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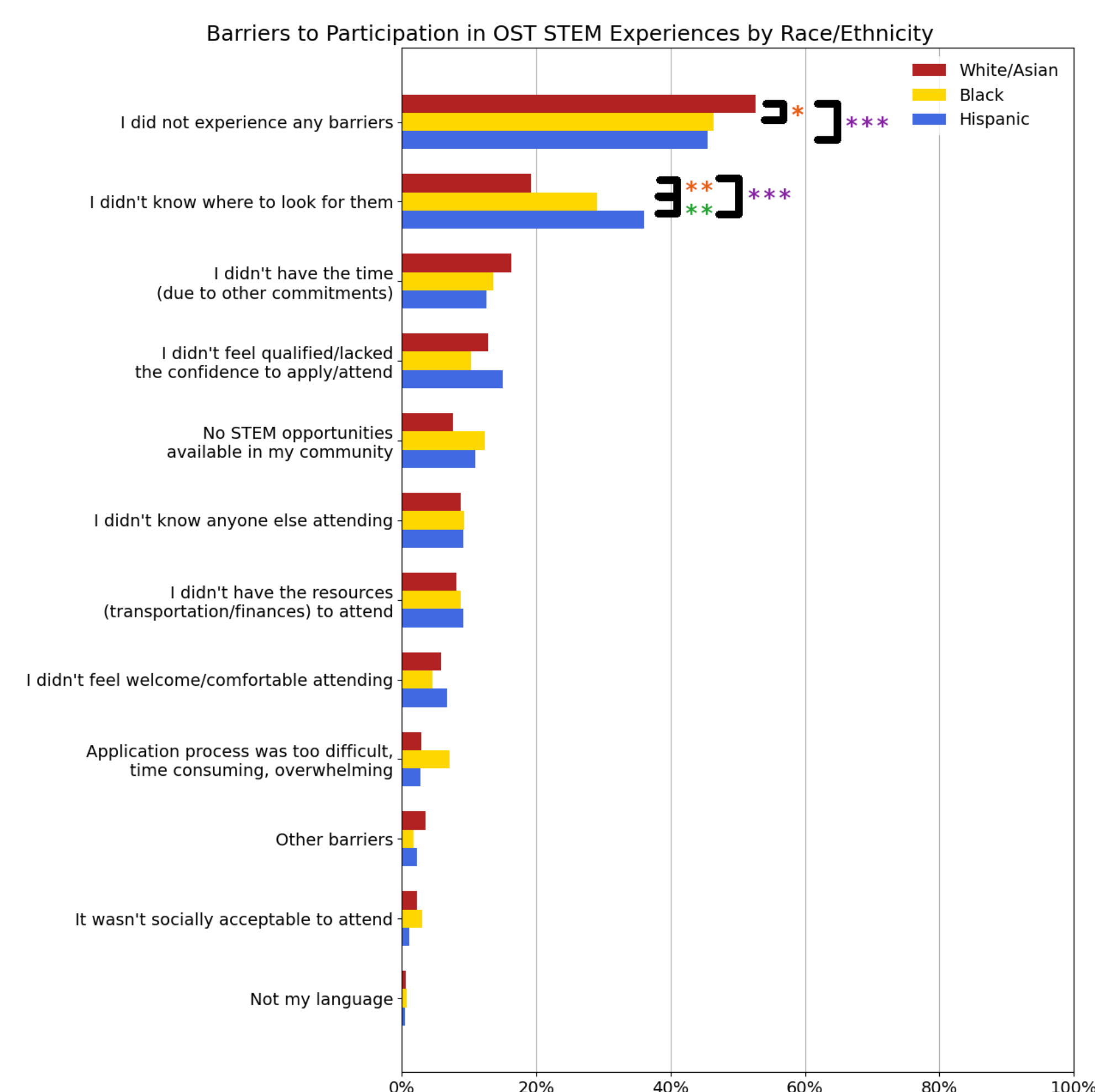
INTRODUCTION

The continuing shortage of science, technology, engineering, and mathematics (STEM) professionals in the United States has urged researchers and educators to examine how best to increase and diversify the STEM workforce. Of utmost concern is the underrepresentation of Black and Hispanic students in the STEM workforce. Because many students begin to formulate career aspirations during adolescence, it is critical to understand how career aspirations *change* during middle and high school. Furthermore, understanding the barriers against participation for Black and Hispanic students as well as the opportunities they have when participating in OST STEM programs is paramount to investigating the mechanisms contributing to URM students' general STEM interest and, in particular, STEM career interest before they start college.

