Asian American students' postsecondary STEM education pathways

by

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ABSTRACT

This study aims to understand Asian American students' postsecondary STEM education pathways. It examined Asian American students as a whole and as geographical and generational subgroups. It studied postsecondary STEM education as a whole and as five different fields. It examined STEM pathways through six research topics. And, it explored factors that related to Asian American students' STEM education pathways. This study contributes to the current research body by focusing on an important matter that needs more exploration, by offering justifiable definitions and classifications of Asian Americans and STEM education, and by suggesting related factors of STEM education.

An US national representative and longitudinal data set, Education Longitudinal Study of 2002 (ELS: 2002), was utilized in this study to explore the intended research topics. SPSS, R, and AM were used for the analyses. Missing data imputation was applied. When analyzing the data, the nested structure of ELS: 2002 was considered. And, both descriptive and inferential analyses were carried out. The descriptive analyses were used both as a preparation for inferential analyses and as ways to answer the research questions. The inferential analyses were realized through stepwise logistic regressions. With three regressions for Asian Americans as a whole and three regressions for Asian Americans as subgroups, six stepwise regressions were conducted for the research topics of postsecondary enrollment, STEM choice as a whole, and STEM completion as whole. Due to the limitation of the analytic sample sizes, the research topics of STEM as an individual major choice, STEM individual major completion, and STEM individual major persistence were not examined by using regressions.

This study found that Asian American students were generally more likely to receive postsecondary education and major in STEM fields than White students. Among the five STEM fields, Asian American and White students both favored the fields of biological/agricultural sciences and engineering/engineering technologies. Both Asian American and White students were likely to obtain STEM degrees and persist in the same STEM fields they originally chose. More importantly, examination of the within-Asian American differences indicated that basically no difference was found among Asian American subgroups at certain stages of STEM education: receiving postsecondary education, choosing a STEM major, obtaining a STEM degree, and persisting in the same STEM fields. Nevertheless, Asian American subgroup disparities were found in choosing and obtaining a degree in different STEM fields. On the other hand, different stages of Asian American students' postsecondary STEM education pathways did not involve the same related factors. Moreover, the same factors did not exhibit the same relative status at different pathway stages. The results imply the importance for future research to examine the within- Asian American and STEM education differences. Also, they have implications for ways to increase postsecondary enrollment, STEM major choice, and STEM degree obtainment.

Chapter 1. Introduction

Research Purpose and Significance of the Study

This study aims at understanding Asian American students' postsecondary education pathways in science, technology, engineering, and mathematics (STEM) fields. Although Asian Americans are often treated as a single racial group, they are a diverse group and include substantial variations among geographical and generational subgroups. This study also recognizes the fact that STEM education consists of different areas. The contributions of this study to understanding Asian Americans' educational experiences are several. First, relatively few researchers put emphasis on Asian Americans' postsecondary STEM education pathways, especially with regards to Asian American subgroups. Through studying the pathways of postsecondary STEM education for Asian Americans and their subgroups, a more thorough understanding of their STEM educational experiences can be obtained. Second, this study uses a relatively recent large-scale national data set, the Education Longitudinal Study of 2002 (ELS: 2002), to trace students from postsecondary enrollment to degree completion. These results have a greater generalizability for current student populations. Third, there is a lack of agreement on the definition and classification of STEM. This study deals with this challenge by suggesting a justifiable definition and classification of STEM. Fourth, there is a lack of a commonly agreed upon definition and classification of Asian Americans. This study intends to provide a reasonable definition and classification of Asian Americans. Fifth, through understanding the related factors of STEM education pathways, the results can be used to inform policy and practice for improving postsecondary STEM education enrollment and completion. For example, results can be utilized to assist Asian American students and their families to be better prepared for STEM education.

The reasons for focusing on the Asian American population as well as on postsecondary STEM education pathways are elucidated. Furthermore, this section provides definition and classification of STEM and Asian Americans, respectively. In the end, research questions are listed out.

Why focus on the Asian American population?

Asian Americans as a whole are increasingly becoming more visible in the US. While the Asian American population[1] constitutes only 5 percent of the total population in the US, this percentage is rising rapidly (The Asian Population, 2010). For example, from the year 2000 to 2010, the total US population grew 9.7 percent, but the Asian American population increased with 45.6 percent. Therefore, with more and more Asian Americans living in the US, it is crucial to learn about their experiences. Among these, Asian Americans' education occupies a vital position. Nowadays, for instance, a great amount of articles in the *New York Times* discuss Asian Americans' academic performance, college enrollment, as well as the possible educational obstacles they may face.

It is essential to highlight the diversity of people from Asian backgrounds. Tran and Birman (2010) reviewed a series of papers on Asian Americans' academic performance, in which they suggested the importance of looking at the differences within Asian Americans. Also, in order to serve different Asian American students better, we need to analyze these differences and understand how they work.

[1] Currently, there is no formal definition of Asian Americans can help to distinguish this population from the Asian population as a whole in the US. Therefore, in this study, Asians in the US are regarded as Asian Americans, when it is not possible to know the actual status of those Asians (e.g., international students).

Thus, this study targets not only on Asian Americans as a whole, but also Asian American subgroups.

Why study the postsecondary STEM education pathways of Asian Americans?

The study of the STEM education in itself is particularly important, inasmuch as, nowadays, STEM is part of the future well-being of a country. For example, in 2010, Barack Obama stated,

> Whether it's improving our health or harnessing clean energy, protecting our security or succeeding in the global economy, our future depends on reaffirming America's role as the world's engine of scientific discovery and technological innovation. And that leadership tomorrow depends on how we educate our students today, especially in math, science, technology and engineering.

Research on the postsecondary STEM education for Asian Americans is intriguing. The general consensus among many researchers (Wong, et al., 1998; Wong & Halgin, 2006; Zhao & Qiu, 2009) is that Asian Americans are among the highest academic achievers, which has created the image that Asian Americans are comprehensively educated students. Nevertheless, through examining the results of several studies, at the secondary education level, in comparison to White students[2], math rather than science and reading is the distinct area that Asian Americans excel at[3] (Appendix A). This is consistent with the pattern that they are more likely than White students to

[2] White students are chosen as the reference in comparison with Asian Americans, because they are usually regarded and found having better academic performance and attainment than races like Hispanics and Blacks (Ross, et al., 2012).

[3] Asian American students also tend to have better performance in terms of the overall grades/GPA than White students (Appendix A). But, relatively less research put their focus on the overall grades/GPA than the math performance, when studying the Asian Americans' academic achievement. Further, the higher overall grades/GPA of Asian Americans may result from Asian Americans' superior math performance.

take advanced math courses (Science and Engineering Indicators, 2012; Women, Minorities, and Persons with Disabilities in Science and Engineering, 1998). On the other hand, even though it is hard to conclude that Asian Americans have a superior science performance, they tend to take more advanced science courses than White students.[4] Research suggests that pre-college test performance[5] and course-taking patterns are related to students' undergraduate major choice (Hoepner, 2010; Li et al., 2009; Stanton, 2010). We can therefore assume that Asian Americans may be more likely to choose majors in STEM areas.

The examination of pathways in postsecondary STEM education

With the goal of better understanding the mechanism of STEM education at postsecondary level, this study focuses on pathways. Postsecondary enrollment pattern is first examined. Two major components of STEM pathways are STEM choice and STEM degree completion. STEM choice includes STEM choice as a whole and STEM as an individual major choice; STEM degree completion contains STEM completion as a whole and STEM individual major completion. Moreover, based on STEM as an individual major choice and STEM individual major completion, STEM individual major persistence is obtained.

Definition and Classification of STEM

The purpose is to reach a reasonable definition and classification of STEM. This is because although STEM is a widely referred to term, there is a lack of consensus on what

[4] Conger, Long and Iatarola (2009), through analyzing data from the Florida Department of Education, found among twelfth graders from 2002 to 2003, Asians were more likely than Whites to take AP/IB courses and level 3 courses (i.e. more difficult courses) in math, science, English and social studies. However, because Conger, Long and Iatarola (2009) used regional data, the external validity of their research is limited.
[5] The pre-college tests include academic achievement and aptitude tests.

constitutes STEM. National Science Foundation (NSF) uses Science and Engineering (S & E) to stand for STEM, for which includes biological/agricultural sciences, physical sciences (i.e., chemistry, physics, astronomy, and earth/ocean/atmospheric sciences), computer sciences, mathematics/statistics, engineering, psychology, and social sciences (STEM Education Data and Trends, 2013). On the other hand, a report from National Center for Education Statistics (NCES) prepared by Chen and Weko (2009) adopted a narrower definition of STEM, where computer/information sciences, engineering/engineering technologies, mathematics/statistics, and natural sciences (i.e., physical sciences and biological/agricultural sciences) are regarded as STEM fields. Table 1.1 summarizes several sources in their definitions of STEM.

Table 1.1 Disciplines in STEM by different sources

Source	Organization/ Data	STEM Disciplines
Baker & Finn (2008)	NELS: 88[1]	Agriculture Biology Chemistry Computer and Information Engineering and Engineering Technology Geology Health Mathematics Physics and Astronomy Social Science
Chen & Weko (2009)	NCES	Computer/Information Sciences Engineering/Engineering Technologies Mathematics/Statistics Natural Sciences (i.e., Physical Sciences and Biological/Agricultural Sciences)
Department of Homeland Security (2013)	Department of Homeland Security	Actuarial Science Biological and Biomedical Sciences Computer Science Applications Engineering Engineering Technologies Mathematics and Statistics Medical Scientist Military Technologies Physical Sciences Science Technologies
Ma (2011)	NELS: 88	Computer Science Engineering (of all sorts) Life Science Mathematics Physical Science
Riegle-Crumb & King (2010)	ELS: 2002[2]	Physical Science and Engineering (e.g., Mathematics and Computer Science) Biological Science
STEM Education Data and Trends (2013)	NSF	Biological/Agricultural Sciences Computer Sciences Engineering Mathematics/Statistics Physical Sciences (i.e., Chemistry, Physics, Astronomy, and Earth/Ocean/Atmospheric sciences) Psychology Social Sciences

Notes: [1]NELS: 88 stands for National Education Longitudinal Study of 1988 which is a nationally representative longitudinal study. In 1988, 8th graders were recruited and followed up in 1990, 1992, 1994, and 2000.
[2]ELS: 2002 stands for Education Longitudinal Study of 2002 which is a nationally representative longitudinal study. In 2002, 10th graders were recruited and followed up in 2004, 2006, and 2012.

In this study, Chen and Weko's (2009) categorization of STEM is adopted (Table 1.1), though one adjustment is made, that is, physical sciences and biological/agricultural sciences are separated into two areas rather than being regarded as one field. Thus, STEM is classified as biological/agricultural sciences, computer/information sciences, engineering/engineering technologies, mathematics/ statistics, and physical sciences. There exist three major reasons for this classification. First, Chen and Weko's (2009) definition excludes disciplines such as social sciences and psychology in that as the researchers point out, many federal and state legislative efforts do not consider disciplines like social sciences and psychology as belonging to STEM. Second, this study intends to analyze ELS: 2002 data, thus the classification of Chen and Weko (2009) is suitable for analysis purpose. Third, some researchers indicate there are potential differences between physical sciences and biological/agricultural sciences (Riegle-Crumb & King, 2010; Riegle-Crumb, King, Grodsky & Muller, 2012).

By using the STEM classification of this study, the actual data informs the necessity of it. For instance, after recalculating the data provided by NSF, in 2010, approximately 16 percent of all awarded Bachelor's degrees were STEM degrees (STEM Education Data and Trends, 2013). In particular, among the awarded Bachelor's degrees in STEM, 42 percent were in biological/agricultural sciences, 28 percent were in engineering/engineering technologies, 15 percent were in computer/information sciences, 9 percent were in physical sciences, and 6 percent were in mathematics/statistics.

Definition and Classification of Asian Americans

In order to have a clear understanding of the educational experiences of Asian Americans, it is imperative to know who constitutes this population, for which this part deals. Additionally, with regards to Tran and Birman's (2010) research[6], this part differentiates Asian Americans into subgroups based on their geographical location and generational status.

Who constitutes Asian Americans?

While there is a lack of consensus on the definition of Asian Americans, Asians who come from east of Pakistan and are either native-, foreign-born, or permanent residents of the US are usually regarded as Asian Americans (Zhou & Lee, 2004). The US Census of Population and Housing (2010) provides a similar definition, by which Asian Americans are those who come from or have origins in the Far East, Southeast Asia, or the Indian subcontinent. Therefore, people who come from or originate in middle or west Asian countries, such as Iran and Lebanon, are not widely regarded as Asian Americans.

Based on definitions and studies of Asian Americans (Kitano & Daniels, 1988; Ling & Austin, 2010; Min, 1995; US Census of Population and Housing, 2010; Zhou & Lee, 2004), in this study, people who come or originate from around twenty-three Asian countries are referred to as Asian Americans (Table 1.2). Among these Chinese, Filipino, Indian, Japanese and Korean Americans, followed by Cambodian, Laotian and Vietnamese Americans are most frequently

[6] Tran and Birman (2010) regarded Asian Americans differed in their geographical location and generational status. They pointed out much of the research related to Asian Americans do not provide a theoretical reason for grouping Asian Americans of different country origins. In addition, the generational differences of Asian Americans are usually not studied (or at least not fully).

studied (Kitano & Daniels, 1988; Min, 1995; Nakanishi & Nishida, 1995; Ono, 2005; Park & Chi, 1999; Zhou & Lee, 2004).

Table 1.2 Country, language and population information of Asian Americans

Country	Official or National Language	Asian Alone Population		
		2000	2010	% Change
Bangladesh	Bengali	46,905	142,080	202.9
Bhutan	Dzongkha	192	18,814	9,699.0
Brunei	Malay, English			
Cambodia	Central Khmer	183,769	255,497	39.0
China	Mandarin Chinese	2,564,190	3,535,382	37.9
India	Hindi, English	1,718,778	2,918,807	69.8
Indonesia	Indonesian	44,186	70,096	58.6
Japan	Japanese	852,237	841,824	-1.2
Korea (North, South)	Korean	1,099,422	1,463,474	33.1
Laos	Lao	179,103	209,646	17.1
Malaysia	Malay	15,029	21,868	45.5
Maldives	Maldivian	29	102	251.7
Mongolia	Halh Mongolian	3,699	15,138	309.2
Myanmar	Burmese	14,620	95,536	553.5
Nepal	Nepali, English	8,209	57,209	596.9
Pakistan	Urdu, Sindhi, English	164,628	382,994	132.6
Philippines	Filipino, English	1,908,125	2,649,973	38.9
Singapore	Mandarin Chinese, Malay, Tamil, English	2,017	4,569	126.5
Sri Lanka	Sinhala, Tamil	21,364	41,456	94.0
Thailand	Thai	120,918	182,872	51.2
Timor-Leste	Tetun, Portuguese			
Viet Nam	Vietnamese	1,169,672	1,632,717	39.6

Note: Table based on information from Lewis (2009) and The Asian Population (2010).

Table 1.2 presents three features of the Asian American population. First, Chinese, Indian, Filipino, Vietnamese and Korean Americans largely make up the Asian American population (over 80 percent). Second, from 2000 to 2010, every segment of the Asian American population in the US experienced growth, though in different degrees, with the exception of the Japanese population where there was basically no change. Third, English is the official or national language for six of twenty-three Asian countries, which implies that more recent Asian American immigrants from these countries may face fewer language problems. These three features alone suggest the essentiality of not viewing Asian Americans as one group. The reasons are: first, the characteristics of smaller Asian American groups may be unknown; second, the different growth rates of Asian American ethnic groups may result from different immigration experiences; third, variation in English proficiency can result in varied immigration experiences.

Asian American subgroups

In this study, Asian Americans differences are viewed through the lenses of the geographical location and generational status. Accordingly, the Asian American subgroups are divided into geographical and generational subgroups, respectively.

Geographical subgroups

While it is tempting to study and compare Asian Americans of different country origins[7], considering the feasibility of analyzing data, this study grouped the country origins of Asian Americans into East, Southeast and South Asia. The grouping is based on information from National Education Longitudinal Study of 1988 (NELS: 88), Education Longitudinal Study of 2002 (ELS: 2002), High School Longitudinal Study of 2009 (HSLS: 09) and the Asian and Pacific Islander Institute on Domestic Violence (APIIDV) (see Table 1.3).[8]

[7] Some researchers claimed Asian Americans tend to view themselves as belonging to their respective Asian country of origin; for example, Indian Americans tend to view themselves as Indian Americans rather than view themselves as members of a bigger Asian American cluster, such as South Asian Americans (Kodama & Abreo, 2009; Lien, Conway & Wong, 2003).
[8] Based on NELS: 88, ELS: 2002, and HSLS: 09, Mongolia is excluded from the twenty-three Asian countries.

Table 1.3 Asian American Classification

Category	Asians
National Education Longitudinal Study of 1988 (NELS: 88)	
Chinese	
Filipino	
Japanese	
Korean	
Southeast Asian	Vietnamese, Laotian, Cambodian, Thai, etc.
South Asian	Indian, Pakistani, Bangladeshi, Sri Lankan, etc.
Other Asian	
Education Longitudinal Study of 2002 (ELS: 2002)	
Chinese	
Filipino	
Japanese	
Korean	
Southeast Asian	Vietnamese, Laotian, Cambodian, Thai, Burmese
South Asian	Indian, Bangladeshi, Sri Lankan
High School Longitudinal Study of 2009 (HSLS: 09)	
Chinese	
Filipino	
Southeast Asian	Vietnamese, Thai, etc.
South Asian	Indian, Sri Lankan, etc.
Other Asian	Korean, Japanese, etc.
Asian & Pacific Islander Institute on Domestic Violence (APIIDV)	
East Asian	Chinese, Japanese, Korean (South, North)
Southeast Asian	Bruneian, Burmese, Cambodian, Filipino, Indonesian, Laotian, Malaysian, Singaporean, Timorese, Thai, Vietnamese
South Asians	Bangladeshi, Bhutanese, Indian, Maldivians, Nepali, Pakistani, Sri Lankan

Note: Table based on information from NELS (1988), ELS (2002), HSLS (2009) and APIIDV (2012).

Information from Table 1.4 indicates potential differences exist between the Asian American geographical subgroups, which proves the necessity of examining the differences between these subgroups. For example, on average, among people over twenty-five years old, East Asian Americans are more likely to graduate from high school (89.1 percent) and obtain Bachelor's degrees (30.9 percent), followed by South Asian Americans (high school :82.5 percent; Bachelor's degree: 27.6 percent), and Southeast Asian Americans (high school: 78.9 percent; Bachelor's degree: 25.1 percent). In contrast, South Asians have a higher probability of gaining a graduate or professional degree (23.8 percent) than East Asians (20.0 percent), while Southeast Asians are the least likely to have more advanced degrees (11.1 percent). Combined, it seems that East and South Asian Americans won an edge over Southeast Asian Americans in education attainment. On the other hand, indeed, there are variations within each of the geographical subgroups (see Table 1.4), but due to the limitation in the size of the available data, this study does not further divide the geographical subgroups.

Table 1.4 Education attainment and median Income by Asian American geographical subgroups

Asians	Educational Attainment (population twenty-five years and older)				Median Family Income
	Less than High School	Bachelor's Degree	Graduate or Professional Degree	Bachelor or Higher	
			East Asian		
Chinese	18.5%	26.1%	26.5%	52.6%	81,107
Japanese	5.6%	32.0%	15.3%	47.3%	90,163
Korean (North, South)	8.6%	34.6%	18.3%	52.9%	64,401
Average	10.9%	30.9%	20.0%	50.9%	78,557
			Southeast Asian		
Burmese	27.6%	26.3%	12.4%	38.7%	48,024
Cambodian	37.5%	11.5%	3.0%	14.5%	49,338
Laotian	34.1%	9.6%	2.5%	12.1%	56,485
Thai	16.5%	26.3%	16.5%	42.8%	62,926
Vietnamese	28.5%	19.0%	7.3%	26.3%	59,450
Sub-average	28.8%	18.5%	8.3%	26.9%	55,245
Filipino	7.9%	39.7%	8.5%	48.2%	86,354
Indonesian	6.4%	33.2%	15.5%	48.7%	66,916
Malaysian	10.0%	34.9%	23.1%	58.0%	77,292
Sub-average	8.1%	35.9%	15.7%	51.6%	76,854
Average	21.1%	25.1%	11.1%	36.2%	63,348
			South Asian		
Bangladeshi	16.5%	27.3%	22.3%	49.6%	47,008
Bhutanese	49.0%	14.2%	1.7%	15.9%	16,600
Indian	8.9%	32.5%	38.2%	70.7%	99,017
Nepali	10.3%	32.4%	27.2%	59.6%	53,779
Pakistan	13.4%	30.6%	24.6%	55.2%	65,479
Sri Lanka	7.0%	28.8%	28.5%	57.3%	78,755
Average (without Indian and Bhutanese)	11.8%	29.8%	25.7%	55.4%	61,255
Average	17.5%	27.6%	23.8%	51.4%	60,106

Notes: 1. Table based on information from American Community Survey (ACS) five-year selected population tables (2010).

2. Data for Bruneian, Maldivian, Singaporean, and Timorese are not available.

Generational subgroups

In terms of the generational status, US census (2013) categorizes people into three generational groups: first, second, and third-or-higher. More specifically, it defines the first generation as people "who are foreign born," the second generation as people "with at least one foreign-born parent," and the third-or-higher generation as people "with two US native parents." Therefore, it is a person's birthplace or their parents' that decides which generation they belong to.

