysis is used to test the significance of the likelihood of taking different levels of course sequence. The reference group in each model is intermediate grade-level course sequence. The testing was not applied to American Indians, Pacific Islanders, or Black, as the number of cases in some course sequence categories are too small.

The significance level is demonstrated by: +: p-value <0.1; \*: p-value <0.05; \*\*: p-value <0.01.



Table 3b. The percentage of science course sequence before and after FIRST program participation, by student characteristics

	Total	FIRST participation	
		Before	After
<b>All</b>			
Noncore science only	8.5%	11.2%	5.5%**
Chemistry or Physics	51.9%	45.9%	58.5%
Biology only	34.6%	37.9%	30.8%
Biology + noncore science	1.4%	1.9%	0.9%
2 or more core science-Bio, Chem, Phys	3.6%	3.1%	4.2%*
<b>Female</b>			
Noncore science only	8.2%	8.5%	7.9%
Chemistry or Physics	50.8%	46.1%	56.0%**
Biology only	34.8%	39.2%	29.9%
2 or more core science-Bio, Chem, Phys	4.4%	3.7%	5.1%+
<b>Male</b>			
Noncore science only	8.6%	12.3%	4.5%**
Chemistry or Physics	52.3%	45.9%	59.6%**
Biology only	34.5%	37.3%	31.2%
Biology + noncore science	1.3%	1.6%	0.9%
2 or more core science-Bio, Chem, Phys	3.3%	2.9%	3.8%+
<b>Asian</b>			
Noncore science only	6.2%	8.4%	3.9%
Chemistry or Physics	54.0%	44.9%	63.4%**
Biology only	32.8%	40.2%	25.0%
2 or more core science-Bio, Chem, Phys	6.0%	4.7%	7.4%*
<b>White</b>			
Noncore science only	9.5%	12.4%	6.2%**
Chemistry or Physics	51.4%	45.9%	57.8%**
Biology only	34.3%	36.4%	31.9%
Biology + noncore science	1.6%	2.2%	0.8%+
2 or more core science-Bio, Chem, Phys	3.2%	3.1%	3.3%
<b>FRPL eligible</b>			
Noncore science only	10.7%	16.5%	3.5%
Chemistry or Physics	44.1%	36.7%	53.2%**
Biology only	39.5%	41.9%	36.5%
Biology + noncore science	2.2%	2.3%	2.1%+
2 or more core science-Bio, Chem, Phys	3.5%	2.6%	4.6%+

Non-FRPL eligible	Total	FIRST participation	
		Before	After
Noncore science only	7.9%	9.6%	6.0%**
Chemistry or Physics	54.1%	48.8%	60.0%**
Biology only	33.1%	36.6%	29.3%
Biology + noncore science	1.2%	1.8%	0.6%
2 or more core science-Bio, Chem, Phys	3.7%	3.3%	4.1%

Note: Sample size less than 10 is not reported. For space, only disaggregations with statistically significant differences are reported.

Multinomial logistic regression analysis is used to test the significance of the likelihood of taking difference level of course sequence. The reference group in each model is taking only biology course, as taking an End-of-Course biology is required to fulfill high school graduation requirement. The testing was not applied to American Indians, Pacific Islanders, or Black, as the number of cases in some course sequence category are too small. The significance level is demonstrated by: +: p-value <0.1; \*: p-value <0.05; \*\*: p-value <0.01

Table 4. Difference in student characteristics and postsecondary outcomes between non-FIRST and FIRST participants from WA public schools who later enrolled in postsecondary institutions.

	FIRST Program	Non-participants	Overall
Enrolled in college within 2 years	0.49**	0.42	0.42
Earned STEM credits in Year 1	0.80**	0.54	0.54
Declared STEM major by Year 2	0.24**	0.08	0.08
N	588	30,503	31,091

Note: For this analysis, a slightly different cohort (with similar demographic breakdown) was used. Using t-test on mean, the significance level is demonstrated by: \*\* p<0.01





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