To this end, we conducted a survey of 1,134 beginning college students at 23 institutions in the U.S., including Historically Black Colleges and Universities and Hispanic Serving Institutions, asking students to report their career aspirations at four time points—from the beginning of middle school to the beginning of college. Considering that White and Asian students are well-represented in the STEM workforce, this study oversampled underrepresented minoritized (URM) students (i.e., 40% Black and 34% Hispanic).

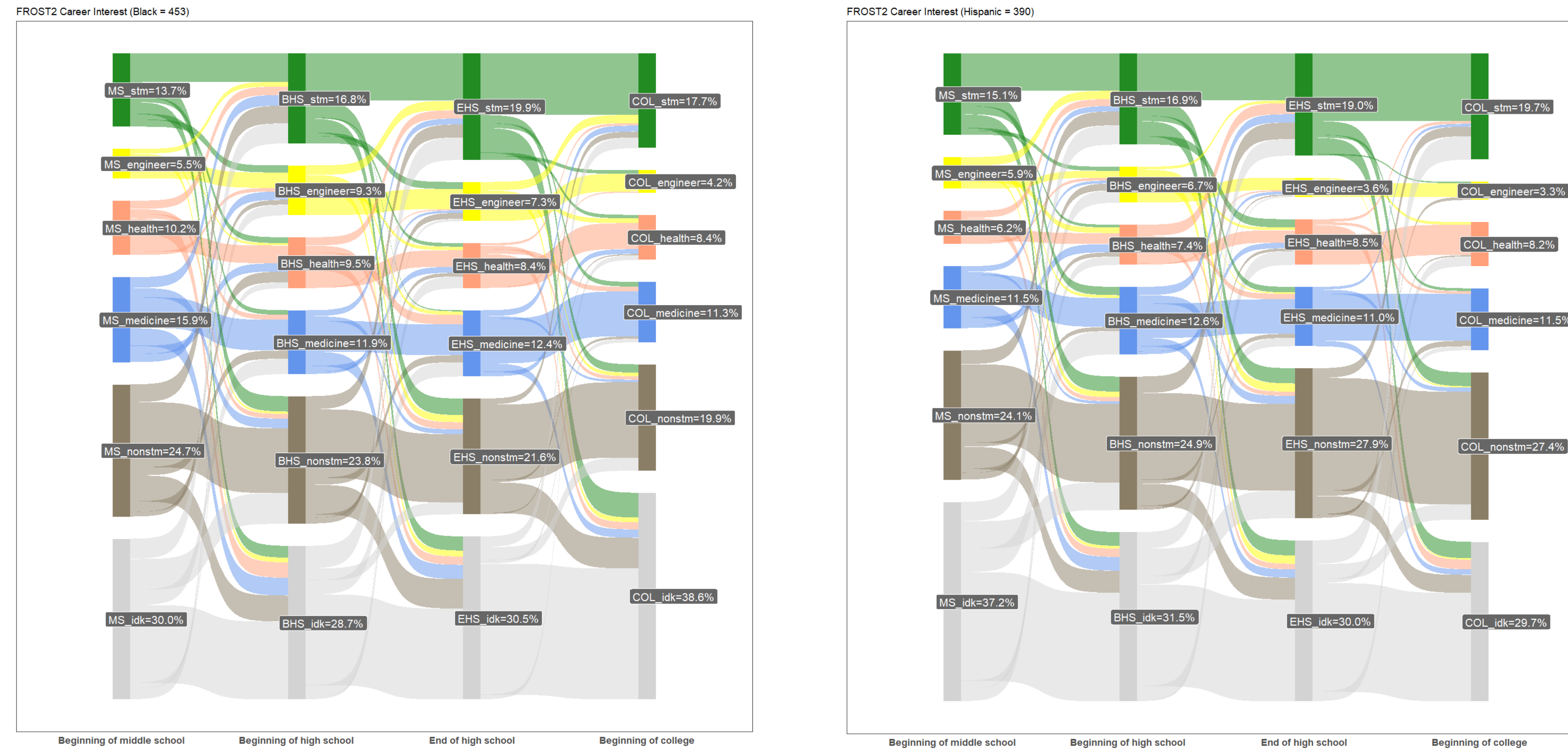
We examined the inflow and outflow of students' career choices throughout the entire span of the study (i.e., beginning of middle school to beginning of college) with the aid of Sankey diagrams for each racial and ethnic group. In addition, we performed individual regression analyses and multivariate regression analyses to examine the associations between OST factors and students' general STEM interest and STEM career interest at the start and the end of high school, respectively.