However, the US census (2013) does not state whether people's parents should be US or foreign born when defining first generation and whether people should be US or foreign born when defining second and third generations[9]. In this study, first generation is regarded as foreign-born people with foreign-born parents. Second generation is regarded as US-born people with at least one foreign-born parent. Third generation is regarded as US-born people with US-born parents. There are two main reasons for modifying the US census definition of generational status. First, foreign-born people with at least one US-born parent may not share similar characteristics as US-born people with at least one US-born parent (second and third generations), especially when considering those foreign-born people may come to the US in a relatively older age. Second, foreign-born people with at least one US-born parent may also not share similar characteristics as foreign-born people with foreign-born parents. Table 1.5 was constructed following the modified definition of generation status.

Table 1.5 Generational status by children and parents' birthplaces

		Parents' Birthplace		
		Both US	One Foreign	Both Foreign
Child's Birthplace	US	3rd Generation	2nd Generation	2nd Generation
	Foreign	———	———	1st Generation

[9] In this study, third generation stands for third-or-higher generation.

With the modified classification of generational status, this study contains generational subgroups: first-, second-, and third-generation Asian Americans.

Research Questions

This study aims to understand Asian American students' postsecondary STEM education pathways. This understanding includes learning Asian American students' performance in relation to White students and the possible dissimilarities between Asian American subgroups. Additionally, factors that may influence Asian American students' postsecondary STEM education pathways are examined. Specifically, by separating STEM education pathways into six components, the research questions are subsequently grouped into 6 research topics.

Topic one is postsecondary education enrollment. It has two purposes: first, to understand Asian American students' postsecondary enrollment in relation to their White peers; second, to examine the Asian American subgroup differences in college enrollment as classified by geographical origin and generational status. The covariates include demographic characteristics, high school type, parental influence, high school academic preparation, and high school STEM occupation expectation. The research questions are as follows:

1.1. Were Asian American students more likely than White students to enroll in postsecondary education? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

1.2. Were there differences among Asian American geographical and generational subgroups in postsecondary education enrollment? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Topic two is postsecondary STEM choice as a whole.[10] It has two purposes: first, to understand whether there is any difference between Asian American and White students in choosing versus not choosing STEM as their field of study; second, to examine STEM choice among Asian American geographical and generational subgroups. The covariates contain demographic characteristics, high school type, parental influence, high school academic preparation, high school STEM occupation expectation, and postsecondary education level. The research questions are as follows:

2.1. Were Asian American students more likely than White students to choose a major in STEM fields (versus non-STEM fields)? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

2.2. Were there differences among Asian American geographical and generational subgroups in choosing a major in STEM fields (versus non-STEM fields)? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Topic three is postsecondary STEM as an individual major choice. Unlike the postsecondary STEM choice as a whole, this topic explores the disparities between different STEM fields. It has two aims: first, to understand whether there is any difference between Asian

[10] It focuses on high school graduates who enrolled in either 2- or 4-year universities.

American and White students in choosing different STEM majors; second, to examine STEM major choice among Asian American geographical and generational subgroups. The covariates are demographic characteristics, high school type, parental influence, high school academic preparation, high school STEM occupation expectation, and postsecondary education level. The research questions are as follows:

3.1. Were Asian American students more likely than White students to choose all kinds of STEM fields? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

3.2. Were there differences among Asian American geographical and generational subgroups in choosing different STEM fields? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Topic four concerns postsecondary STEM completion as a whole. Its aims are: first, to understand whether there is any difference between Asian American and White students in acquiring a degree in the STEM fields versus out of the STEM fields; second, to examine STEM completion among Asian American geographical and generational subgroups. The covariates include demographic characteristics, high school type, parental influence, high school academic preparation, high school STEM occupation expectation, and postsecondary education level. The research questions are as follows:

4.1. Were Asian American students more likely than White students to obtain a degree in STEM fields (versus non-STEM fields)? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

4.2. Were there differences among Asian American geographical and generational subgroups in obtaining STEM degrees (versus non-STEM degrees)? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Topic five focuses on postsecondary STEM individual major completion. Its goals are: first, to understand whether there is any difference between Asian American and White students in acquiring degrees from different STEM fields; second, to examine STEM major completion among Asian American geographical and generational subgroups. The covariates include demographic characteristics, high school type, parental influence, high school academic preparation, high school STEM occupation expectation, and postsecondary education level. The research questions are as follows:

5.1. Were Asian American students more likely than White students to earn degrees in all STEM fields? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

5.2. Were there differences among Asian American geographical and generational subgroups in earning degrees in STEM fields? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Topic six is about the postsecondary STEM individual major persistence. Persistency is measured based on STEM major choice and STEM major completion variables. Its aims are: first, to understand whether there is any difference between Asian American and White students in STEM persistence; second, to examine STEM persistence among Asian American geographical and generational subgroups. The covariates include demographic characteristics, high school type, parental influence, high school academic preparation, high school STEM occupation expectation, and postsecondary education level. The research questions are as follows:

6.1. Were Asian American students more likely than White students to persist in all STEM fields? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

6.2. Were there differences among Asian American geographical and generational subgroups in persisting in STEM fields? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Chapter 2. Literature Review

This chapter has two main objectives. The first is to identify what is known and unknown about Asian American students' postsecondary STEM education. The second is to locate factors relevant to Asian American students' postsecondary STEM education. Together, the literature review can assist in deciding variables included in the actual analysis and the composition of these variables.

To realize the first objective, Asian American students are examined both as a whole and as subgroups. To fulfill the second objective, relevant factors are examined from the aspects of student, family, and school.

Asian Americans and STEM Education

Relatively few studies have focused on Asian Americans' STEM education. And there are hardly any studies that explore Asian American variations in STEM education areas, much less the classifications this study suggested for Asian Americans and STEM. Given the limitation of the available research, in this section, when possible and necessary, results from existing studies are clustered by Asian American subgroups and STEM education areas.[11]

Comparing Asian American students as a whole with White students

According to *Science and Engineering Indicators* (2012), Asians generally had a higher tendency to major in STEM in undergraduate education than Whites. For example, in 2010, 39.4 percent of Asian American freshmen reported their tendency to major in STEM, which was higher than Whites (at 26.4 percent) (Table 2.1). A closer examination of different STEM areas

[11] I made this based on prior research.

revealed that the racial gap in STEM tendency was the largest for engineering (5.9 percent difference) in 1995; computer science (7.2 percent difference) and engineering (6.1 percent difference) in 2000; biological or agricultural sciences (8.7 percent difference) and engineering (5.8 percent difference) in 2005; and biological or agricultural sciences (7.5 percent difference) and engineering (4.2 percent difference) in 2010. The results imply that Asians gradually rise in their tendency to major in biological or agricultural sciences, with engineering gaining their favor as well.

Table 2.1 Comparing Freshmen's Intention to Enroll in STEM Majors between Asians and Whites (in percentage)[a]

Course by Race	1995	2000	2005	2010
White				
Physical Sciences	2.5	2.0	2.4	2.8
Biological/Agricultural Sciences	9.3	6.7	7.1	10.8
Mathematics/Statistics	0.7	0.7	0.8	0.9
Computer/Information Sciences	2.5	4.3	1.5	1.4
Engineering	7.5	8.3	8.0	10.5
Asian American[b]				
Physical Sciences	1.9	1.4	2.2	3.0
Biological/Agricultural sciences	13.2	10.5	15.8	18.3
Mathematics/Statistics	0.6	0.6	0.9	1.2
Computer/Information Sciences	5.3	11.5	1.5	2.2
Engineering/Engineering Technologies	13.4	14.4	13.8	14.7

Notes: a. This table was adapted from *Science and Engineering Indicators* (2012) based on Chen and Weko's (2009) definition of STEM majors;
b. The definition of Asian Americans is not the same as in this study, so readers should interpret it with caution.[12]

An earlier study conducted by Chen and Weko (2009) provides supplemental results on STEM major enrollment. The researchers analyzed Beginning Postsecondary Students Longitudinal Study (BPS: 96/01), which is a nationally representative data set. Results show

[12] According to *Science and Engineering Indicators* (2012), in 1997 Asian Americans included Chinese, Filipino, Japanese, Korean, Southeast Asian and Other Asian population; in 2001 Native Hawaiian/Pacific Islanders were added to Asian Americans.

Asian Americans were more likely to study STEM than Whites (47.4 percent compared with 21.5 percent). Table 2.2 provides more information. When comparing Table 2.2 with Table 2.1 (especially in 2000), patterns show consistency. First, Asian students in general had higher inclination and enrollment in STEM majors than White students; second, Asians had higher inclination and enrollment in biological sciences, engineering, and computer sciences (in 2000) than the other STEM areas; third, Asian American students exhibited a lower tendency and enrollment in math than the other STEM areas, which is significant, since Asian American students, on average, excel at math in secondary school. Nonetheless, considering that Chen and Weko's (2009) definition of Asian Americans differs from this study, the generalizability and internal validity of the results are weakened.[13] Moreover, because Chen and Weko used earlier data than the *Science and Engineering Indicators* (2012), its generalizability is further reduced. For example, Table 2.1 indicates that the percentage for the inclination to major in computer sciences reduced greatly in 2005 and 2010. However, because the data Chen and Weko (2009) analyzed does not provide information about these years, it is unknown whether the enrollment in computer sciences was actually reduced in 2005 and 2010, or whether there was a gap between students' inclination and enrollment.

[13] Chen and Weko (2009) considered Native Hawaiians as Asian Americans. Additionally, they did not clearly state who composed the Asian American population

Table 2.2 Comparing STEM Major Enrollment (between 1995-96 and 2001) between Asian and White students (in percentage)

STEM area	Asian American	White
Total STEM Entrance	47.4	21.5
Mathematics/Statistics	1.1	1.1
Total Natural Science Entrance	19.1	7.8
Physical Sciences	4.3	1.6
Biological/Agricultural Sciences	15.9	6.5
Engineering/Engineering technologies	15.0	8.4
Computer/Information Sciences	14.9	5.7

Notes: a. This table was adapted from Chen and Weko (2009);
b.The definition of Asian Americans is not as same as in this study, so readers should interpret it with caution.
c. According to Chen and Weko (2009) "estimates for entering specific STEM fields do not sum to the total because some students entered more than one STEM field" (p.9).

To sum up, Asian American students are more likely than White students to choose STEM majors. Asian Americans' STEM major choices are generally consistent with their inclinations. Asian Americans continue to be increasingly inclined toward majoring in biological and agricultural sciences. This may be due to reasons such as the increasing economic return of biological and agricultural science majors; Goyette and Mullen (2006) mention that Asians are more likely to enter fields with higher earnings or status potential.

Comparing Asian American subgroups

No research is found that actually compares and examines the geographical subgroups of Asian Americans according to their postsecondary majors, especially STEM majors. This may be explained by the following: 1) there is no difference between Asian American subgroups in terms of their postsecondary major choice, 2) existing subgroup differences may not have caught the attention of prior researchers, and 3) the limitation of the available data, or perhaps there are other explanations that remain unexplored.

Similarly, no study is found comparing Asian American generational subgroups as defined in this study. However, Bagasao (1983), analyzing 226 Asian Americans from High School and Beyond (HS&B), found that the length of time spent in the US was associated with postsecondary major choice.[14] In particular, the longer Asian American students stayed in the US, the less likely they were to choose science majors.[15] Namely, the longer Asians stayed in the US, the more likely they were to choose non-science majors. According to this finding, my hypothesis is that first-generation Asian Americans are more likely to choose STEM majors than second-and third-generation Asians.

Moreover, Bagasao (1983) found that even within science majors, Asian American students had different preferences, with longer time spent in the US associated with lesser preference for choosing applied science majors (e.g., engineering and computer science).[16] Thus, it seems Asian American generational subgroups not only differ in choosing STEM majors over non-STEM majors, but they also differ in their preferences for choosing the kinds of STEM areas. More specifically, first-generation Asian American students may be more likely to choose applied STEM majors than second- and third-generation Asian American students.

However, the data Bagasao (1983) utilized is a relatively earlier data set; therefore, the findings may not be generalizable to the current Asian American population. Also, because of the relatively small sample size, a lack of weighting, and the different definition of Asian Americans, the generalizability and internal validity of Bagasao's (1983) study are further

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[14] HS&B is a nationally representative longitudinal data set, which is one of the five studies that make up NELS program (NELS: 88 is also one of them). It includes two cohorts—one is the 1980 senior class, the other is the 1980 sophomore class. Both of them were surveyed every two years through 1986, with the 1980 sophomore class being surveyed again in 1992.

[15] Bagasao (1983) regarded majors like engineering and computer science as science majors.

[16] Considering this, I regrouped the five STEM areas into non-applied (math/statistics and physical sciences), intermediate (biological/agricultural sciences), and applied (computer/information sciences and engineering/engineering technologies) areas.

weakened.[17] Even worse, Bagasao did not employ the same STEM definition and classification as this study, and nothing about biological or agricultural sciences was touched upon. In all, though the research of Bagasao (1983) sheds some light on the generational subgroup differences in STEM major choice, the findings need to be understood with caution.

To sum up, there is currently a lack of research comparing Asian American geographical and generational subgroups (as defined in this study) with regard to their postsecondary major choice, particularly STEM majors. Thus, it remains unknown whether there is any variation between Asian American geographical subgroups in STEM major choice. For Asian American generational subgroups, it seems first-generation Asian American students may be more likely to choose STEM majors, especially applied STEM majors, followed by second- and then third-generation Asian American students. However, this conclusion needs to be tested in the future. Furthermore, the interaction effect between Asian American geographical and generational subgroups on major choices needs to be studied.

Factors Related to Asian American students' STEM Education

Selections of related factors for Asian American students' STEM education are based on the findings of relevant literature that do not necessarily need to focus on Asian Americans. I group these factors into three aspects according to the existing literature and the underlying connections between the factors. The first aspect, academic preparation in secondary education, includes academic test performance and course-taking patterns. The second aspect, STEM expectation and plan in secondary education, consists of students' STEM education/career expectation as well as career plan. The last aspect, background and school variables, contains

[17] The Asian American sample being used in Bagasao's (1983) study included Chinese, Filipino, Japanese, Korean, Vietnamese and Other Asians.

parental influence, SES, English proficiency, gender, high school type, and postsecondary education level.

Academic preparation in secondary education

Crisp, Nora, and Taggart (2009) analyzed data from a large doctoral-granting Hispanic Serving Institution.[18] Results show SAT math score was positively associated with declaring a STEM major and earning a STEM degree. This implies the existence of the relationship between pre-college aptitude test performance and postsecondary STEM education. However, according to the research of Crisp, Nora, and Taggart (2009), the relative status of the aptitude test performance to course taking is nebulous.

Findings from Ma (2010) can offer an answer to this question. The researcher analyzed NELS: 88. After dividing the analyses by gender, she tested the effects of achievement tests and course taking in high school on STEM expectation, STEM choice, and STEM completion, individually.[19] Three basic patterns emerged from the results. First, taking courses in physics, computer, and calculus all together had the strongest relationship with all of the three dependent variables, regardless of people's gender. For instance, the odds of choosing a STEM major (versus non-STEM major) for female students taking more physics, computer, and calculus courses in high school was about 44 percent higher than the odds of choosing a STEM major for female students taking fewer upper level courses in physics, computer, and calculus. Second, the effect of taking courses in biology and chemistry on the three dependent variables (especially for STEM expectation and STEM choice) varied by people's gender. More specifically, taking high

[18] Students being included in their research earned an undergraduate degree in fall and spring semesters between 2006 and 2008.
[19] STEM expectation, STEM choice, and STEM completion are three dummy-code variables.

school courses in biology and chemistry tended to be associated with the dependent variables for women rather than for men. Third, as for the achievement tests, science achievement tends to relate to all of the dependent variables, while math achievement has no relation to the dependent variables.

To conclude, course taking tends to matter more than academic test performance in the relationship with postsecondary STEM education. In addition, different STEM areas do not follow unanimous patterns.

STEM expectation and plan in secondary education

Notwithstanding the results from the previous studies (Crisp, Nora, & Taggart, 2009; Ma, 2010), Maltese and Tai's research (2011)[20] implies that students' high school expectations and plans toward STEM weigh more heavily than high school course taking and academic test performance (i.e., academic preparation). Their results show that initially course-taking and academic achievement variables were significantly related with STEM degree completion. However, after taking account of both background (e.g., race) and postsecondary variables (e.g., grades), the effects of course taking and academic achievement on STEM degree completion basically disappeared. Instead, the *8th graders who expect a STEM career at age 30* and especially the *12th graders who plan a STEM major* had stronger associations with STEM degree completion.[21] Therefore, Maltese and Tai (2011) believed that high school STEM expectations and plans mattered more than high school course taking and academic achievement in deciding the STEM degree completion. The conclusion reached by Maltese and Tai (2011) conveys the

[20] NELS: 88 was analyzed in Maltese and Tai's research. The sample was limited to students who were present from eighth grade (1988) to their midtwenties (2001).
[21] 8th graders' expectation of a STEM career at age 30 and 12th graders' planned STEM major were both regarded as STEM attitude/interest variables by Maltese and Tai (2011).

idea that STEM expectation and plan in high school can decide STEM course taking and academic test performance which in turn determine the STEM degree completion.

Therefore, I suggest that high school STEM expectations and plans are the possible variables that outpace the importance of course taking and academic test performance. Nonetheless, the discordance among the prior research regarding which variables were included and how they were defined makes it difficult to comprehend the associations of high school course taking, academic test performance, and STEM expectation and plan with postsecondary STEM education.

Background and school variables

From my review of the literature, certain secondary education experiences do relate to postsecondary STEM education. Correspondingly, variables that relate to these secondary education experiences may also yield relationships with postsecondary STEM education. Hence, I review studies with either academic preparation[22] or postsecondary STEM education as the dependent variable to locate related background variables.

Parents' influence

By analyzing NELS: 88, Kao and Tienda (1995) examined the effect of parental education on eighth graders' academic performance. Their findings indicate that parents' education was positively associated with academic performance, though there was no significant difference between parents who had master's or doctoral degrees.[23]

[22] High school STEM expectation and plan are hardly being studied as the dependent variable.
[23] I examined whether there was any statistical significant difference between parents who had master's and doctoral degrees on dependent variables.

Next, the researchers (Kao & Tienda, 1995) tested generational subgroup differences according to family rules, family communication, and parental participation. For family rules, parents of first-generation students were less likely to have rules about household chores than parents of third-generation students. Concerning family communication, parents of first-generation students were on average less likely than parents of third- generation students, followed by parents of second-generation students, to talk with their children about school experiences, high school and post-high school plans. For parental participation, first-generation parents were least likely to belong to parent-teacher groups, attend parent-teacher activities, and volunteer at school, but they were more likely to go to parent-teacher meetings[24] and most likely to provide a place to study. In general, it seems that first-generation parents were less likely than third- generation parents, followed by second-generation parents, to focus on things that were not directly academically oriented.[25] This may elucidate why in general third-generation Asian American students had the worst overall academic performance.

In addition, through re-analyzing the results of Goyette and Xie's (1999) research, [26] I obtained Asian American geographical subgroup differences and differences between Asian Americans and Whites in parent's expectation. That is, South Asian American parents were found to have the highest expectations, followed by East and Southeast Asian Americans, and then Whites.

In conclusion, it seems that parents may play some role in affecting students' academic performance. Currently, a problem for research on parental influence variables is that prior

[24] Second-generation parents were mostly likely to go to parent-teacher meetings.
[25] The concept of academically oriented things is based on researchers' claim. I regard academically oriented things as things have more direct influence on academic performance.
[26] The researchers used NELS: 88.

researchers do not have a shared definition for variables like parental participation versus family obligations.

SES

By using NELS: 88[27], Goyette and Mullen (2006) studied the effect of SES on whether students could enter arts and science majors versus vocational majors in 4-year colleges.[28] After controlling for variables such as race and college type, their results showed SES had a positive effect on the likelihood of a student entering arts and science majors.[29] In other words, students with higher SES were more likely to choose arts and science majors, while students with lower SES were more likely to choose vocational majors. Since in this study STEM education contains five different areas, some of which can be more vocational inclined while the others can be more non-vocational inclined, an effect of SES can be expected.

After I grouped Asian Americans in Goyette and Xie's (1999) research, South Asian Americans had the highest SES on average, followed by East and Southeast Asian Americans.[30] Therefore, Asian American geographical subgroup differences in STEM major choice can be assumed. Additionally, Kaufman, Chavez, and Lauen (1998),[31] using eighth graders in NELS: 88, compared Asian American generational subgroups according to their SES[32]. The results indicated first-generation students had the lowest SES, followed by third- and second-generation students. Combining this with the findings from Goyette and Mullen (2006), it is possible that

[27] The researchers used the second and third follow-ups of NELS: 88.
[28] SES was a composite variable of parents' education, occupation and income.
[29] Logistic regression was run to examine the effect of SES.
[30] Like Goyette and Mullen (2006), Goyette and Xie (1999) used NELS: 88 to access SES information. SES in their study includes prestige of parents' occupations, family income and parents' education.
[31] Their study was a part of the Postsecondary Education Descriptive Analysis Reports (PEDAR) series.
[32] They defined SES as parents' education and whether people living at or below poverty level, which was similar but not the same as Goyette and Mullen' (2006) study, because parents' occupation status was not included.

the lower SES of first-generation students resulted in their having the highest likelihood of choosing vocational STEM majors, followed by third- and second-generation Asians.[33] In other words, second-generation Asian American students tend to have the highest likelihood of choosing non-vocational STEM majors, followed by third- and first-generation Asian American students.[34] This somewhat contradicts Bagasao's (1983) study. In brief, from what I inferred, the first generation might have a higher tendency to choose applied STEM majors, followed by second- and third-generation Asian American students, because Bagaso (1983) stated that a shorter time in the US was associated with a higher chance of choosing applied STEM majors. Two possible explanations are: first, Bagasao (1983) did not study generational status in the way defined in this study; second, the classifications of STEM majors were different in the two studies.