BARRIERS



Notes. Brackets indicate that there is a significant difference between two particular race and ethnicity groups (i.e., White/Asian vs. Black, White/Asian vs. Hispanic, Black vs. Hispanic). Asterisks indicate the level of significance (* $p < .05$; ** $p < .01$; *** $p < .001$). They are shown in orange, green, and purple. Orange represents the difference between the White/Asian and Black groups, green represents the difference between the Black and Hispanic groups, and purple represents the difference between the White/Asian and Hispanic groups.

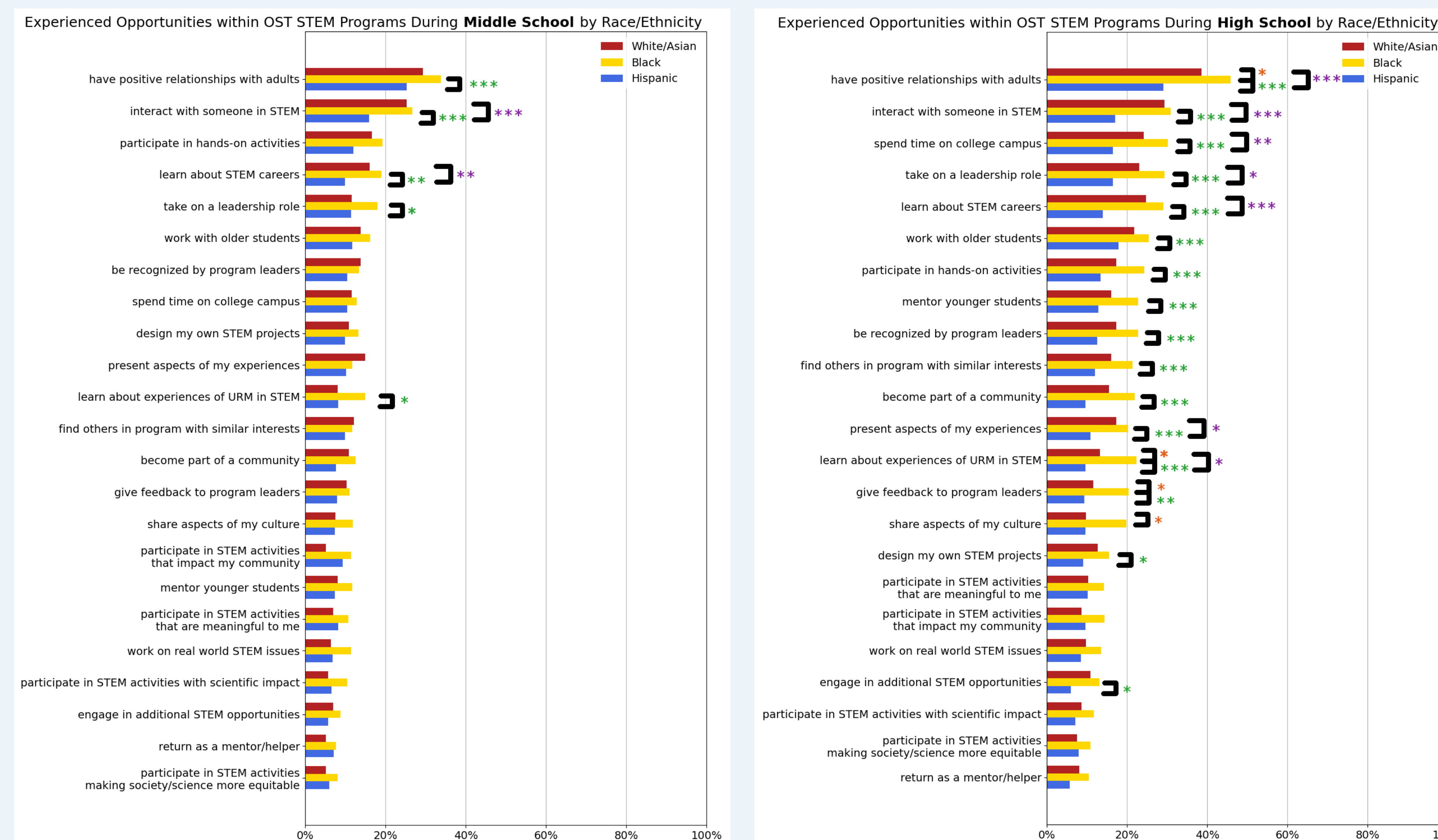
STEM CAREER PATHWAYS



There was high volatility of career pathways between the start of middle school and the start of college for Black and Hispanic students. Compared to Hispanic students, Black students experienced a sharper decline in pursuing Engineering and an increase in uncertainties about career pathways during this time period.

Notes. Sankey diagram displays flows between successive stages (i.e., beginning of middle school -> beginning of high school -> end of high school -> beginning of college) through arrows whose thickness is proportional to flow quantity (i.e., percentage).

PARTICIPATION



Overall, Black students reported higher participation in these opportunities than their Hispanic and White/Asian peers, as indicated by the higher percentages depicted in yellow bars. In particular, during both middle school and high school, Black students participated significantly more than Hispanic students in these five activities: Having positive relationships with adults, interacting with someone in STEM, learning about STEM careers, taking on a leadership role, and learning about experiences of URM in STEM.

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OST FACTORS

		EHS STEM Interest	BHS STEM Career Interest	EHS STEM Career Interest
Structured OST Activities	Clubs/teams outside of school			-
	Maker/DIY STEM activities/events		+	
	STEM-related vacations or summer camps			-
	STEM-related lectures/talks	+		
	STEM-related courses/workshops outside of school			-
	STEM-related competitions		+	
	Work volunteer or internship	+		
Controls	Prior STEM Interest/Career Interest	+	+	+
	Female			
	Black	+		
	Hispanic			-

		EHS STEM Interest	BHS STEM Career Interest	EHS STEM Career Interest
Opportunities Within OST STEM Programs	Spend time on college campus	+		
	Learn about STEM careers			
	Participate in hands-on activities	+		+
	Design my own STEM projects	+		
	Participate in STEM activities with scientific impact		+	
	Participate in STEM activities that are meaningful to me			+
	Share aspects of my culture		-	-
Controls	Engage in additional STEM opportunities	-	-	-
	Prior STEM Interest/Career Interest	+	+	+
	Female			
	Black	+		
Hispanic			-	

Notes. These two tables present the results from our individual regression analyses and comprehensive regression analyses. All individual regression analyses controlled for students' prior STEM interest in Column 1 and students' prior STEM career interest in Columns 2 and 3. All comprehensive regression analyses controlled for students' prior STEM interest, gender, and race and ethnicity in Column 1 and students' prior STEM interest, gender, and race and ethnicity in Columns 2 and 3. The light green "+" and orange "-" in the left half-columns indicate that the predictor shows a positive or negative effect in the individual regression model *only*. The light green "+" and orange "-" in the right half column indicate that the predictor shows a positive or negative effect in the comprehensive regression model *only*. Blocks in dark green indicate that a particular predictor shows a positive effect in both individual and comprehensive models.

ACKNOWLEDGMENTS

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