Generally speaking, SES may be one of the factors that contributes to the postsecondary STEM education pathways of Asian American students. A higher SES may result in a lower likelihood of choosing vocational STEM majors, while a lower SES may result in a higher likelihood of choosing vocational STEM majors. This may provide explanations for Asian American subgroup disparities, if any, in different STEM education areas.

English proficiency

[33] However, it remains unclear whether first-, second-, or third-generation Asians had higher overall STEM major choices (i.e., non-vocational and vocational STEM majors combined) (Bagasao's (1983) study provided some information on this, page 37).

[34] Actually, second-generation Asian American students' tendency to choose non-vocational STEM majors might reflect the effect of immigrant optimism.

Barret et al. (2012) used ELS: 2002 to test both the direct and indirect effects of English proficiency[35] on tenth and twelfth graders' math achievement scores[36] through tenth graders' reports of academic motivation[37].[38] Results indicated that, for Asian American students, English proficiency was positively associated with motivation, with higher levels of English proficiency being associated with higher levels of academic motivation. Higher levels of academic motivation were positively associated with tenth and twelfth grade students' math performance, while there was no significant relationship between English proficiency and tenth and twelfth grade students' math performance. Therefore, the researchers concluded that English proficiency was "indirectly associated with higher senior math achievement scores through higher academic motivation" (p.1625). This might explain why first-generation Asian American students, on average, had better academic performance than third-generation Asian American students. That is, in my view, with reasons such as higher levels of perceived prejudice, first-generation Asian American students had higher academic motivation than their third-generation peers, which led to their superior academic performance.

An earlier research carried out by Mouw and Xie (1999)[39] tested the effect of Asian American students' language ability on math performance and GPA, respectively. Researchers grouped students into 4 language ability subgroups—fluent bilingual, English dominant, native

[35] Students' English proficiency was based on responses to four questions from the base-year data—"How well do you do the following? …understand spoken English,…speak English, …read English, and …write English" (Barret et al., 2012, p. 1622). Additionally, a higher score meant a better English proficiency.
[36] IRT-estimated scores were used.
[37] Academic motivation was a composite variable made by researchers from eight items. It included items in two areas—students' emphasis on good grades and education, and the amount of academic effort students exert.
[38] The researchers handled missing data by using Expectation Maximization (EM).
[39] The researchers used NELS: 88 to study eighth graders who were first- and second-generation Asian American students with Asian parents.

language dominant, and subtractive bilingual.[40] Essentially, the English dominant group was more likely to perform better than the other language ability subgroups in math and GPA. Considering that Mouw and Xie (1999) only studied first- and second-generation Asian American students, it is possible that second-generation Asian American students were more likely to belong to the English dominant group. The results may thus embody the immigrant optimism effect. Namely, second-generation students were the most advantaged ones, followed by first- and then third-generation students.

To sum up, English proficiency can either directly or indirectly be positively associated with academic performance which in turn can relate to college major choice. The direct effect of English proficiency is mostly embodied through the immigrant optimism effect. That is, English proficiency plays a role in deciding whether second-generation Asian American students perform better than their first-generation peers. For the indirect effect of English proficiency, factors like academic motivation may mediate the relationship between English proficiency and academic performance. This may explain why first-generation Asian American students perform better than third-generation Asian American students.

Gender

This section discusses the possible influence of gender on STEM education from three aspects. First, this part studies the gender gap in the scope of postsecondary STEM education as

[40] Fluent bilingual meant that students were fluent in both English and their parents' native language; English dominant meant students were better in English; native language dominant meant students were better in their native language; and subtractive bilingual meant students were neither fluent in English nor in their native language.

a whole. Second, it examines gender gaps in different postsecondary STEM areas. Third, it looks at the gender differences in postsecondary STEM persistence[41].

Gender gap in STEM education

In general it was found that men were the majority in postsecondary STEM education compared to women. Mann and DiPrete (2013) studied students of four cohorts by using the NLS-72 (Cohort 1), HS & B (Cohort 2), NELS: 88 (Cohort 3), and ELS: 2002 (Cohort 4). It appeared that women of all cohorts were less likely than their male peers to major in STEM areas. For Cohort 1 through 4, the odds of majoring in postsecondary STEM education for women were respectively 50 percent, 65 percent, 62 percent, and 60 percent less than the odds of majoring in postsecondary STEM education for men. The results of Mann and DiPrete's (2013) research exhibited that gender gap in STEM choices was the smallest for students of Cohort 1 and basically remains the same for students of Cohort 2, 3, and 4. In terms of STEM degree completion, Ma (2011), by analyzing NELS: 88, finds the odds of gaining a STEM degree for female students was 38 percent lower than the odds of gaining a STEM degree for males.

Disparities in STEM majors are associated with gender. By analyzing BPS: 96/2001, Chen and Weko (2009) revealed that the gender gap was the greatest in regard to entering into engineering/engineering technologies (males: 15.1 percent versus females: 2.7 percent), followed by entrance into computer/information sciences (males: 9.3 percent versus females: 4.3 percent), biological/agricultural sciences (males: 8 percent versus females: 6.3 percent), mathematics/statistics (males: 1.7 percent versus females: 0.7 percent), and physical sciences (males: 1.7 percent versus females: 1.3 percent).

[41] In this study, STEM persistence is regarded as the persistence/consistency of STEM major choice and STEM degree attainment.

Gender difference was also observed in STEM persistence. Chen and Weko (2009) uncovered a gender gap in STEM persistence. In particular, among people who began their postsecondary education between 1995 and 1996 and chose a major in STEM (BPS: 96/2001), as of 2001, 28.4 percent of females versus 25.5 percent of males attained a bachelor's degree in postsecondary STEM education. Thus, with an 18 percent gap in STEM entrance[42] (males over females) and a 2.9 percent gap in postsecondary STEM education completion (females over males), female students were more likely to persist in postsecondary STEM than male students. However, this was not in agreement with Griffith's (2010) research. Griffith's (2010) study indicated that among students who initially planned to major in a STEM field and later received a 4-year degree in that field, female students had lower persistence rates than their male peers in both NLSF and NELS: 88. The gender gap for NSLF was 6.6 percent (36.5 percent of females versus 43.1 percent of males) and for NELS: 88 was 3.5 percent (43.5 percent of females versus 47 percent of males). Since NELS: 88 is an earlier dataset than NSLF, the results suggest that the gender gap in STEM persistence enlarged as time passed.[43] Possible explanations for the inconsistency between the research of Chen and Weko (2009) and Griffith (2010) are: first, the three datasets being analyzed did not contain students of similar cohorts; second, the STEM persistence information of those two studies were not obtained based on the same duration of time;[44] third, the two studies might not adopt the same STEM definition.

High school type

[42] It not only included information of students in 4-year universities, but also students of the other postsecondary education backgrounds.
[43] This conclusion is weakened by the fact that NLSF is not a nationally representative dataset.
[44] For example, the STEM persistence information of Chen and Weko's (2009) research was gained by using BPS: 96/2001 data between 1995/96 and 2001. On the other hand, in order to acquire the STEM persistence information from the NELS: 88, Griffith (2010) needed to analyze data between 1994 and 2000.

Studying 4th and 8th graders[45] and controlling for student and school variables, Lubienski and Lubienski (2006) found that both 4th and 8th grade students in private schools[46] performed worse than public school students in math. Building upon this research, the results of Lubienski, Lubienski, and Crane (2008) presented similar patterns. The research of Braun, Jenkins, and Grigg (2006)[47] claimed, after controlling for student characteristics, that US 4th graders in private schools shared similar reading performance with their public school peers, while they performed worse than their public school peers in math. Among 8th graders, private school students performed better than public school students in reading; nevertheless, they performed as well as public school students in math. However, Peterson and Llaudet (2006) disagreed with the way Braun, Jenkins, and Grigg (2006) handled and analyzed the data. In their own research,[48] the results implied 4th and 8th graders in private schools retained their advantage in both math and reading in comparison with public school students. Likewise, through examining US high school students[49] and holding constant variables including background characteristics, Carbonaro and Covay (2010) found students in both Catholic and private-secular high schools had higher math gains than public school students, though there was no difference in math gains between students in private-other religious and public high schools.

After controlling for all the other variables (e.g., background variables), the research of Engberg and Wolniak (2010)[50] indicated that students in Catholic high schools had a higher chance of enrolling into 2-year postsecondary institutions than students in public high schools,

[45] The 2003 National Assessment of Educational Progress (NAEP) was analyzed using Hierarchical Linear Modeling (HLM).
[46] Especially Catholic and conservative Christian schools.
[47] They also analyzed 2003 NAEP using HLM.
[48] The researchers analyzed 2003 NAEP utilizing HLM. But, their models were different from that of Braun, Jenkins, and Grigg (2006).
[49] ELS: 2002 was analyzed.
[50] The researchers analyzed ELS: 2002.

while there was no difference between students in Catholic and public high schools in the enrollment of 4-year postsecondary education. Finally, there was no difference between other private high school students and public high school students in their enrollment in both 2- and 4-year postsecondary schools.

In general, without holding any other variables constant, students in private schools performed better and achieved higher than students in public schools. Nevertheless, since different researchers adopted different models, utilized different analysis methods, and analyzed different datasets in their studies the results of high school type varied. This is further complicated by the different and more detailed classifications of high school type. Thus, there is a lack of consensus on the relationship between high school type and academic performance/achievement.

Postsecondary education level

Engberg and Wolniak (2014), using ELS: 2002, ran their analyses for predicting 2- and 4-year postsecondary enrollment (versus no postsecondary education). Their study results indicated that not all of the variables played similar roles in the prediction of enrolling into either 2- or 4-year postsecondary education. For instance, the number of friends planning to attend 2-year colleges did not relate to enrolling into 2-year postsecondary institutions (versus no postsecondary enrollment), while it did associate with enrolling into 4-year schools (versus no postsecondary enrollment). By analyzing ELS: 2002, Lee (2015) found after controlling for all the other variables, taking more science courses and performing better in the ACT math test were related to a higher likelihood of enrolling into 4-year (versus 2-year) postsecondary education among students in postsecondary STEM fields. Among students in non-STEM fields, when holding constant all the other variables, taking more computer science courses was associated with a lower chance of enrolling into 4-year (versus 2-year) schools, while taking more science courses and performing better in the ACT math test were related to a higher chance of enrolling into 4-year colleges.

On the other hand, the research of Lee (2015) exhibited similarities between 2- and 4-year postsecondary schools. More specifically, regardless of the postsecondary education level (i.e., 2- and 4- year colleges), taking more units of computer sciences and science courses was associated with higher likelihood of choosing STEM majors.[51] Wang (2013), who also analyzed ELS: 2002, found that for students in both 2- and 4- year postsecondary institutions, being Asian American, being male, having higher SES, and performing better in math were associated with a higher likelihood of selecting majors in STEM fields.[52]

Summary

Through the literature review, the key findings can be summarized as follows. First, there were differences between Asian Americans and Whites in postsecondary STEM education pathways, with Asian Americans tending to have greater access in STEM. Second, there were differences among Asian American subgroups in postsecondary STEM education pathways. Third, while high school academic preparation did matter, high school STEM occupation expectation might have more influence. Fourth, family background and school variables including parental influence, SES, English proficiency, gender, high school type, and

[51] The coefficients between course taking and choosing STEM majors were similar in terms of the direction and magnitude between 2- and 4- year colleges. When $\alpha = 0.05$ (Lee (2015) used $\alpha = 0.10$), ACT math scores were positively associated with STEM major choices among students in 4-year postsecondary education, but there was no relationship between ACT math scores and STEM major choices among students in 2-year institutions.
[52] Disparities between 2- and 4- year students were also found. For instance, better science readiness for college was associated with a higher chance of choosing majors in STEM fields for 4-year college students, while science readiness for college was not related to choosing majors in STEM fields for 2-year college students.

postsecondary education level might play some role in the postsecondary STEM education pathways. However, more research was needed to obtain a better understanding of the directions of these variables in their effect on the postsecondary STEM pathways and the relative importance of these variables on the postsecondary STEM education pathways.

The major threats to the internal validity of the previous studies resulted from the lack of agreement in the definitions and classifications of STEM and Asian Americans. Taking the study of Chen and Weko (2009) as an example, the researchers regarded native Hawaiians as Asian Americans, and they did not offer a clear definition of Asian Americans. Thus, the findings about Asian Americans drew from their study might not accurately reflect the experience of Asian Americans. In terms of the external validity, the main threat came from the relatively older datasets being used. For instance, Bagasao (1983) analyzed HS&B which first surveyed high school students in 1980. Therefore, the generalizability of Bagasao's (1983) research to the current student population may be weak.

Considering the possible threats, my study provided clear definitions and classifications of Asian Americans and STEM fields based on existing definitions, classifications, and studies. Also, a more recent US national representative longitudinal dataset, ELS: 2002, was used in this study, which yielded better generalizability than the earlier datasets. Moreover, this study filled a knowledge gap on Asian American students' education experience. That is, when examining Asian American students' postsecondary STEM education pathways, Asian Americans and STEM education were studied both holistically and as subgroups.

Chapter 3. Method

Data Source

This study examines the STEM education pathways of Asian American students. The national longitudinal dataset, ELS: 2002, was used. It is a relatively recent dataset, and it is available in two formats: public-use and restricted-use data. Considering the variables of interest such as prior academic performance, this study analyzed restricted-use data.

As stated by the user's manual (Ingels, Pratt, Wilson, Burns, Currivan, Rogers, Hubbard-Bednasz, 2007), "ELS: 2002 represents a major longitudinal effort designed to provide trend data about critical transition experienced by students as they proceed through high school and into postsecondary education or their careers" (p.7). In particular, a US national sample of 10th grade students was first studied in 2002 (base year), then followed up in subsequent years: in 2004 when most of them were high school seniors (first follow-up), in 2006 when many of them were sophomores in their postsecondary education (second follow-up), and in 2012 when many of them were approximately four years after their undergraduate graduation (third follow-up). Thus, the 2002 and 2004 data provides information about secondary education. The 2006 data offers information about the first and second year of postsecondary education, such as people's major choices. In addition, the 2012 data offers students' information before and after their completion of undergraduate education, such as people's degree completion and career pathways. In all, this offers the opportunity to explore both high school and postsecondary factors that may relate to STEM major choices and completion.

This study focuses on the Asian American population, so not every student in ELS: 2002 was included in the analysis.[53] According to the user's manual (Ingels et al., 2007), in 2002 (base

[53] More specifically, Asian American students were studied as the focus. White students were also examined as the reference group.

year), the final sample sizes of ELS: 2002 included 752 schools and 15,362 students. Among them, there were 390 schools and 1,460 Asian and Pacific Islanders (API) and 8,682 White students.[54]

Sample and Weights

As a longitudinal study, ELS: 2002 first employed a complex sample design to recruit a nationally representative sample of US 10th graders in 2002. Thereafter, it followed those students in the subsequent years. The sample design initially adopted in 2002 was stratified cluster multistage random sampling. More explicitly, the sample selection consisted of two stages. In the first stage, schools were selected by utilizing stratified probability proportional to size. Schools were stratified by their region and urbanicity. This finally led to 752 schools that agreed to participate. In the second stage, a systematic stratified sample of students was recruited. Students were stratified by race. At the end, around 26 students in the 10th grade were selected from each of the participating schools. 15,362 students out of 17,591 eligible selected students actually participated in ELS: 2002. Data from parents (N=13,488), teachers (N=7,135), principals (N=743), and librarians (N=718) were also collected. In the two sampling stages, the oversampling [55] technique was used for the purpose of ensuring the subpopulations had enough sample sizes. For example, private schools and Asian students were oversampled. More information of the ELS: 2002 base year sample design can be obtained through the user's manual (Ingels, Pratt, Rogers, Siegel & Stutts, 2004).

[54] Because in this research Pacific Islanders were not defined as Asian Americans, the school and student sample sizes were even smaller.

[55] As defined by Ingels et al. (2004), oversampling is to "deliberately sampling a portion of the population at a higher rate than the remainder of the population" (p. E-14).

The racial groups being included in this study were Asian Americans and Whites[56]; there were 1,987 and 7,092 in the sample, respectively. In particular, among the Asian Americans, there were 893 East Asians (containing 441 Chinese, 145 Japanese, and 307 Korean students), 797 Southeast Asians (consisting of 307 Filipino and 490 other Southeast Asians), and 297 South Asians. In terms of the generational subgroups, there were 552 first-generation, 695 second-generation, and 181 third-generation[57] Asian Americans. See Appendix B for more information about the variables being used.

Table 3.1 exhibits the sample sizes by race/ethnicity and generational status. Ideally, it would be better to study Asian Americans of different ethnic subgroups in as much detail as possible, but due to the limitation of sample size, the geographical subgroups of Asian Americans include East, Southeast, and South Asians. The generational subgroups of Asian Americans contain first-, second-, and third- generations. Based on the results of descriptive analyses, categories of both geographical and generational subgroups were adjusted when conducting the inferential analyses.

[56] Whites, in this study, were defined as non-Hispanic Whites and belonging to the third-or-higher generation.
[57] In total, there were 7273 third-generation Asian Americans and Whites.

Table 3.1 Unweighted sample sizes

Race		Generational Status: First Generation	Second Generation	Third Generation	Total
East Asian	Chinese	106	154	48	308
	% within row	34.4%	50.0%	15.6%	100%
	% within column	19.2%	22.2%	26.5%	21.6%
	Japanese	17	34	62	113
	% within row	15.0%	30.1%	54.9%	100%
	% within column	3.1%	4.9%	34.3%	7.9%
	Korea	82	98	9	189
	% within row	43.4%	51.9%	4.8%	100%
	% within column	14.9%	14.1%	5.0%	13.2%
	East Asian total [a]	205	286	119	610
	% within row	33.6%	46.9%	19.5%	100%
	% within column	37.1%	41.2%	65.7%	42.7%
Southeast Asian	Filipino	65	120	33	218
	% within row	29.8%	55.0%	15.1%	100%
	% within column	11.8%	17.3%	18.2%	15.3%
	Southeast Asian (exclude Filipino)	154	204	13	371
	% within row	41.5%	55.0%	3.5%	100%
	% within column	27.9%	29.4%	7.2%	26.0%
	Southeast Asian total [a]	219	324	46	589
	% within row	37.2%	55.0%	7.8%	100%
	% within column	39.7%	46.6%	25.4%	41.2%
South Asian [a]		128	85	16	229
	% within row	55.9%	37.1%	7.0%	100%
	% within column	23.2%	12.2%	8.8%	16.0%
Asian Americans total [a]		552	695	181	1428
	% within row	38.7%	48.7%	12.7%	100%
	% within column	100%	100%	100%	100%
White [b]				7,092	7,092
	% within row			100%	100%
	% within column			97.5%	83.2%
Total [c]		552	695	7,273	8,520
	% within row	6.5%	8.2%	85.4%	100%
	% within column	100%	100%	100%	100%

Notes: a. the sum of *% within column* for *East Asian total*, *Southeast Asian total*, and *South Asian* was approximately 100 percent;

b. the *% within column* for *White* was in relation to Asian American students.

c. *Total* contains both Asian American and White students.

To deal with the oversampling, nonresponse, and non-participation issues in ELS: 2002, weights were applied. Both cross-sectional (F1QWT) and panel (F3BYPNLWT) weights were used. Table 3.2 presents the weighted sample sizes in correspondence with Table 3.1.

Table 3.2 Weighted sample sizes

Race		Generational Status			Total
		First Generation	Second Generation	Third Generation	
East Asian	Chinese	8,174	13,670	8,149	29,993
	% within row	27.3%	45.6%	27.2%	100%
	% within column	17.8%	21.2%	30.6%	21.9%
	Japanese	1,269	3,977	5,506	10,752
	% within row	11.8%	37.0%	51.2%	100%
	% within column	2.8%	6.2%	20.7%	7.8%
	Korea	6,562	8,045	2,278	16,885
	% within row	38.9%	47.6%	13.5%	100%
	% within column	14.3%	12.5%	8.6%	12.3%
	East Asian total [a]	16,005	25,692	15,933	57,630
	% within row	27.8%	44.6%	27.6%	100%
	% within column	34.9%	39.8%	59.8%	42.1%
Southeast Asian	Filipino	7,258	15,282	4,465	27,005
	% within row	26.9%	56.6%	16.5%	100%
	% within column	15.8%	23.7%	16.8%	19.7%
	Southeast Asian (exclude Filipino)	11,542	15,510	2,826	29,878
	% within row	38.6%	51.9%	9.5%	100%
	% within column	25.2%	24.1%	10.6%	21.8%
	Southeast Asian total [a]	18,801	30,791	7,291	56,883
	% within row	33.1%	54.1%	12.8%	100%
	% within column	41.0%	47.7%	27.4%	41.5%
South Asian [a]		11,086	8,001	3,405	22,492
	% within row	49.3%	35.6%	15.1%	100%
	% within column	24.2%	12.4%	12.8%	16.4%
Asian Americans total [a]		45,891	64,485	26,629	137,005
	% within row	33.5%	47.1%	19.4%	100%
	% within column	100%	100%	100%	100%
White [b]				1,648,212	1,648,212
	% within row			100%	100%
	% within column			98.4%	92.3%
Total [c]		45,891	64,485	1,674,841	1,785,217
	% within row	2.6%	3.6%	93.8%	100%
	% within column	100%	100%	100%	100%

Notes: a. the sum of *% within column* for *East Asian total*, *Southeast Asian total*, and *South Asian* was approximately 100 percent;
b. the *% within column* for *White* was in relation to Asian American students.
c. *Total* contained both Asian American and White students.

Missing Data

Missing data imputation was used on predictors other than the ones indicating students' racial/ethnic identity[58], English proficiency, high school STEM occupation expectation, and postsecondary education level. Before imputing the missing values, simple correlations between variables were run for the purpose of deciding which variables can be grouped together for the imputation process. For the derived variables, missing data imputations were done before the creation of these variables. To detect whether data was missing completely at random (MCAR)[59], Little's MCAR test was applied, with a significant value indicating the data were not MCAR. Finally, descriptive statistics of the variables before and after the missing imputations were run in order to test whether there was any great discrepancy before and after the imputations.

Expectation Maximization (EM)[60] was used to impute the missing values. When imputing the missing values, the user missing categories -3 (i.e., item legitimate skip/NA) and -8 (i.e., survey component legitimate skip/NA) were left without any imputations. See Appendix C for the coding of the user missing categories in ELS: 2002. The software SPSS was used to do the missing data imputation.

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[58] This limited the sample size to 9,079 students.
[59] There are three forms of missing. The first one is missing completely at random (MCAR), which indicates the chance for a data point to be missing is completely at random. The second one is missing at random (MAR). This means the chance for a data point to be missing is not related to the missing data, but it is associated with some of the other variables in a study. Lastly, missing not at random (MNAR) happens if data are not MCAR or MAR.
[60] The EM imputation method imputes the missing values based on the other variables.

Variables

In this section, the selection of the variables was based on Chapter 2. Variables were classified into dependent, independent, and explanatory (also called covariates). Appendix B provides detailed information of all the variables.

Dependent variables

There are six dependent variables. The first one indicates whether students were enrolled in postsecondary education or not. The remaining five can be divided into two postsecondary education phases, the sophomore year versus the senior year. The two variables in the sophomore phase are postsecondary STEM choice and STEM major choice. The purpose of using the postsecondary STEM choice variable was to know the racial and ethnic differences in choosing postsecondary STEM education field (versus non-STEM field). Through the postsecondary STEM major choice variable, the aim was to understand Asian Americans' inclination in choosing postsecondary STEM majors. The three variables in the senior phase are postsecondary STEM completion, STEM major completion, and STEM major persistence. Upon utilizing the postsecondary STEM completion variable the object was to recognize the racial and ethnic differences in completing postsecondary STEM education (versus non-STEM education). In addition, by studying the postsecondary STEM major completion variable, the goal was to unveil the postsecondary STEM degree attainment pattern of Asian Americans. Lastly, the purpose of studying postsecondary STEM major persistence was to understand whether Asian American subgroups exhibited varied patterns and whether the pattern of STEM major persistence was different from STEM major completion. One prominent advantage of researching variables in those two phases is the capability of understanding the STEM pathway in postsecondary education.

Postsecondary enrollment. This is a dummy variable (0=No postsecondary education, 1=Postsecondary education). The aim was to understand the pattern of postsecondary enrollment (versus no postsecondary enrollment). F3EVRATT was adapted to obtain this variable (see Appendix B for more information). The unweighted data shows that through 2012, 777 people (10.1 percent) had no postsecondary enrollment at all, while 6909 people (89.9 percent) received at least some postsecondary education.[61]

STEM choice. This is a dummy variable (0=Non-STEM, 1=STEM). Majors were separated into being a postsecondary STEM major or not. More specifically, to identify whether a major belonged to the STEM field, the classification of STEM mentioned in Chapter 1 was used. There categories are: biological/agricultural sciences, computer/information sciences, engineering/engineering technologies, mathematics/statistics, and physical sciences. F2MAJOR2 was recoded to get this variable (See Appendix B for more information). The unweighted data shows that in 2006 3,386 students (80 percent) chose a non-STEM major versus 835 students (19.8 percent) chose a STEM major.[62]

STEM major choice. This is a categorical variable which was made up of 5 STEM areas: biological/agricultural sciences, computer/information sciences, engineering/engineering technologies, mathematics/statistics, and physical sciences (Chapter 1 provides information

[61] Only students who were Asian Americans and Whites were studied in this study. In addition, according to the unweight data, 28 Asian Americans (8 East Asians, 20 Southeast Asians, and no South Asian) once attended less-than-2-year institutions. Therefore, postsecondary enrollment for Asian Americans mostly represents the enrollment into either 2-year or 4-year institutions.
[62] Students here were only composed of Asian Americans and Whites. Furthermore, based on F2B22 (major declared/undeclared), the declared majors included the declared double majors.

about the classification of STEM).[63] F2MAJOR2 was used to obtain these five STEM areas. In F2MAJOR2, there was a category called "science technologies/technicians," which was regarded as belonging to STEM field, but was excluded from the STEM major choice variable. This was because according to the Classification of Instructional Programs 2000 (CIP 2000), this category included academic areas like biology and physics, which made it unclassifiable (CIP, 2000). Appendix B presents procedures for obtaining this variable. The unweighted data indicates that in 2006 the number of students who declared majors was 334 in biological/agricultural sciences (40.7 percent), 84 in computer/information sciences (10.2 percent), 280 in engineering/engineering technologies (34.1 percent), 43 in mathematics/statistics (5.2 percent), and 79 in physical sciences (9.6 percent).[64]

STEM completion. This variable came from the 3rd follow-up of ELS: 2002, which aimed to determine whether students obtained a degree in STEM fields. The variable was dummy coded as 0= an Associates' or Bachelor's degree in non-STEM fields, 1= an Associates' or Bachelor's degree in STEM fields. More specifically, F3ICREDTYPE_1 (the credential type of the highest/only credential from the corresponding institution) and F3ICREDTYPE_2 (the credential type of the additional credential from the corresponding institution) were used to identify whether people obtained Bachelor's/Associate's degrees or not at the 3rd follow-up of ELS: 2002.[65] F3ICREDGEN_1 (the field of study of the highest/only credential from the corresponding institution) and F3ICREDGEN_2 (the field of study of the additional credential

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[63] Considering the limitation of the sample size, in Chapter 4, when running inferential analyses, the STEM categories might be combined or deleted based on descriptive analyses.

[64] Here, the students only included Asian Americans and Whites. In addition, based on F2B22 (major declared/undeclared), the declared majors contained the declared double majors.

[65] There were people who indicated they obtained graduate level degrees (e.g., a doctoral degree), but with no information about their undergraduate degrees and, especially, majors. Data from those people were excluded from this study, because through examining the available data some people did change their majors. Interestingly, among people who switched between non-STEM fields and STEM fields, they tended to move from STEM to non-STEM fields rather than the other way around.

from the corresponding institution) were utilized to decide whether students were in STEM fields or not. The same coding scheme for STEM choice variable was applied. Since students could have multiple postsecondary attendance records, F3IFIRSTINST (whether the corresponding institution was student's first-attended postsecondary institution) was used to locate the first postsecondary institution each student attended. The process of creating this variable involved both SPSS and manual recoding. Appendix B shows procedures of obtaining this variable. The unweighted data indicates that as of 2012, 2,921 students (81.1 percent) obtained either an Associate's or Bachelor's degree in non-STEM fields, while 681 students (18.9 percent) obtained an Associates' or Bachelor's degree in STEM fields.

STEM major completion. This variable came from the 3rd follow-up of ELS: 2002 which indicated whether students obtained an Associate's or Bachelor's degree in the five STEM areas as defined in this study. Similar to the creation of the STEM completion variable, F3ICREDTYPE_1, F3ICREDTYPE_2, F3ICREDGEN_1, F3ICREDGEN_2, and F3IFIRSTINST were involved in obtaining the STEM major completion variable. The same coding scheme for STEM major choice variable was applied. Appendix B provides more details. The unweighted data indicates that through 2012, among people who obtained either an Associate's or Bachelor's degree in STEM fields, 269 of them (39.9 percent) were in biological/agricultural sciences, 79 of them (11.7 percent) were in computer/information sciences, 225 of them (33.4 percent) were in engineering/engineering technologies, 43 of them (6.4 percent) were in mathematics/statistics, and 58 of them (8.6 percent) in physical sciences.

STEM major persistence. This was obtained based on STEM major choice and STEM major completion variables. 820 students had data for undergraduate STEM major choice; 674 people had data for undergraduate STEM major completion. By running the crosstab between

STEM major choice and STEM major completion, 407 people had data available for STEM major persistence. According to Table 3.3, among those who chose biological/agricultural sciences, 93.4% (N=128) of them obtained a degree in the same field; among those who chose computer/information sciences/support technicians, 85.7% (N=36) of them obtained a degree in the same field; among those who chose engineering technologies/technicians, 91.1% (N=153) of them gained a degree in the same field; among those who chose mathematics/statistics, 96% (N=24) of them achieved a degree in the same field; finally, among those who chose physical sciences, 77.1% (N=27) of them had a degree in the same field.[66] To sum up, out of the 407 people who had the available data 368 of them persisted in the same STEM fields, while 39 of them did not.

[66] Even though this study did not focus on the relationship between STEM choice and STEM completion, it is interesting to note that among people who chose a major in STEM fields, 22.1% (N=117) of them obtained a degree in non-STEM fields and 77.9% (N=413) of them gained a degree in STEM fields; among people who chose a major in non-STEM fields, 4.5% (N=91) of them obtained a degree in STEM fields and 95.5% (N=1924) of them had a degree in non-STEM fields. Thus, it seems people who originally chose non-STEM fields tended to stay within the non-STEM fields, while people who originally chose STEM fields had higher levels of movability.

Table 3.3 Crosstab between STEM major choice and STEM major completion using unweighted data

		STEM major completion					Total
		Biological/ agricultural sciences	Computer/ information sciences/ support technicians	Engineering technologies/ technicians	Mathematics and statistics	Physical sciences	
STEM major choice	Biological/agricultural sciences	128	0	3	0	6	137
	% within major choice	93.4%	0%	2.2%	0%	4.4%	
	% within major completion	90.8%	0%	1.9%	0%	17.1%	
	Computer/information sciences/ support technicians	0	36	5	0	1	42
	% within major choice	0%	85.7%	11.9%	0%	2.4%	
	% within major completion	0%	83.7%	3.1%	0%	2.9%	
	Engineering technologies/technicians	7	5	153	2	1	168
	% within major choice	4.2%	3.0%	91.1%	1.2%	0.6%	
	% within major completion	5.0%	11.6%	94.4%	7.7%	2.9%	
	Mathematics/statistics	0	1	0	24	0	25
	% within major choice	0%	4.0%	0%	96.0%	0%	
	% within major completion	0%	2.3%	0%	92.3%	0%	
	Physical sciences	6	1	1	0	27	35
	% within major choice	17.1%	2.9%	2.9%	0%	77.1%	
	% within major completion	4.3%	2.3%	0.6%	0%	77.1%	
Total		141	43	162	26	35	407

Independent variables

Asian Americans

When conducting the analyses that compared Asian American students with White students, Asian Americans were grouped together, with 0=Whites[67], 1=Asian Americans. On the other hand, when conducting the analyses that focused on Asian American subgroup differences, Asian Americans were separated into geographical and generational subgroups.

Geographical subgroups. This variable came from F1ASIAN (student's Asian subgroup) and F1RACE (student's race). The variable was coded as 1= East Asian, 2= Filipino, 3= Southeast Asian, 4= South Asian. It was also coded as 1= East Asian, 2= Southeast Asian, 3= South Asian. Table 3.4 illustrates the groupings of this variable and their corresponding sample sizes.

Table 3.4 Sample sizes for geographical groups

Grouping method 1		Grouping method 2	
Groups	Sample size	Groups	Sample size
East Asian	893	East Asian	893
Filipino	307	Southeast Asian	797
Southeast Asian	490		
South Asian	297	South Asian	297
White		7092	
Total		9079	

According to the results of Appendix D (i.e., crosstabs between Asian American geographical subgroups and dependent variables), considering both the subgroup differences and the sample size for each subgroup, this study used grouping method 2 which consisted of East, Southeast, as well as South Asian American students.

67 White students only included those who belonged to the third generation.

Generational subgroups. This variable included only Asian Americans, which made from BYP17 (whether 10th grader's mother's birthplace is in the US or elsewhere), BYP20 (whether 10th grader's father's birthplace is in the US or elsewhere), BYP23 (whether 10th grader's birth place is in the US or elsewhere) (See Appendix B for more information). It contains three categories: first (N=552), second (N=695), and third (N=181) generations.

Appendix E includes unweighted crosstabs between Asian American generational subgroups and dependent variables.

Explanatory variables

Demographic characteristics. This consists of three variables, that is, female, SES, and English proficiency.

Female. This is a dummy variable (0=male, 1=female) being recoded from F1SEX (1=male, 2=female). There was no missing value for this variable. In total, there were 4,542 male (50 percent) and 4,537 female (50 percent) students in the sample.

SES. F1SES2 is a continuous variable. It was made by NCES based on five variables: mother's education, father's education, family income, father's occupation, and mother's occupation. Furthermore, it used the 1989 General Social Survey (GSS) occupational prestige scores. There were 11 missing cases, which all belong to the missing category -8 (i.e., survey component legitimate skip/NA), so no missing imputation was done. With 9,068 available data, the minimum value of SES was -2.12, while the maximum value was 1.97. The mean of SES was 0.19, with the standard deviation being 0.74. The higher value in this variable indicated the higher SES.

English proficiency. This is a dummy variable. BYS67 was used, in which 10th graders were asked whether English is their native language, with 0= No, 1= Yes.

High school sector. This is a dummy coded variable, with 0=Public (N= 6905), 1= Private (N=2174). BYSCTRL was used to create this variable (See Appendix B for more information).

Parental influence. It consists of four variables: parental participation, family communication, family rules, and parental expectation.

Parental participation. Five items were used to create this variable: *belong to parent-teacher organization* (BYP54A), *attend parent-teacher organization meetings* (BYP54B), *take part in parent-teach organization activities* (BYP54C), *act as a volunteer at the school* (BYP54D), and *belong to other organization with parents from school* (BYP54E). The items were coded as: 0= No, 1= Yes.

After running the factor analysis, based on eigenvalue greater than 1, one component was extracted. The reliability for the five items was 0.731. When the item *belong to other organization with parents from school* was deleted, the reliability raised to 0.733. However, since this was a minor increase, no deletion was made.

By running Little's MCAR test, $p<0.05$, the data was not missing completely at random, so no imputation was made. A derived variable was created by calculating the mean of the variables. In particular, if any 3 of the 5 variables was observed, the mean was calculated (Mean=0.332, SD=0.327).[68] Table 3.5 provides more information about the results from different variable deletion methods.

[68] The computation method in SPSS is MEAN.3(BYP54A,BYP54B,BYP54C,BYP54D,BYP54E). Due to the limitation of the sample size, this study does not limit the calculation to if any 4 of the 5 variables is observed.

Table 3.5 Descriptive statistics of different mean calculation methods for parental participation

Calculation method	N	Minimum	Maximum	Mean	SD
Listwise deletion	7664	0	1	0.328	0.325
If any of the variables observed	8057	0	1	0.336	0.331
If any 3 of the 5 variables observed	7950	0	1	0.332	0.327
If any 4 of the 5 variables observed	7888	0	1	0.331	0.326

Note: The values were unweighted.

Family communication. Six items were used to establish this variable providing: *advice about selecting courses or programs* (BYP56A), *advice about plans for college entrance exams* (BYP56B), *advice about applying to college/school after high school* (BYP56C), *advice about jobs to apply for after high school* (BYP56D), *information about community/national/world events* (BYP56E), and *advice about things troubling 10th grader* (BYP56F). The items were coded as: 1= Never, 2= Sometimes, 3= Often.

After running the factor analysis, based on eigenvalue greater than 1, one component was extracted. The reliability for the six items was 0.765. When any of the items were deleted, the reliability did not increase.

By running Little's MCAR test, $p>0.05$, the data was missing completely at random, so EM imputation was applied. The imputation was made based on the six items of family communication. With the variables being imputed, the reliability for the six items was 0.766. A derived variable was created by calculating the mean of the variables, Mean=2.284, SD=0.439. Table 3.6 provides a comparison with and without the imputation.

Table 3.6 Descriptive statistics before and after EM imputation for family communication

Calculation method	N	Minimum	Maximum	Mean	SD
With EM imputation	9035	1	3	2.284	0.439
Without EM imputatioin, listwise deletion	7805	1	3	2.285	0.466

Notes: 1. The values were unweighted.

2.Across the 6 items, there were 44 people belonging to *Survey component legitimate skip/NA*.

Family rules. Four family rules for 10th graders were used to create this variable: maintaining grade average (BYP69A), doing homework (BYP69B), doing household chores (BYP69C), and watching TV (BYP69D). The items were coded as: 0=No, 1=Yes.

After running the factor analysis, based on eigenvalue greater than 1, one component was extracted. The reliability for the four items was 0.583. If any of the items were deleted, the reliability did not increase.

By running Little's MCAR test, $p>0.05$, it was found that the data was missing completely at random, so EM imputation was applied. The imputation was made based on the four items of family rules. With the variables being imputed, the reliability for the four items was 0.586. A derived variable was created by calculating the mean of the variables, Mean=0.800, SD=0.241. Table 3.7 provides a comparison with and without the imputation.

Table 3.7 Descriptive statistics before and after EM imputation for family rules

Calculation method	N	Minimum	Maximum	Mean	SD
With EM imputation	9035	0	1	0.800	0.241
Without EM imputatioin, listwise deletion	7816	0	1	0.800	0.256

Notes: 1. The values were unweighted.

2. Across the 4 items, there were 44 people belonging to *Survey component legitimate skip/NA*.

Parental expectation. This is an ordinal variable (N=7960, Mean=4.95, SD=1.36), which asked parents "how far in school you expect your tenth grader will go" (BYP81). The variable was coded as: 1=less than high school graduation, 2=high school graduation or GED only, 3=attend or complete 2-year college/school, 4=attend college, 4-year degree incomplete, 5=graduate from college, 6=obtain master's degree or equivalent, 7=obtain PhD, MD, or other advanced degree. In this study, this variable was analyzed as a scale variable.

By running Little's MCAR test, $p<0.05$, it was found that the data was not missing completely at random, so no imputation was made.[69]

High school academic preparation. This contains two variables: course taking and academic achievement.

Course taking. It consists of two variables: the math and science pipelines. The math pipeline variable being used was F1RMAPIP (from *no math* to *advanced III/calculus*) (N=8426, Mean=5.76, SD=1.64). It was coded as: 1=no math, 2=non-academic, 3=low academic, 4=middle academic, 5=middle academic II, 6=advanced I, 7=advanced II/pre-calculus, 8=advanced III/calculus. The science pipeline used was F1RSCPIP (from *no science* to *chemistry and physics and level 7*) (N=8426, Mean=5.29, SD=1.53). It was coded as: 1=no science, 2=primary physical science, 3=secondary physical science and basic biology, 4=general biology, 5=chemistry 1 or physics 1, 6=chemistry 1 and physics 1, 7=chemistry 2 or physics 2 or advanced biology, 8=chemistry and physics and level 7. In this study, those two variables were regarded as scale variables. See Appendix B for variable coding.

[69] BYP81 (how far in school you expect your tenth grader will go), BYPARASP (how far in school parent wants 10th grader to go-composite), and BYP79 (how far in school wants 10th grader to go) were included in the running. The relationship between BYP81 and BYPARASP was positively strong, r=0.71; similarly, the relationship between BYP81 and BYPARASP was also positively strong, r=0.72.

By running Little's MCAR test, $p<0.05$.[70] That is, the data was not missing completely at random, so no imputation was made.

Academic achievement. Due to the unavailability of the science test scores, only the math standardized test at the first follow-up, F1TXMSTD[71], was used.[72] In this study, this variable was converted into a z-score variable (N=7988, Minimum= -3.02, Maximum=2.98, Mean=0.32, SD=0.97).[73]

By running Little's MCAR test ($p<0.05$), it was obtained that the data was not missing completely at random, so no imputation was made.

High school STEM occupation expectation. This is a dummy variable: 0=Non-STEM occupation expectation, 1=STEM occupation expectation. It originated from F1S57 which asked students to "write in the name of the job or occupation that you expect or plan to have at age 30." Based on the STEM definition of this study, F1S57 was manually recoded. Answers such as *auto mechanic* and *radiology technician* were not regarded as belonging to STEM, while answers like *food chemist* and *marine engineer* were regarded as STEM. At the end, 5,086 students did not expect a STEM occupation, while 511 students did expect a STEM occupation. Replies from 136 students were too ambiguous to be classified (e.g., *teaching*, *webmaster*, *zookeeper or researcher*, *pharmacist or chemical engineer*, and *professor*).

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[70] F1RMAPIP (the math pipeline), F1RSCPIP (science pipeline), and F1TXMSTD (math standardized score at 12th grade) were included in the running. The relationship between F1RMAPIP and F1TXMSTD was positively strong, $r=0.72$; the relationship between F1RSCPIP and F1TXMSTD was positively moderate, $r=0.55$; moreover, the relationship between F1RMAPIP and F1RSCPIP was positively moderate to strong, $r=0.64$.
[71] This variable provides standardized T score. This indicates the full ELS: 2002 sample had a mean of 50 and SD of 10.
[72] ACT math (TXACTM) and science (TXACTS) scores were not included in this study. First, the sample sizes were small for both variables $N_{math}=3700$, $N_{science}=3766$. Second, the correlation between TXACTM and F1TXMSTD was strong, $r=0.85$.
[73] The formula being applied was: z score= (T-50)/10. Thus, with the full ELS: 2002 sample, this variable had a mean of 0 and SD of 1.

Postsecondary education level. This is a dummy variable (0=2-year postsecondary education, 1=4-year postsecondary education), which provides information about the level of people's first-attended postsecondary institution. F3PS1LVL was recoded to obtain this variable (see Appendix B for more information). People were sorted as enrolled in either at-least-2-year, but less-than-4-year institutions[74] or 4-year institutions. Due to the limitation of the sample size, people enrolled in less-than-2-year institutions were not studied.[75] The unweighted data shows that as of 2012, 2,141 people were at one time enrolled in 2-year institutions (32.3 percent). And, 4,487 people were at one time enrolled in 4-year institutions (67.7 percent). [76]

Data Analysis Method

Both descriptive and inferential analyses were carried out in this study. The descriptive analyses include: 1) the minimum value, maximum value, mean, and standard deviation of individual variables, 2) the minimum value, maximum value, mean, and standard deviation of the variables by race/ethnicity, 3) the crosstabs between independent and dependent variables, 4) the means of explanatory variables by independent variables, and 5) the simple correlations between the variables.

The inferential analyses contain: 1) the preliminary stepwise logistic regressions for selecting variables, and 2) the final stepwise logistic regressions. Step 1 of the stepwise logistic regressions included only the independent variables (i.e., racial groups and Asian American subgroups). Step 2 added variables of demographic characteristics (i.e., gender, SES, and English

[74] To make it simple, in the paper, 2-year institutions stood for at least 2-year, but less-than-4-year institutions.
[75] The unweighted data indicated 6 first-generation, 7 second-generation, and 6 third-generation Asian Americans once enrolled in less-than-2-year institution, respectively. Additionally, 8 East-, 20 Southeast-, and 0 South- Asian Americans once enrolled in less-than-2year institution, respectively.
[76] Data only contained Asian Americans and Whites.

proficiency) to step one. Finally, step 3 consisted of all the variables. Before carrying out the inferential analyses, the multicollinearity test was conducted to examine whether the predictors were highly correlated with each other.

Three statistical software tools were used, including SPSS, R, and AM. First, all of the descriptive analyses were conducted by using SPSS, which were all weighted. Second, R was used for the multicollinearity test as well as for deciding the predictors to be included in the models. This is because R provides a relatively easy way to test the multicollinearity as well as to consider the design effect resulting from the nested structure of ELS: 2002. Last, due to the nested structure of ELS: 2002, AM was utilized for the final stepwise logistic regression analyses. The reason for using AM rather than R for the final analyses is that R does not allow a stratum containing only one primary sampling unit, so manual adjustment is needed when utilizing R.

The analytical framework of this study, that is, Asian American students' postsecondary STEM education pathways, is demonstrated below (Figure 3.1). More specifically, the postsecondary enrollment of Asian American students as a whole were compared with that of White students. Among the students who enrolled in postsecondary institutions, a comparison between Asian American and White students in choosing STEM education (versus non-STEM education) was conducted; also, Asian American and White students were compared in their patterns of choosing the five different STEM fields. Subsequently, regardless students chose a major in STEM fields or not in their sophomore year, a comparison between Asian American and White students in obtaining a degree in STEM fields (versus non-STEM fields) was carried out; also, Asian American and White students were compared in their patterns of earning a degree in the five different STEM fields. Finally, among students who chose a major in STEM fields, Asian American and White students were compared in their persistence (versus non-persistence) in the same STEM fields. For example, students who chose a major in biological/agricultural sciences in their sophomore year and later earned a degree in this STEM field were considered as STEM persisters.

Likewise, Figure 3.1 also illustrates Asian American subgroups' postsecondary STEM education pathways. Asian American subgroups consist of Asian American geographical (i.e., East, South, and Southeast Asian Americans) and generational (i.e., first-, second-, and third-generation Asian Americans) subgroups. The Asian American subgroup disparities were first examined in postsecondary enrollment (versus no postsecondary enrollment). Second, among students who enrolled in postsecondary education, Asian American subgroup differences in choosing a major in STEM fields (versus non-STEM fields) were studied; also, the subgroup dissimilarities were examined in the patterns of choosing the five different STEM fields. Next, Asian American subgroup differences in obtaining a degree in STEM fields (versus non-STEM fields) were studied, regardless of their sophomore-year major choice; additionally, Asian American subgroup differences were examined in their patterns of earning a degree in the five different STEM fields. Last, among students who chose a major in STEM fields, Asian American subgroups were compared in their persistence (versus non-persistence) in the same STEM fields.

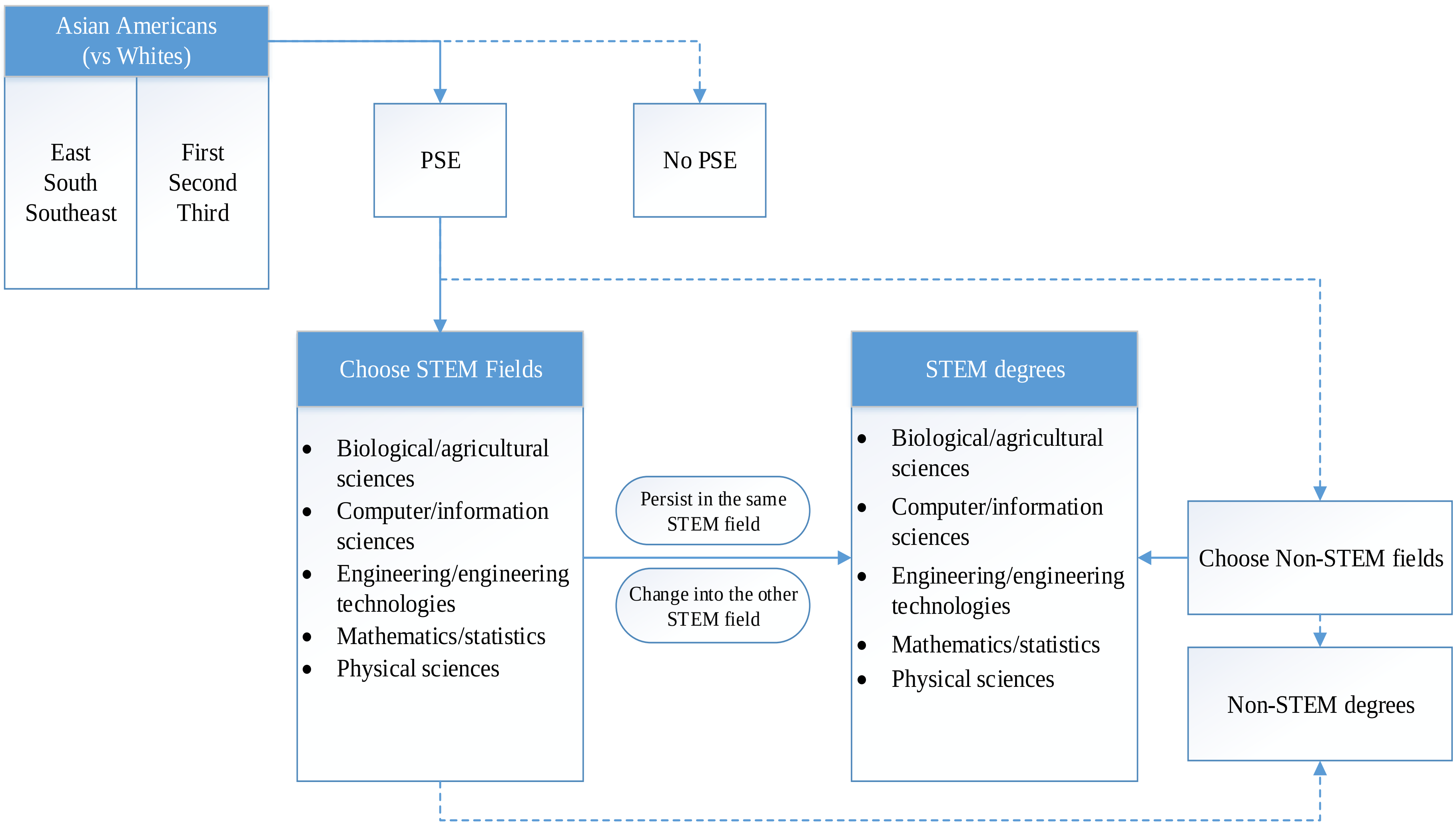

Figure 3.1. Analytical framework for Asian Americans' postsecondary STEM education pathways
Note: Line arrows indicate hypothetical pathways.

Model

In general, the logistic regression models of this study are variations of the one shown below,

$$\text{Ln}\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14}$$

Where,

$\text{Ln}\left(\frac{p}{1-p}\right)$ equals to the log-odds of the dependent variables;

X_1 represents either the racial group variable—Asian Americans (versus Whites) or the Asian American subgroup variables;

X_2 represents female (versus male);

X_3 represents SES;

X_4 represents English proficiency (versus no English proficiency);

X_5 represents private high schools (versus public high schools);

X_6 represents parental participation;

X_7 represents family communication;

X_8 represents family rules;

X_9 represents parental expectation;

X_{10} represents the math pipeline;

X_{11} represents the science pipeline;

X_{12} represents academic achievement (math);

X_{13} represents high school STEM occupation expectation (vs. no STEM occupation expectation);

X_{14} represents 4-year institution (vs. 2-year institution).[77]

[77] Due to the characteristics of the dependent variables, as an explanatory variable whether students were in a 2- versus 4- year institution was not included in the models with postsecondary enrollment as the dependent variable.

Chapter 4. Results

Descriptive Statistics

Table 4.1 presents descriptive statistics for Asian Americans and Whites altogether. In particular, among those who were 10th graders in 2002, 87 percent of Asian Americans and Whites had once been enrolled in a postsecondary institution as of 2012.[78] 20 percent of Asian American and White students did actually choose a postsecondary major in STEM. Among them, 37 percent were in biological/agricultural sciences, 12 percent in computer/information sciences, 34 percent in engineering/engineering technologies, 6 percent in mathematics/statistics, and 10 percent in physical sciences. 19 percent of Asian American and White students obtained a degree in STEM till 2012. Among them, 37 percent were in biological/agricultural sciences, 14 percent in computer/information sciences, 34 percent in engineering/engineering technologies, 5 percent in mathematics/statistics, and 9 percent in physical sciences. In addition, 90 percent of Asian American and White students stayed in the same STEM field during the period of their postsecondary education.

11 percent of students were Asian Americans, while 89 percent of them were Whites. Among Asian Americans, there were 46 percent East, 41 percent Southeast, and 13 percent South Asian Americans. Also, the group was composed of 33 percent first-, 47 percent second-, and 20 percent third- generation Asian Americans.

Additionally, 51 percent of students were female, 94 percent of students had English as their native language, 10 percent of students were in private high schools, and the average SES

[78] In comparison, US Bureau of labor Statistics indicated 66.7 percent of high school graduates from the class of 2004 were enrolled into postsecondary institution (College Enrollment and Work Activity of 2004 High School Graduates, 2005).

of students was 0.16. Later, 64 percent of students attended a 4-year postsecondary institution, while 36 percent of them were in a 2-year postsecondary institution.

On the other hand, the average parental participation level was 0.31 (Minimum= 0, Maximum= 1); the average family communication level was 2.29 (Minimum= 1, Maximum= 3); the average level of family rules was 0.80 (Minimum= 0, Maximum= 1); and the average parental expectation level was 4.85 (Minimum= 1, Maximum= 7). The mean for the math pipeline was 5.68 (Minimum= 1, Maximum= 8), while for the science pipeline was 5.21 (Minimum= 1, Maximum= 8). The average academic achievement in math was 0.31 (Minimum= -2.67, Maximum= 2.98).[79] Furthermore, 10 percent of Asian American and White high school students expected themselves to have a STEM occupation at age 30.

[79] Since this is a standardized variable based on people of all racial groups, having a mean value larger than 0 indicates Asian American and White students basically had better performance in math than students of the other racial groups.

Table 4.1 Weighted descriptive statistics for individual variables[80]

Variable name		Minimum	Maximum	Mean	Standard deviation
Dependent variables					
Postsecondary enrollment		0	1	0.87	0.33
STEM choice		0	1	0.20	0.40
STEM major choice					
	Computer	0	1	0.12	0.33
	Engineering	0	1	0.34	0.47
	Math	0	1	0.06	0.23
	Physics	0	1	0.10	0.31
STEM completion		0	1	0.19	0.39
STEM major completion					
	Computer	0	1	0.14	0.35
	Engineering	0	1	0.34	0.47
	Math	0	1	0.05	0.22
	Physics	0	1	0.09	0.29
STEM major persistence		0	1	0.90	0.30
Independent variables					
Asian Americans		0	1	0.11	0.31
Geographical subgroups					
	Southeast	0	1	0.41	0.49
	South	0	1	0.13	0.34
Generational subgroups					
	Second	0	1	0.47	0.50
	Third	0	1	0.20	0.40
Explanatory variables					
Female		0	1	0.51	0.50
SES		-2.12	1.97	0.16	0.70
English proficiency		0	1	0.94	0.24
Private high school		0	1	0.10	0.30
Parental participation		0	1	0.31	0.32
Family communication		1	3	2.29	0.44
Family rules		0	1	0.80	0.24
Parental expectation		1	7	4.85	1.38
Math pipeline		1	8	5.68	1.64
Science pipeline		1	8	5.21	1.52
Academic achievement (math)		-2.67	2.98	0.31	0.96
High school STEM occupation expectation		0	1	0.10	0.30
4-year institution		0	1	0.64	0.48

Descriptive statistics by Asian Americans and Whites

[80] Variables were weighted by F3BYPNLWT.

Table 4.2 shows descriptive statistics for the dependent and explanatory variables broken down by Asian American and White students. Asian American (87 percent) and White (89 percent) students shared similar postsecondary enrollment rates. On the other hand, Asian Americans (31 percent) were more likely than their White peers (18 percent) to choose a STEM major. Among those who went into the STEM fields, Asian American and White students were both more likely to major in biological/agricultural sciences (Asian Americans: 39 percent; Whites: 37 percent) and engineering/engineering technologies (Asian Americans: 31 percent; Whites: 35 percent), followed by physical sciences (Asian Americans: 14 percent; Whites: 10 percent) and computer/information sciences (Asian Americans: 11 percent; Whites: 13 percent), and then mathematics/statistics (Asian Americans: 5 percent; Whites: 6 percent). Asian American students (25 percent) were more likely than their White peers (18 percent) to complete a STEM major, though the gap in STEM completion was smaller than in STEM choice. Among those who earned a degree in STEM fields, Asian American and White students were both more likely to have a degree in biological/agricultural sciences (Asian Americans: 46 percent; Whites: 36 percent) and engineering/engineering technologies (Asian Americans: 28 percent; Whites: 35 percent), followed by physical sciences (Asian Americans: 11 percent; Whites: 9 percent) and computer/information sciences (Asian Americans: 11 percent; Whites: 14 percent), and then mathematics/statistics (Asian Americans: 4 percent; Whites: 6 percent). In terms of STEM persistence, Asian American and White students had common ground (Asian Americans: 89 percent; Whites: 90 percent).

In this study, the percentage of female students was lower for Asian Americans (45 percent) than for Whites (51 percent). The rate of having English as one's native language was lower for Asian Americans (45 percent) than for Whites (99 percent). On average, Asian

American students (Mean = 0.02) had lower SES than their White peers (Mean = 0.17). Nonetheless, Asian Americans (9 percent) shared a similar rate of being in private high schools as White students (10 percent). Also, Asian Americans (67 percent) shared a similar rate of attendance at 4-year postsecondary institutions (versus 2-year postsecondary institutions) as White students (63 percent).

Generally, Asian Americans had a lower average level of parental participation (Asian Americans: 0.24; Whites: 0.31), but higher average parental expectations (Asian Americans: 5.39; Whites: 4.80) than Whites. Asian American and White students had similar average family communication levels (Asian Americans: 2.20; Whites: 2.30) and family rules levels (Asian Americans: 0.81; Whites: 0.8). Asian Americans, on average, had higher scores in both math (Asian Americans: 5.89; Whites: 5.65) and science (Asian Americans: 5.53; Whites: 5.17) pipelines than Whites; but, they had similar mean math academic achievement as White students (Asian Americans: 0.33; Whites: 0.31). Additionally, Asian American (13 percent) and White (10 percent) high school students had a similar rate of expecting to have an occupation in STEM at age 30.

Table 4.2 Weighted descriptive statistics for individual variables by race[81]

	Variable name		Minimum	Maximum	Mean	Standard deviation
	Dependent variables					
White	Postsecondary enrollment		0	1	0.87	0.33
	STEM choice		0	1	0.18	0.39
	STEM major choice					
		Computer	0	1	0.13	0.33
		Engineering	0	1	0.35	0.48
		Math	0	1	0.06	0.23
		Physics	0	1	0.10	0.29
	STEM completion		0	1	0.18	0.38
	STEM major completion					
		Computer	0	1	0.14	0.35
		Engineering	0	1	0.35	0.48
		Math	0	1	0.06	0.23
		Physics	0	1	0.09	0.29
	STEM major persistence		0	1	0.90	0.30
Asian American	Postsecondary enrollment		0	1	0.89	0.32
	STEM choice		0	1	0.31	0.46
	STEM major choice					
		Computer	0	1	0.11	0.31
		Engineering	0	1	0.31	0.46
		Math	0	1	0.05	0.22
		Physics	0	1	0.14	0.35
	STEM completion		0	1	0.25	0.43
	STEM major completion					
		Computer	0	1	0.11	0.31
		Engineering	0	1	0.28	0.45
		Math	0	1	0.04	0.20
		Physics	0	1	0.11	0.31
	STEM major persistence		0	1	0.89	0.31
	Explanatory variables					
White	Female		0	1	0.51	0.50
	SES		-1.70	1.97	0.17	0.68
	English proficiency		0	1	0.99	0.09
	Private high school		0	1	0.10	0.30
	Parental participation		0	1	0.31	0.32
	Family communication		1	3	2.30	0.44
	Family rules		0	1	0.80	0.25
	Parental expectation		1	7	4.80	1.37
	Math pipeline		1	8	5.65	1.61
	Science pipeline		1	8	5.17	1.48

[81] Variables were weighted by F3BYPNLWT.

	Academic achievement (math)	-2.67	2.98	0.31	0.94
	High school STEM occupation expectation	0	1	0.10	0.29
	4-year institution	0	1	0.63	0.48
Asian American	Female	0	1	0.45	0.50
	SES	-2.12	1.97	0.02	0.82
	English proficiency	0	1	0.45	0.50
	Private high school	0	1	0.09	0.29
	Parental participation	0	1	0.24	0.29
	Family communication	1	3	2.20	0.45
	Family rules	0	1	0.81	0.21
	Parental expectation	1	7	5.39	1.36
	Math pipeline	1	8	5.89	1.83
	Science pipeline	1	8	5.53	1.79
	Academic achievement (math)	-2.63	2.65	0.33	1.10
	High school STEM occupation expectation	0	1	0.13	0.33
	4-year institution	0	1	0.67	0.47

Descriptive statistics between independent and dependent variables

Table 4.3 presents a crosstab between independent variables and postsecondary enrollment. Generally, Asian American and White students shared similar rates of postsecondary enrollment. 88.8 percent of Asian American students enrolled in postsecondary institutions, while 87.2 percent of White students enrolled into postsecondary institutions (Figure 4.1 illustrates this). Within Asian Americans, in terms of the geographic subgroups, East Asian American students had the highest rate of postsecondary enrollment (92.7 percent), followed by South (88.8 percent) and then Southeast (84.4 percent) Asian American students (also see Figure 4.2). As for the generational subgroups of Asian Americans, second-generation Asian American students had the highest rate of postsecondary enrollment (93.4 percent), followed by first- (89.6 percent) and then third- (76.5 percent) generation Asian American students (also see Figure 4.3).

Table 4.3 Weighted crosstab between independent variables and postsecondary enrollment (dependent variable)

		Postsecondary enrollment	
		No PSE	PSE
Race (Asian Americans vs. Whites)	Whites		
	% within race	12.8%	87.2%
	% within postsecondary enrollment	90.4%	89.1%
	Asian Americans		
	% within race	11.2%	88.8%
	% within postsecondary enrollment	9.6%	10.9%
Geographical subgroups	East Asian Americans		
	% within geographical subgroups	7.3%	92.7%
	% within postsecondary enrollment	29.9%	47.8%
	Southeast Asian Americans		
	% within geographical subgroups	15.6%	84.4%
	% within postsecondary enrollment	56.7%	38.7%
	South Asian Americans		
	% within geographical subgroups	11.2%	88.8%
	% within postsecondary enrollment	13.5%	13.5%
Generational subgroups	First generation		
	% within generational subgroups	10.4%	89.6%
	% within postsecondary enrollment	31.0%	33.8%
	Second generation		
	% within generational subgroups	6.6%	93.4%
	% within postsecondary enrollment	27.6%	49.2%
	Third generation		
	% within generational subgroups	23.5%	76.5%
	% within postsecondary enrollment	41.4%	17.0%

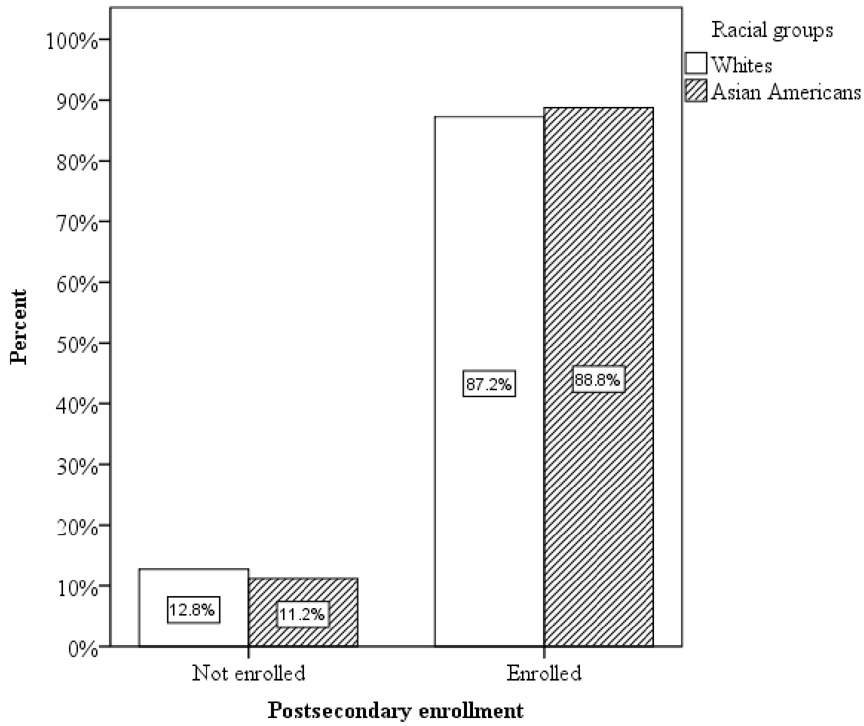

Figure 4.1 Bar graph for postsecondary enrollment by racial groups

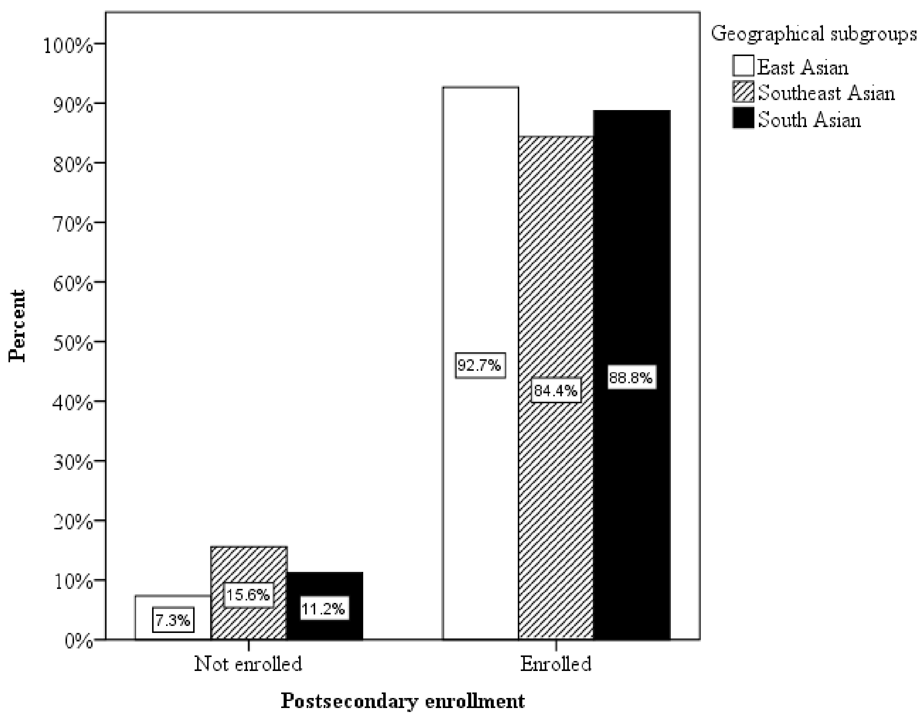

Figure 4.2 Bar graph for postsecondary enrollment by Asian American geographical subgroups

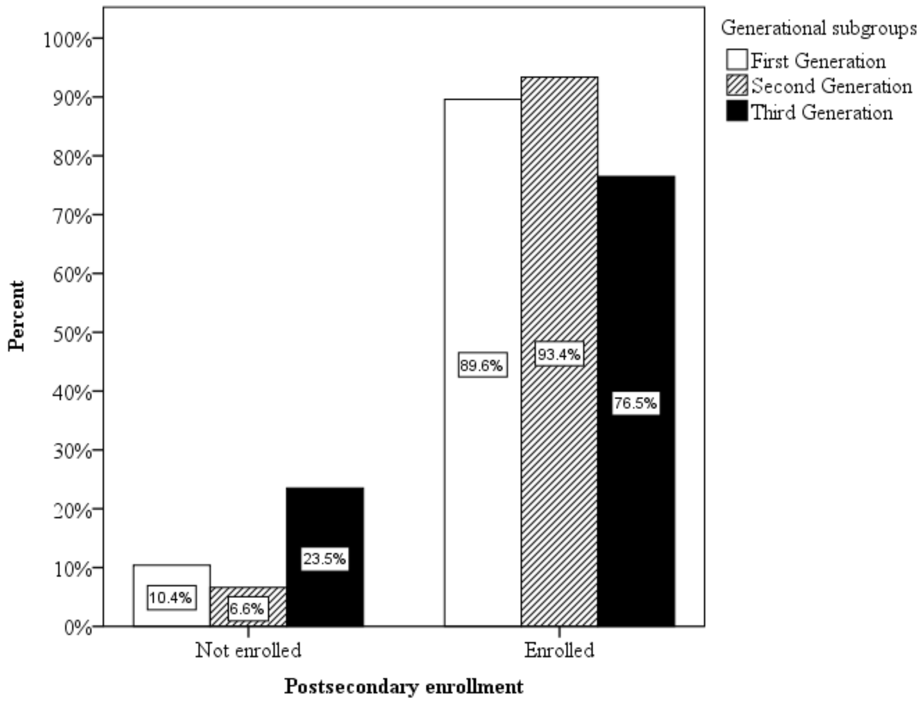

Figure 4.3 Bar graph for postsecondary enrollment by Asian American generational subgroups

Table 4.4 presents a crosstab between independent variables and STEM choice. Asian American students were more likely to choose STEM majors than their White peers (also see Figure 4.4). In particular, 31.3 percent of Asian Americans chose a STEM major, while 18.2 percent of Whites choose a STEM major. Within Asian Americans, South Asian American students had the highest rate of choosing a STEM major (38.7 percent), followed by East (33.8 percent) and then Southeast (24.0 percent) Asian American students (also see Figure 4.5). In terms of the generational subgroups, second-generation Asian American students had the highest rate of choosing a STEM major (30.8 percent), followed by first- (27.5 percent) and then third- (26.0 percent) generation Asian American students (also see Figure 4.6).

Table 4.4 Weighted crosstab between independent variables and STEM choice (dependent variable)

		STEM choice	
		Non-STEM	STEM
Race (Asian Americans vs. Whites)	Whites		
	% within race	81.8%	18.2%
	% within STEM choice	90.9%	83.0%
	Asian Americans		
	% within race	68.7%	31.3%
	% within STEM choice	9.1%	17.0%
Geographical subgroups	East Asian Americans		
	% within geographical subgroups	66.2%	33.8%
	% within STEM choice	48.4%	54.3%
	Southeast Asian Americans		
	% within geographical subgroups	76.0%	24.0%
	% within STEM choice	37.2%	25.8%
	South Asian Americans		
	% within geographical subgroups	61.3%	38.7%
	% within STEM choice	14.4%	19.9%
Generational subgroups	First generation		
	% within generational subgroups	72.5%	27.5%
	% within STEM choice	34.3%	31.9%
	Second generation		
	% within generational subgroups	69.2%	30.8%
	% within STEM choice	50.2%	54.7%
	Third generation		
	% within generational subgroups	74.0%	26.0%
	% within STEM choice	15.5%	13.4%

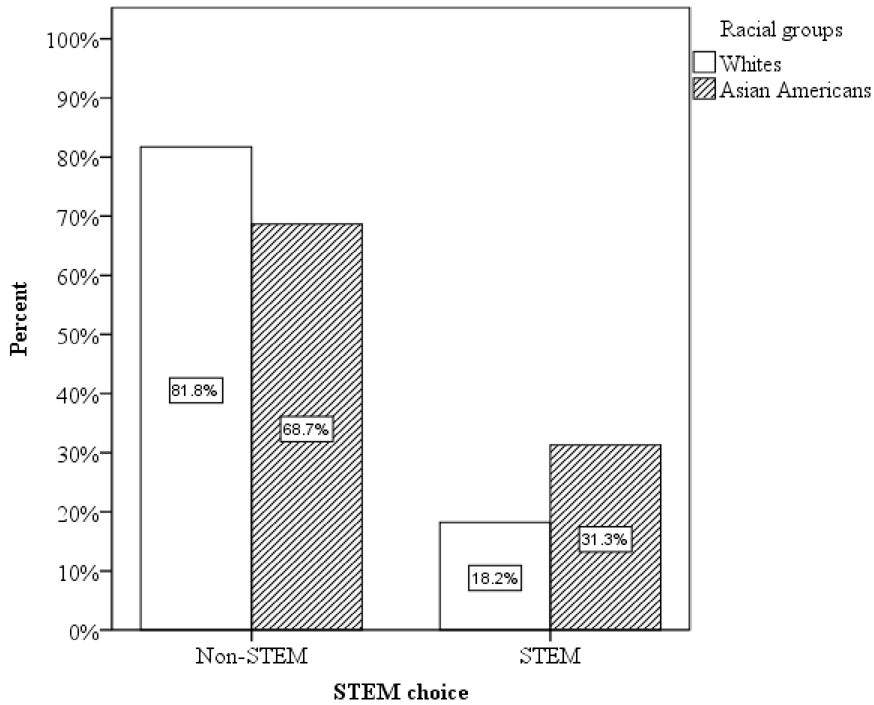

Figure 4.4 Bar graph for STEM choice by racial groups

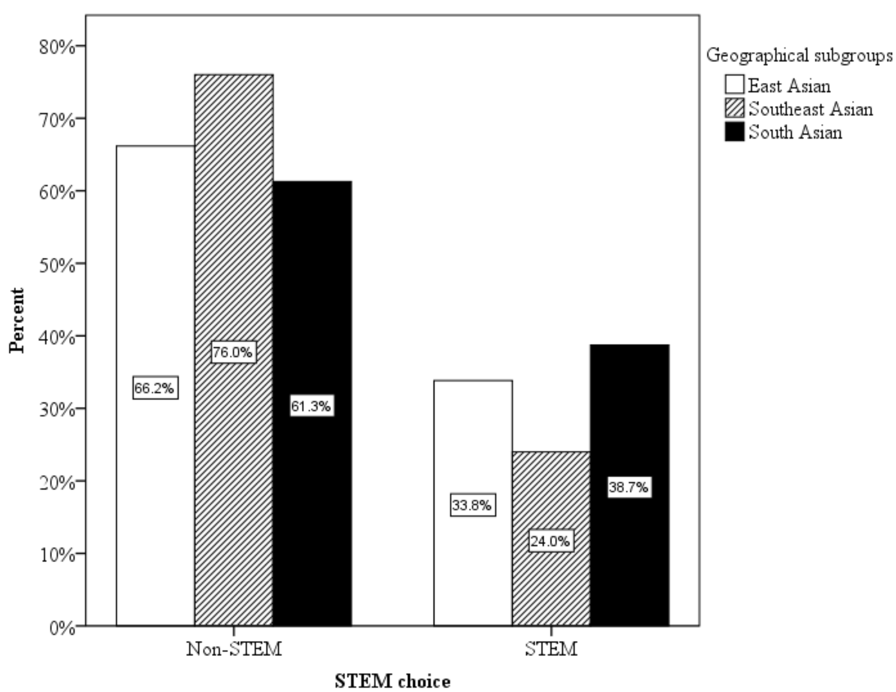

Figure 4.5 Bar graph for STEM choice by Asian American geographical subgroups

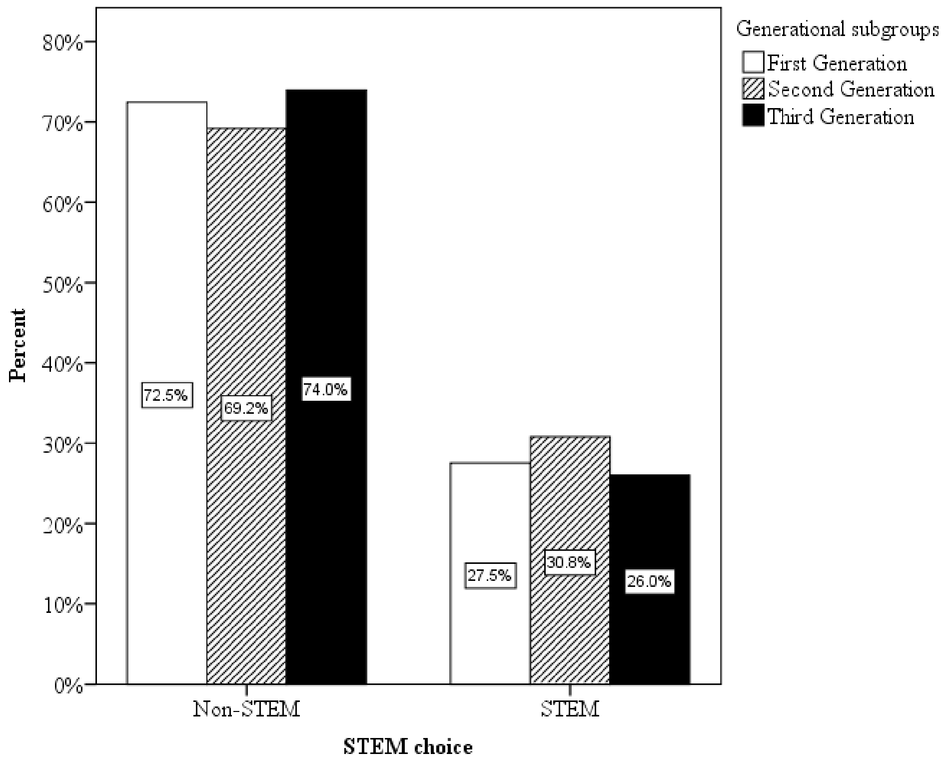

Figure 4.6 Bar graph for STEM choice by Asian American generational subgroups

Table 4.5 presents a crosstab between independent variables and STEM major choice. Among the five STEM fields, Asian Americans were more likely to choose biological/agricultural sciences (39.2 percent) and physical sciences (14.2 percent) than White students (biological/agricultural sciences: 36.9 percent; physical sciences: 9.6 percent) (also see Figure 4.7).

Among Asian Americans that chose STEM majors, Southeast Asian Americans chose biological/agricultural sciences at the highest rate (41.3 percent), followed by South (39.2 percent) and East Asian Americans (38.3 percent). Moreover, Southeast Asian Americans chose a STEM major in mathematics/statistics at the highest rate (12.6 percent), followed by East (2.8 percent) and then South (1.2 percent) Asian Americans. East Asian Americans had the highest rate of choosing a STEM major in computer sciences (11.5 percent), followed by South (10.6

percent) and Southeast (10.1 percent) Asian Americans. In addition, East Asian Americans chose a STEM major in physical sciences at the highest rate (18.0 percent), followed by Southeast (13.2 percent) and then South (5.0 percent) Asian Americans. South Asian Americans, however, chose a STEM major in engineering/engineering technologies at the highest rate (44.1 percent), followed by East (29.4 percent) and then Southeast (22.7 percent) Asian Americans. Also see Figure 4.8.

With regard to generational subgroups, among Asian Americans who selected STEM majors, first-generation Asian Americans chose biological/agricultural sciences at the highest rate (43.4 percent), followed by second- (42.7 percent) and then third- (10.3 percent) generation Asian Americans. Second-generation Asian Americans chose computer sciences at the highest rate (10.1 percent), followed by first- (8.9 percent) and then third- (6.0 percent) generation Asian Americans. Additionally, second-generation Asian Americans chose mathematics/statistics at the highest rate (4.5 percent), followed by first- (1.4 percent) and then third- (0.0 percent) generation Asian Americans. Third-generation Asian Americans chose engineering/engineering technologies at the highest rate (45.5 percent), followed by first- (38.3 percent) and then second- (32.0 percent) generation Asian Americans. Furthermore, third-generation Asian Americans chose physical sciences at the highest rate (38.2 percent), followed by second- (10.7 percent) and then first- (8.0 percent) generation Asian Americans. Also see Figure 4.9.

Table 4.5 Weighted crosstab between independent variables and STEM major choice (dependent variable)

		STEM major choice				
		Biology	Computer	Engineering	Math	Physics
Race (Asian Americans vs. Whites)	Whites					
	% within race	36.9%	12.7%	34.9%	5.8%	9.6%
	% within STEM choice	82.0%	84.9%	84.7%	84.8%	76.6%
	Asian Americans					
	% within race	39.2%	11.0%	30.5%	5.1%	14.2%
	% within STEM choice	18.0%	15.1%	15.3%	15.2%	23.4%
Geographical subgroups	East Asian Americans					
	% within geographical subgroups	38.3%	11.5%	29.4%	2.8%	18.0%
	% within STEM choice	52.8%	56.8%	52.2%	30.3%	68.7%
	Southeast Asian Americans					
	% within geographical subgroups	41.3%	10.1%	22.7%	12.6%	13.2%
	% within STEM choice	27.5%	24.2%	19.4%	65.2%	24.4%
	South Asian Americans					
	% within geographical subgroups	39.2%	10.6%	44.1%	1.2%	5.0%
	% within STEM choice	19.7%	19.0%	28.4%	4.5%	6.9%
Generational subgroups	First generation					
	% within generational subgroups	43.4%	8.9%	38.3%	1.4%	8.0%
	% within STEM choice	35.2%	30.4%	33.5%	15.5%	18.3%
	Second generation					
	% within generational subgroups	42.7%	10.1%	32.0%	4.5%	10.7%
	% within STEM choice	61.1%	60.6%	49.2%	84.5%	43.4%
	Third generation					
	% within generational subgroups	10.3%	6.0%	45.5%	0.0%	38.2%
	% within STEM choice	3.6%	9.0%	17.3%	0.0%	38.3%

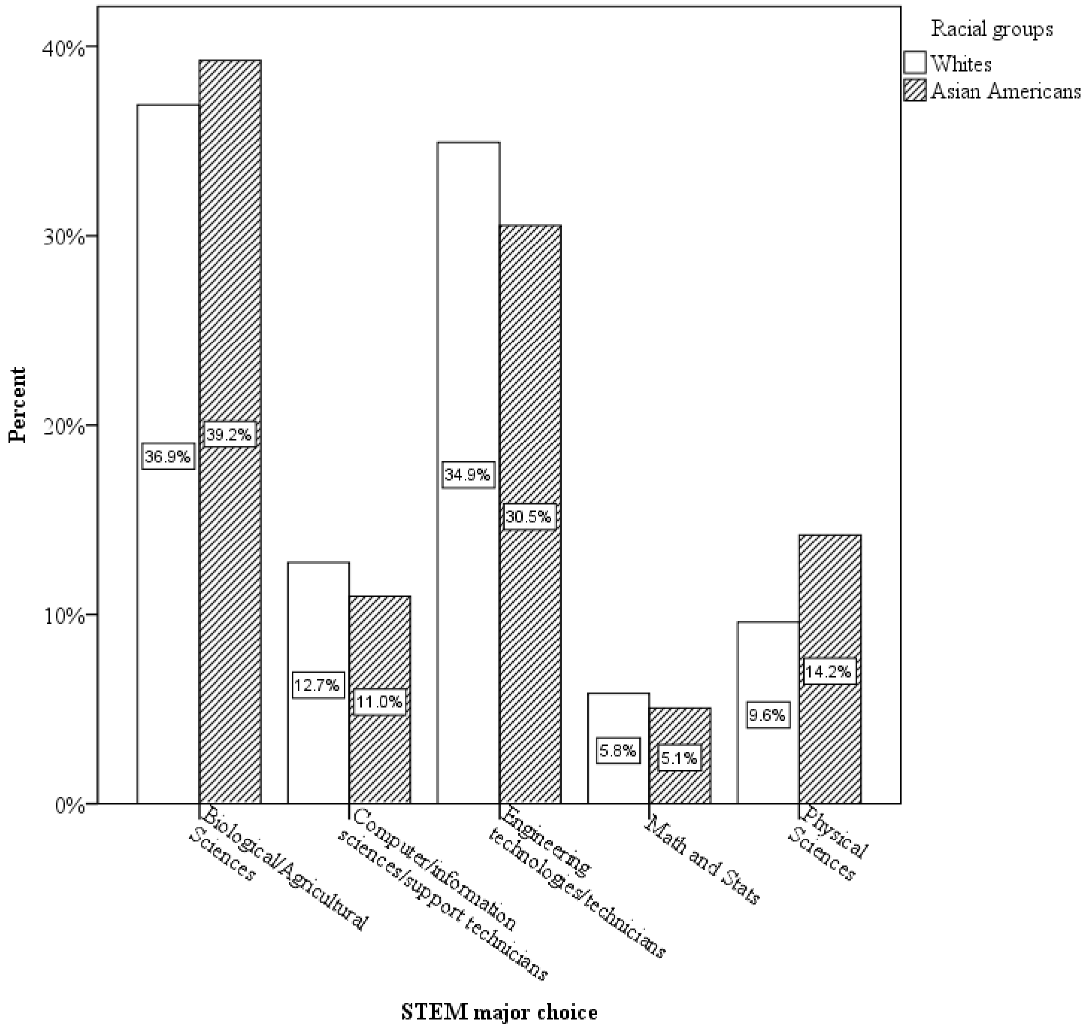

Figure 4.7 Bar graph for STEM major choice by racial groups

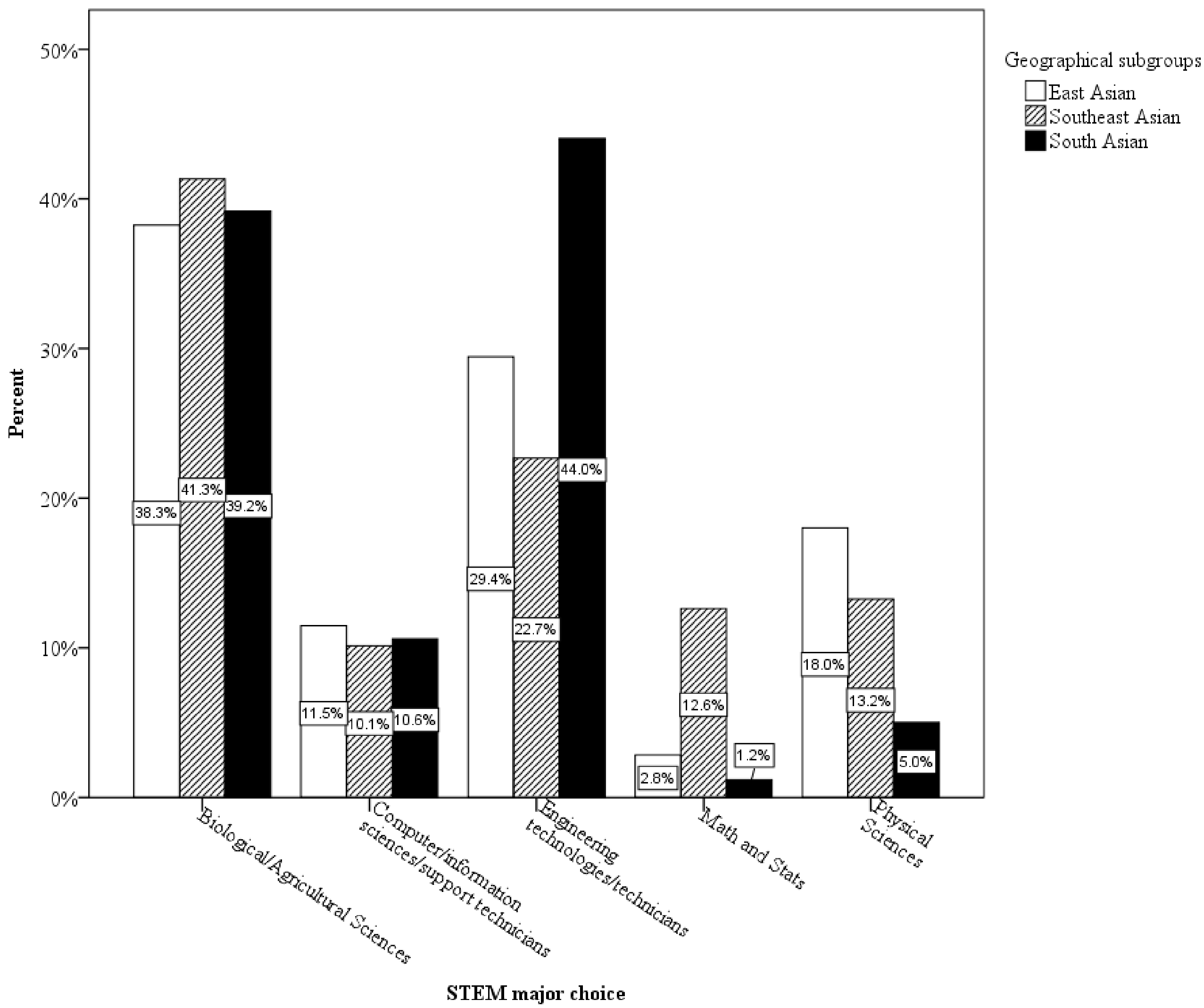

Figure 4.8 Bar graph for STEM major choice by Asian American geographical subgroups

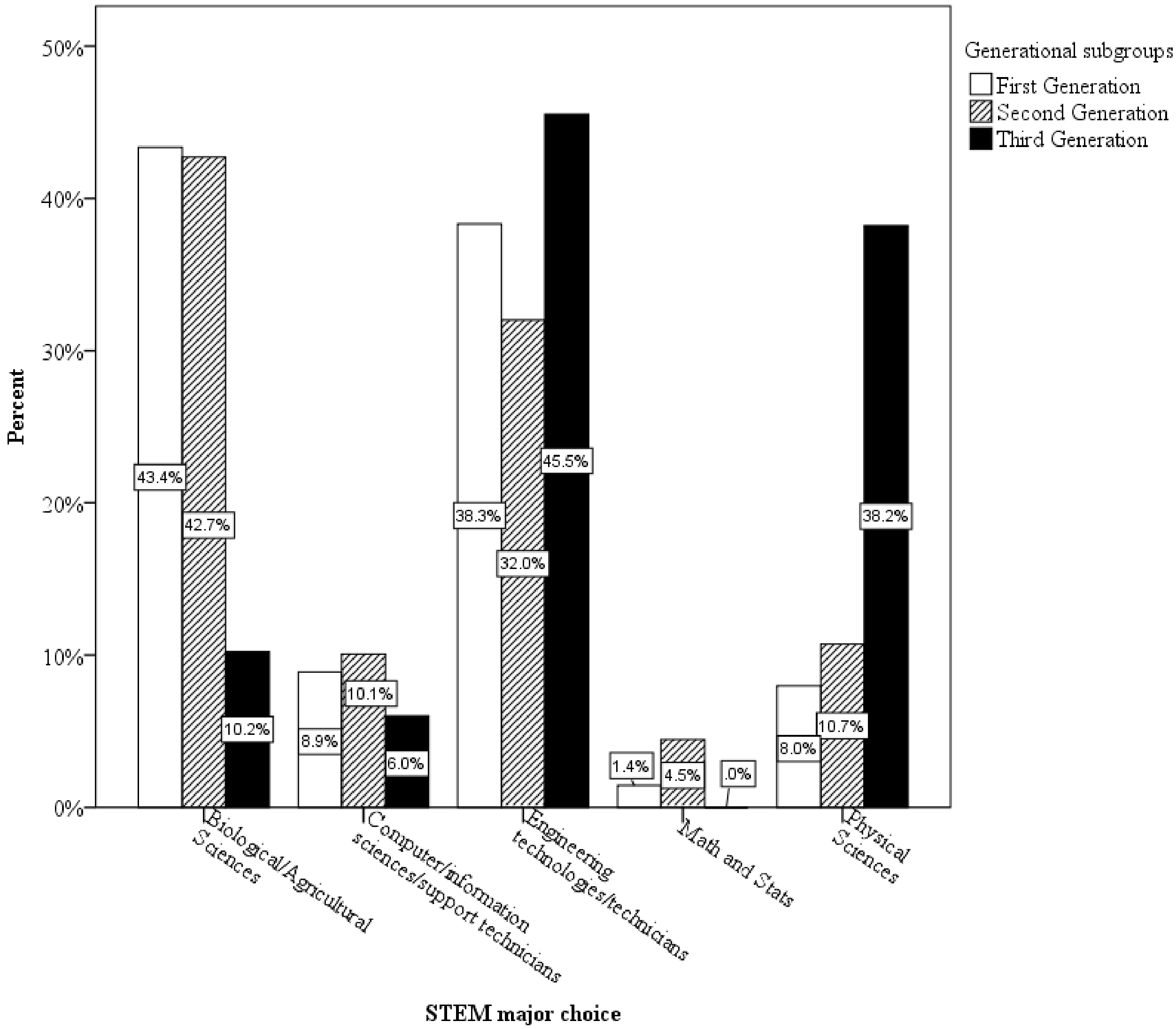

Figure 4.9 Bar graph for STEM major choice by Asian American generational subgroups

Table 4.6 presents a crosstab between independent variables and STEM completion. Overall, Asian American students (25.3 percent) were more likely to obtain a degree in STEM than White students (17.9 percent) (also see Figure 4.10). Within Asian Americans, South Asian American students had the highest rate of earning a STEM degree (34.2 percent), followed by East (26.7 percent) and then Southeast (19.6 percent) Asian American students (also see Figure 4.11). In terms of the generational subgroups, first-generation Asian American students had the highest rate of earning a STEM degree (28.9 percent), followed by third- (26.7 percent) and then second- (20.6 percent) generation Asian American students (also see Figure 4.12).[82]

Table 4.6 Weighted crosstab between independent variables and STEM completion (dependent variable)

		STEM completion	
		Non STEM	STEM
Race (Asian Americans vs. Whites)	Whites		
	% within race	82.1%	17.9%
	% within STEM completion	89.9%	85.2%
	Asian Americans		
	% within race	74.7%	25.3%
	% within STEM completion	10.1%	14.8%
Geographical subgroups	East Asian Americans		
	% within geographical subgroups	73.3%	26.7%
	% within STEM completion	48.6%	52.4%
	Southeast Asian Americans		
	% within geographical subgroups	80.4%	19.6%
	% within STEM completion	38.3%	27.5%
	South Asian Americans		
	% within geographical subgroups	65.8%	34.2%
	% within STEM completion	13.1%	20.0%
Generational subgroups	First generation		
	% within generational subgroups	71.1%	28.9%
	% within STEM completion	30.6%	38.8%
	Second generation		
	% within generational subgroups	79.4%	20.6%
	% within STEM completion	54.2%	43.8%
	Third generation		
	% within generational subgroups	73.3%	26.7%
	% within STEM completion	15.3%	17.4%

[82] This pattern (regardless of the values of the numbers) was different from the one from STEM choice.

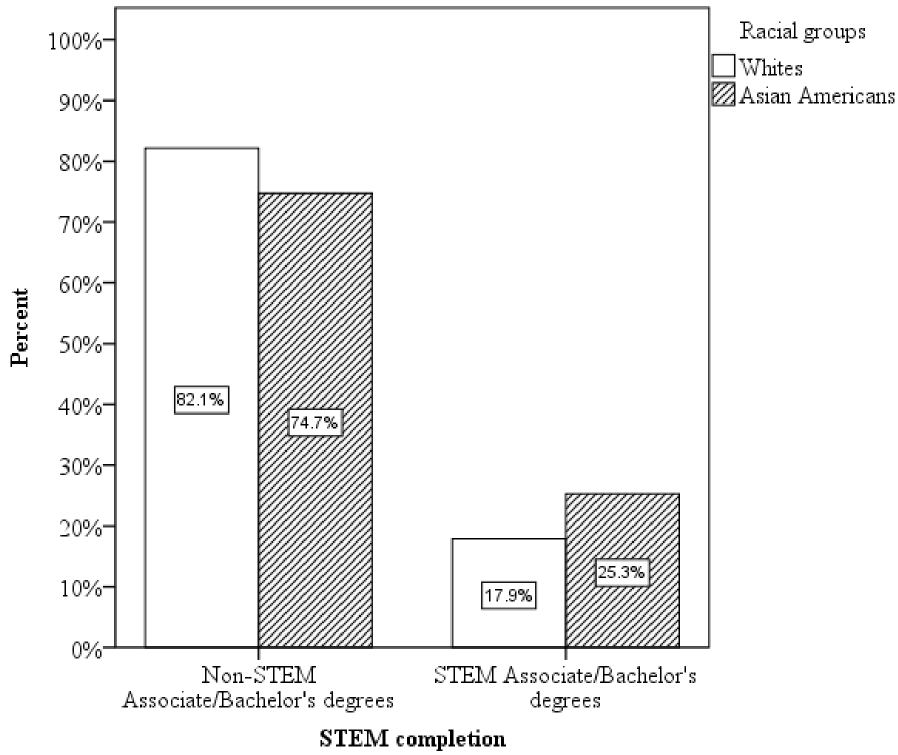

Figure 4.10 Bar graph for STEM completion by racial groups

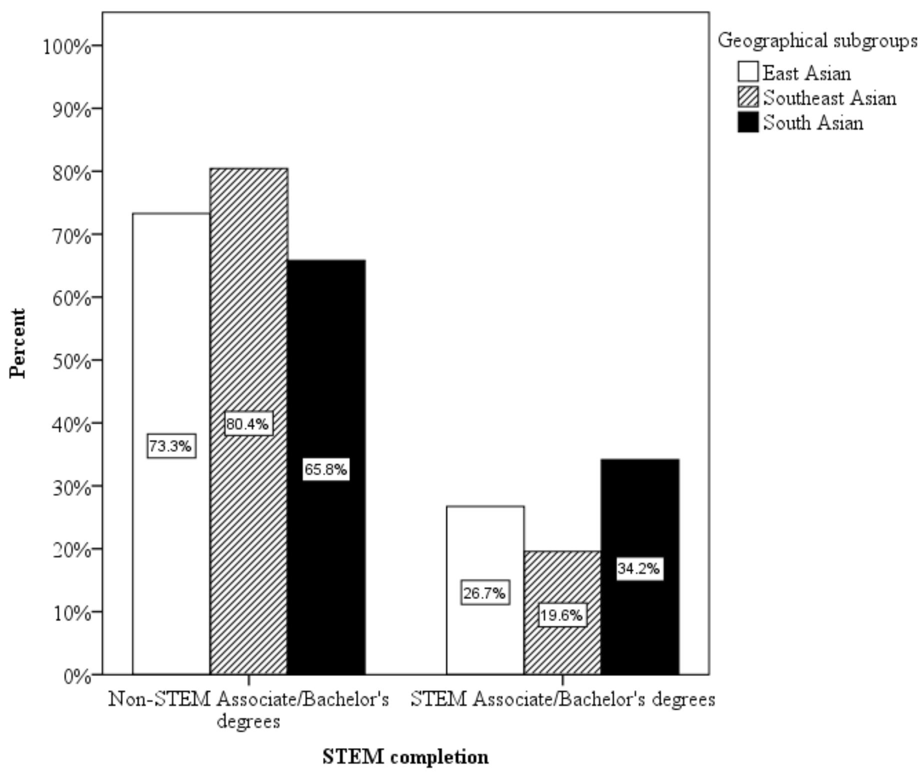

Figure 4.11 Bar graph for STEM completion by Asian American geographical subgroups

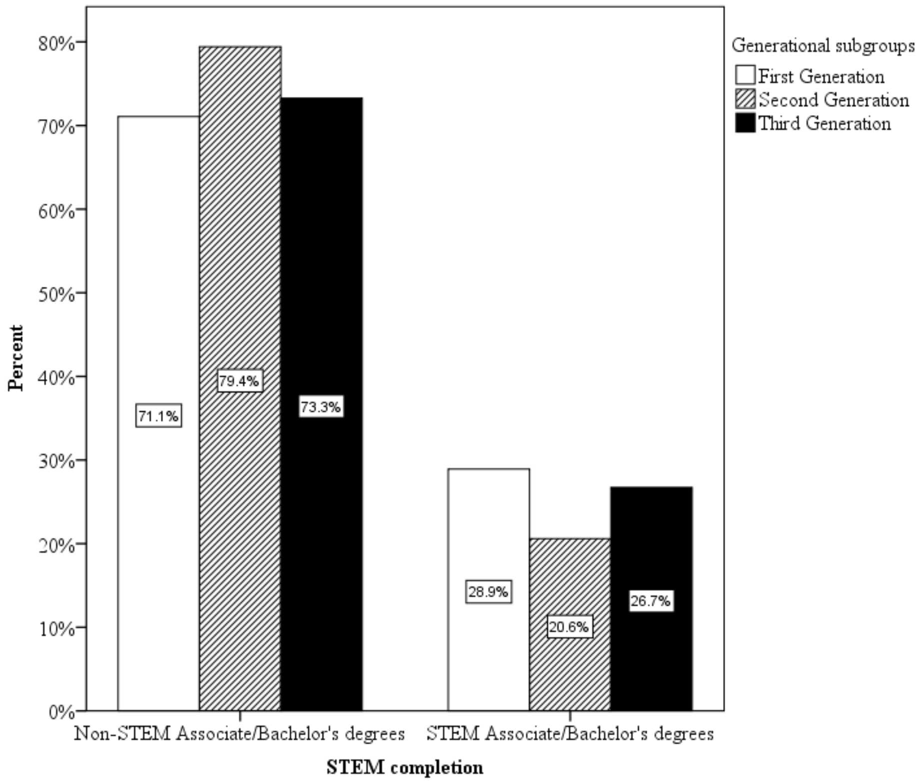

Figure 4.12 Bar graph for STEM completion by Asian American generational subgroups

Table 4.7 presents a crosstab between independent variables and STEM major completion. Among the five STEM fields, Asian Americans were more likely to gain a degree in biological/agricultural sciences (46.1 percent) and physical sciences (11.2 percent) than White students (biological/agricultural sciences: 35.9 percent; physical sciences: 9.1 percent). Also see Figure 4.13.

Among Asian Americans who obtained degrees in STEM fields, Southeast Asian Americans earned degrees in biological/agricultural sciences at the highest rate (47.9 percent), followed by East (46.4 percent) and then South Asian Americans (42.9 percent). South Asian Americans gained degrees in computer sciences at the highest rate (17.6 percent), followed by Southeast (11.2 percent) and East Asian Americans (7.7 percent). Additionally, South Asian

Americans obtained degrees in engineering/engineering technologies at the highest rate (36.3 percent), followed by Southeast (26.7 percent) and East (25.7 percent) Asian Americans. East Asian Americans obtained degrees in mathematics/statistics at the highest rate (4.6 percent), closely followed by Southeast (4.5 percent) and then South Asian Americans (1.7 percent). Furthermore, East Asian Americans gained degrees in physical sciences at the highest rate (15.6 percent), followed by Southeast (9.8 percent) and then South Asian Americans (1.4 percent). As for the Asian American geographical subgroups, the patterns of STEM major choice and STEM major completion were somewhat different. Also see Figure 4.14.

With regard to the Asian American generational subgroups, first-generation Asian Americans had the highest rate of obtaining a STEM degree in biological/agricultural sciences (47.9 percent), followed by second- (43.0 percent) and then third- (30.4 percent) generation Asian Americans. Second-generation Asian Americans had the highest rate of obtaining a STEM degree in engineering/engineering technologies (35.3 percent), followed by third- (34.9 percent) and then first- (23.5 percent) generation Asian Americans. Moreover, second-generation Asian Americans had the highest rate of obtaining a STEM degree in mathematics/statistics (6.9 percent), followed by first- (5.6 percent) and then third- (0.0 percent) generation Asian Americans. On the other hand, third-generation Asian Americans had the highest rate of obtaining a STEM degree in computer sciences (14.0 percent), followed by second- (13.5 percent) and then first- (10.6 percent) generation Asian Americans. Furthermore, third-generation Asian Americans had the highest rate of obtaining a STEM degree in physical sciences (20.7 percent), followed by first- (12.3 percent) and then second- (1.3 percent) generation Asian Americans. As for the Asian American generational subgroups, the patterns of STEM major choice and STEM major completion were not the same. Also see Figure 4.15.

Table 4.7 Weighted crosstab between independent variables and STEM major completion (dependent variable)

		STEM major completion				
		Biology	Computer	Engineering	Math	Physics
Race (Asian Americans vs. Whites)	Whites					
	% within race	35.9%	14.4%	35.1%	5.5%	9.1%
	% within STEM major completion	81.4%	88.4%	87.6%	88.6%	82.1%
	Asian Americans					
	% within race	46.1%	10.6%	28.1%	4.0%	11.2%
	% within STEM major completion	18.6%	11.6%	12.4%	11.4%	17.9%
Geographical subgroups	East Asian Americans					
	% within geographical subgroups	46.4%	7.7%	25.7%	4.6%	15.6%
	% within STEM major completion	52.7%	37.8%	48.0%	60.8%	73.3%
	Southeast Asian Americans					
	% within geographical subgroups	47.9%	11.2%	26.7%	4.5%	9.8%
	% within STEM major completion	28.6%	29.0%	26.1%	30.6%	24.1%
	South Asian Americans					
	% within geographical subgroups	42.9%	17.6%	36.3%	1.7%	1.4%
	% within STEM major completion	18.7%	33.2%	25.9%	8.5%	2.6%
Generational subgroups	First generation					
	% within generational subgroups	47.9%	10.6%	23.5%	5.6%	12.3%
	% within STEM major completion	43.5%	33.1%	29.8%	42.1%	53.1%
	Second generation					
	% within generational subgroups	43.0%	13.5%	35.3%	6.9%	1.3%

	% within STEM major completion	44.1%	47.4%	50.4%	57.9%	6.6%
	Third generation					
	% within generational subgroups	30.4%	14.0%	34.9%	0.0%	20.7%
	% within STEM major completion	12.4%	19.5%	19.8%	0.0%	40.2%

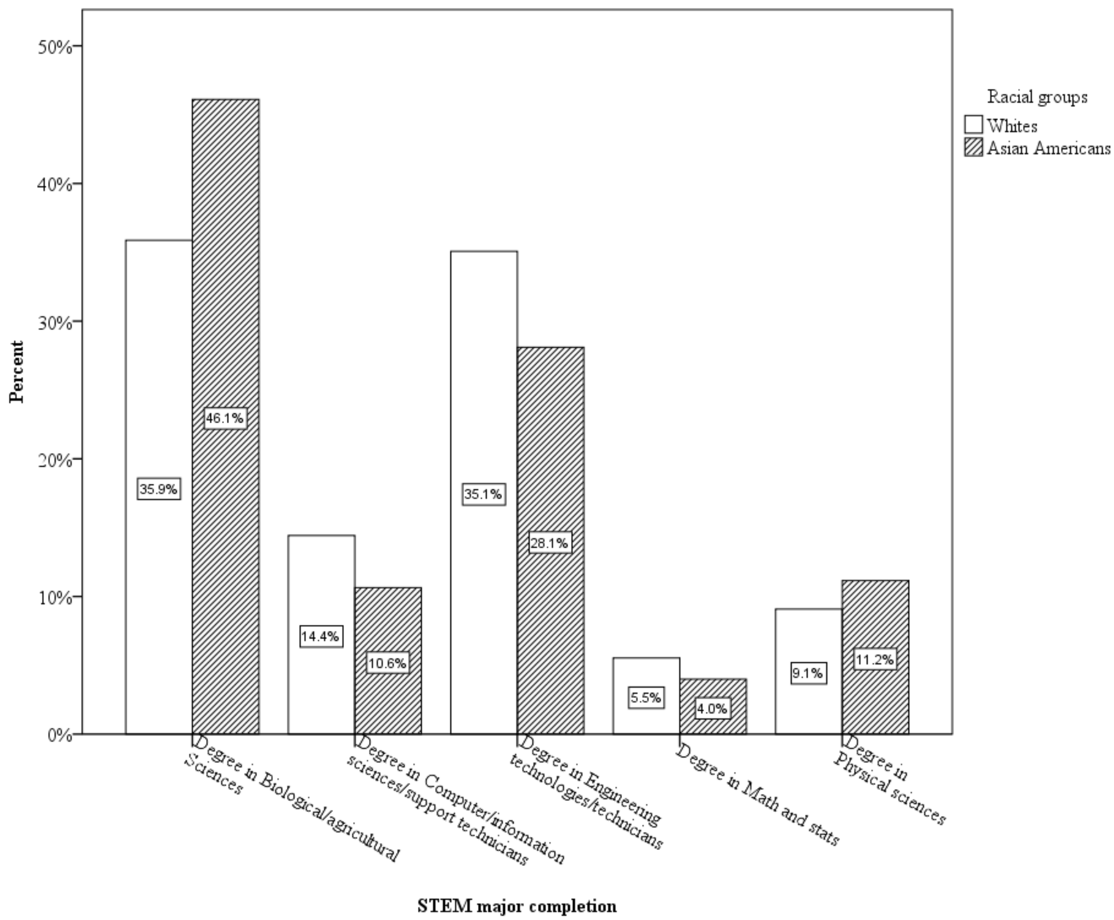

Figure 4.13 Bar graph for STEM major completion by racial groups

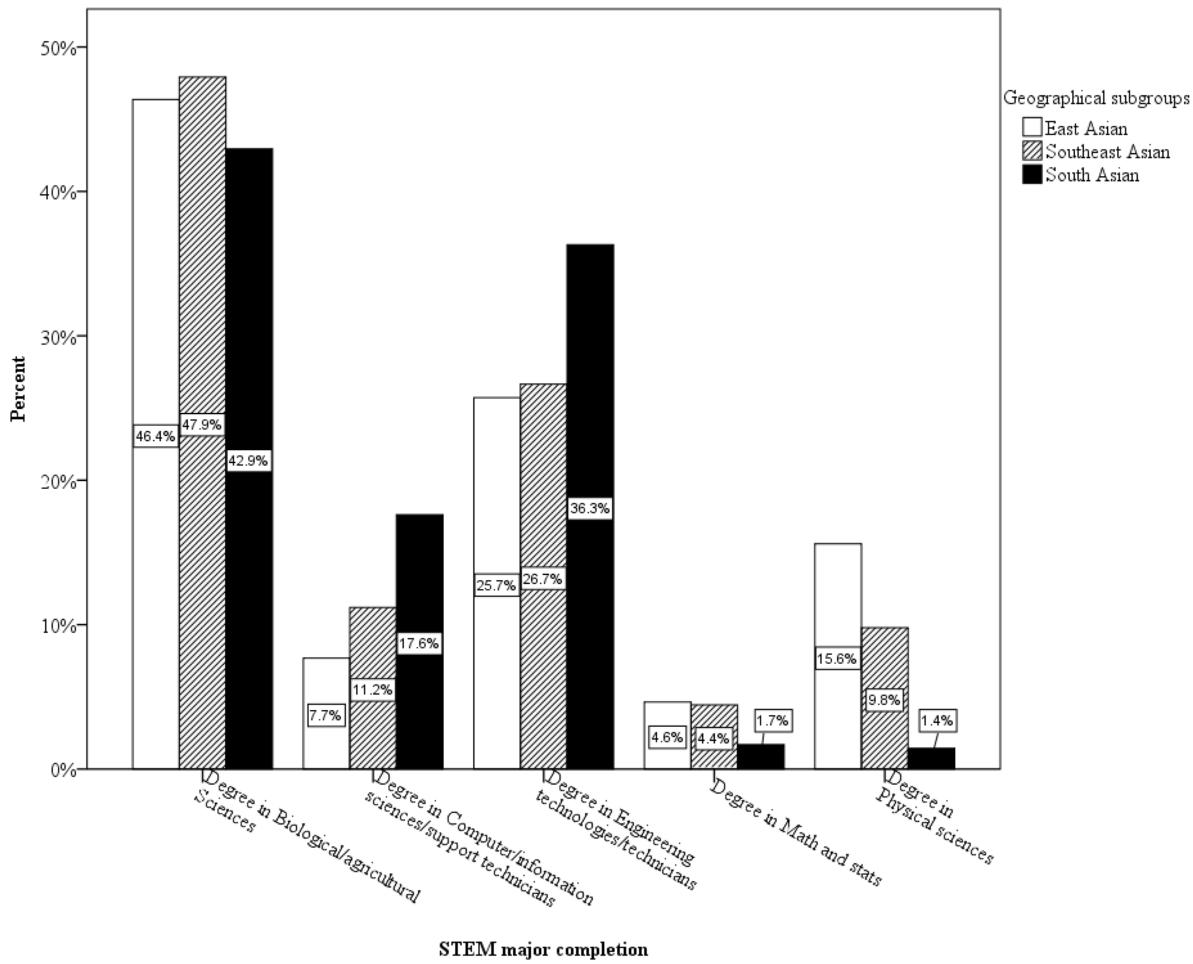

Figure 4.14 Bar graph for STEM major completion by Asian American geographical subgroups

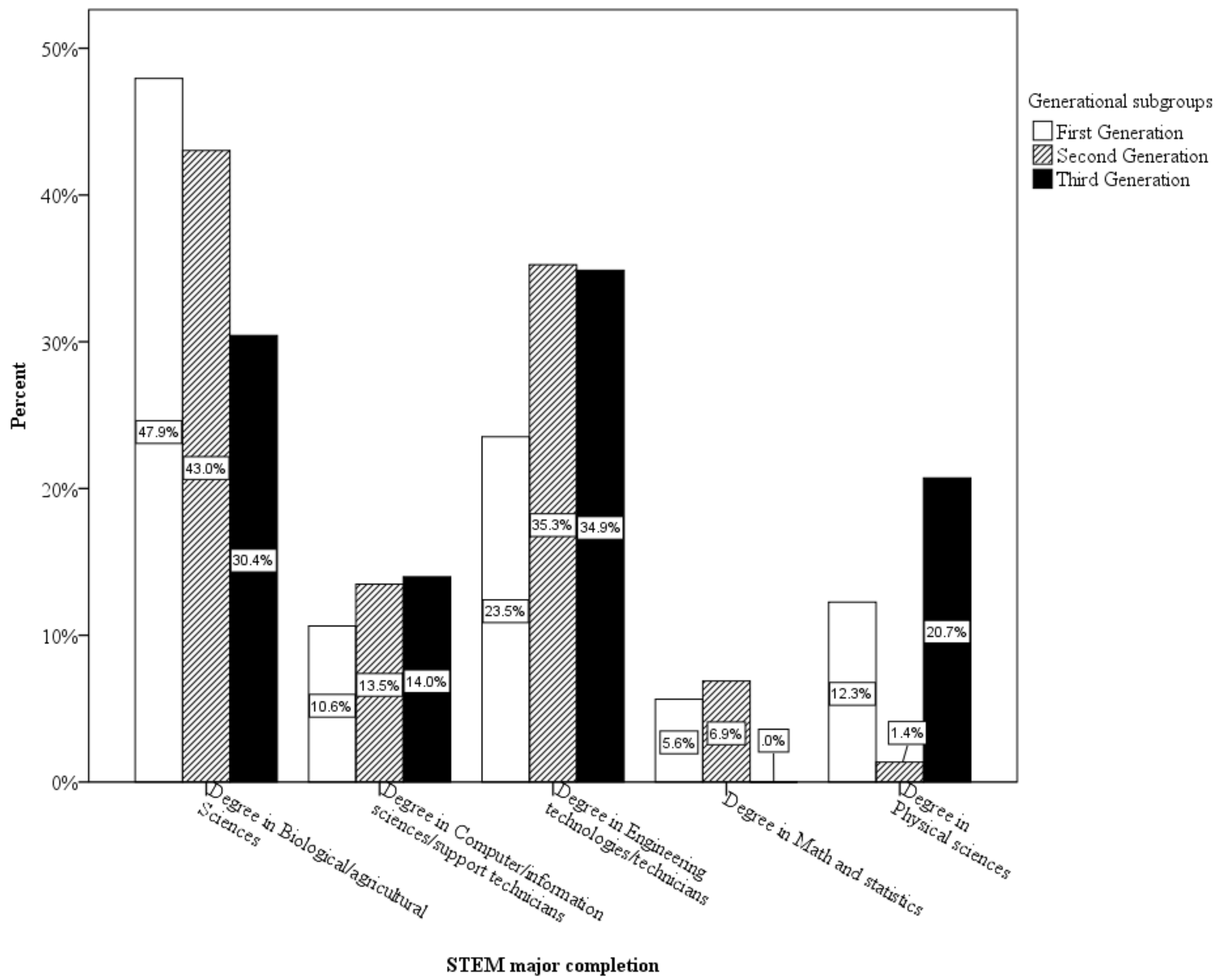

Figure 4.15 Bar graph for STEM major completion by Asian American generational subgroups

Table 4.8 presents a crosstab between independent variables and STEM major persistence. In general, Asian American (89.2 percent) and White (89.8 percent) students were equally likely to persist in the same STEM field (also see Figure 4.16). South Asian American students had the highest rate of persisting in the same STEM field (98.4 percent), followed by East (89.0 percent) and then Southeast (81.6 percent) Asian American students (also see Figure 4.17). In terms of the generational subgroups, second- (93.7 percent) and third- (93.2 percent) generation Asian American students had the highest rate of persisting in the same STEM field, followed by first-generation (91.9 percent) Asian American students (also see Figure 4.18).

Table 4.8 Weighted crosstab between independent variables and STEM major persistence (dependent variable)

		STEM major persistence	
		Not persisted	Persisted
Race (Asian Americans vs. Whites)	Whites		
	% within race	10.2%	89.8%
	% within STEM major persistence	84.2%	85.1%
	Asian Americans		
	% within race	10.8%	89.2%
	% within STEM major persistence	15.8%	14.9%
Geographical subgroups	East Asian Americans		
	% within geographical subgroups	11.0%	89.0%
	% within STEM major persistence	57.7%	56.9%
	Southeast Asian Americans		
	% within geographical subgroups	18.4%	81.6%
	% within STEM major persistence	39.3%	21.1%
	South Asian Americans		
	% within geographical subgroups	1.6%	98.4%
	% within STEM major persistence	3.0%	22.0%
Generational subgroups	First generation		
	% within generational subgroups	8.1%	91.9%
	% within STEM major persistence	37.4%	32.0%
	Second generation		
	% within generational subgroups	6.3%	93.7%
	% within STEM major persistence	45.9%	50.9%
	Third generation		
	% within generational subgroups	6.8%	93.2%
	% within STEM major persistence	16.7%	17.1%

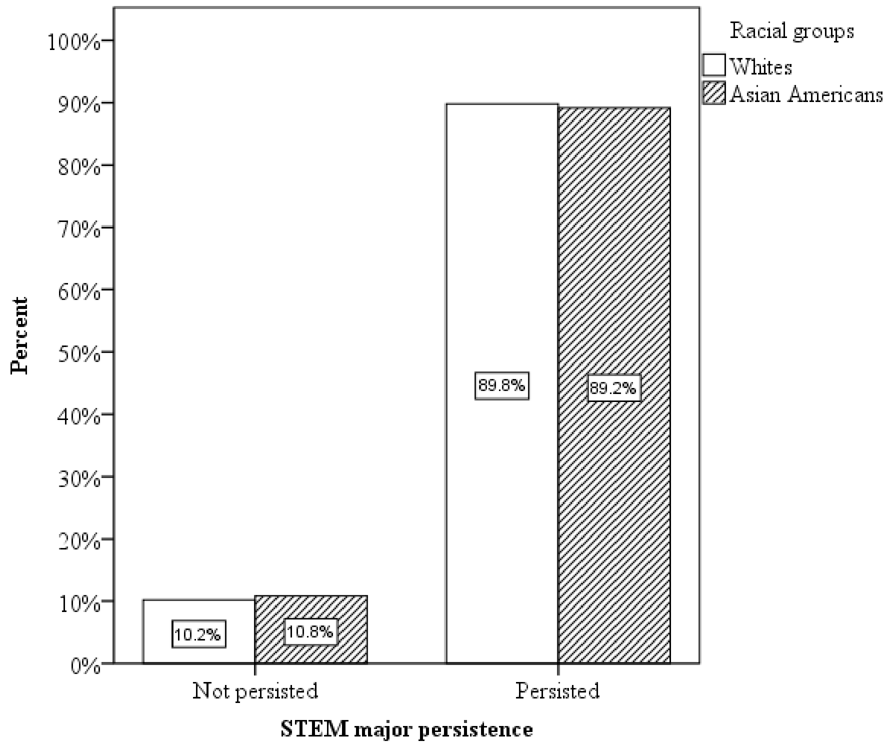

Figure 4.16 Bar graph for STEM major persistence by racial groups

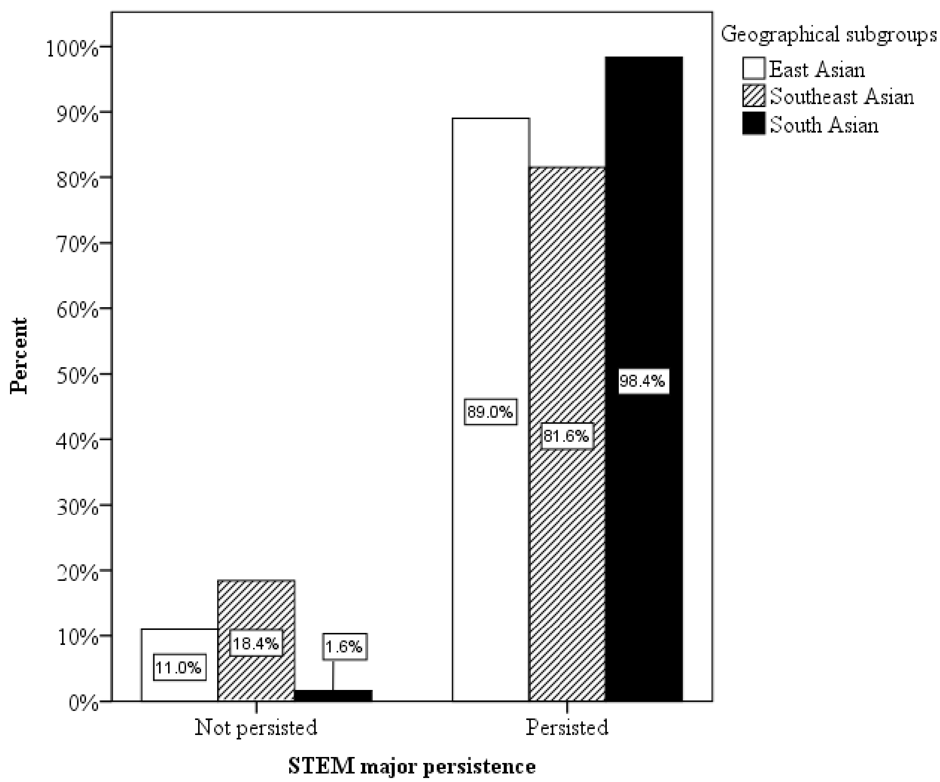

Figure 4.17 Bar graph for STEM major persistence by Asian American geographical subgroups

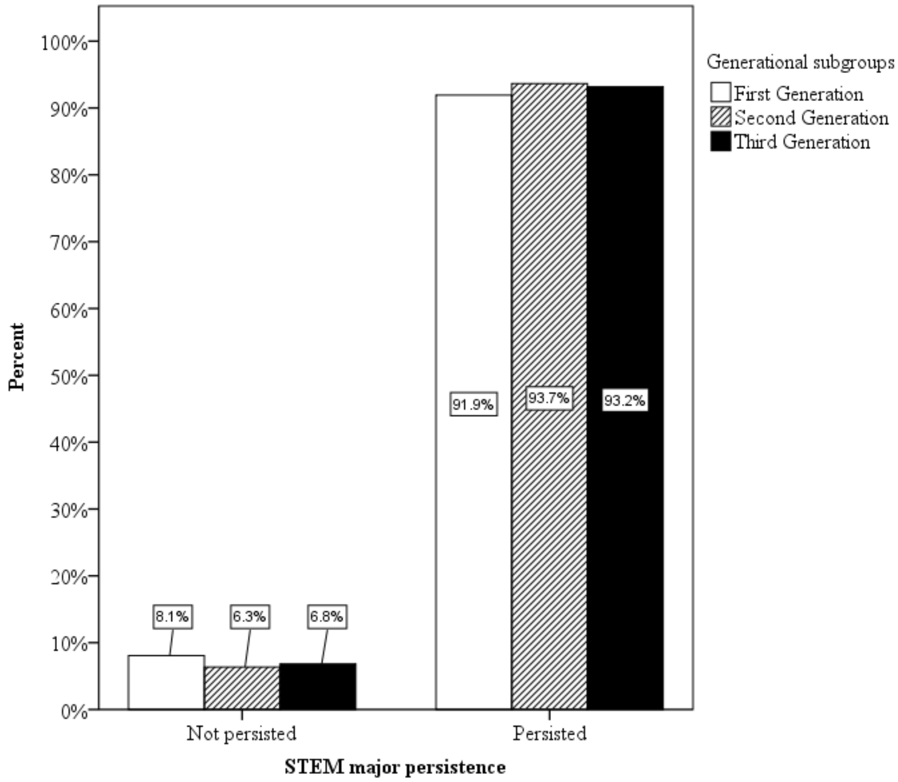

Figure 4.18 Bar graph for STEM major persistence by Asian American generational subgroups

Summary

In general, Asian American and White students were both more likely to enroll into postsecondary institutions than not. More specifically, within Asian American students, East Asian Americans had a higher postsecondary education enrollment rate than South and Southeast Asian Americans. Second-generation Asian Americans had the highest postsecondary education enrollment rate, followed by first- and then third- generation Asian Americans.

Asian American students were more likely than their White peers to choose STEM fields as their postsecondary majors; although for both groups, they chose non-STEM fields at a higher rate than STEM fields. In particular, within Asian Americans, South Asian American students chose STEM fields at the highest rate, followed by East and then Southeast Asian American peers. Second-generation Asian American students had the highest rate of choosing STEM fields, followed by first- and third- generation Asian American students.

Within the five different STEM fields, Asian American students were more likely to choose biological/agricultural sciences, followed by engineering/engineering technologies, physical sciences, computer sciences, and then mathematics/statistics. White students shared a similar pattern. They were more likely to choose biological/agricultural sciences, followed by engineering/engineering technologies, computer sciences, physical sciences, and then mathematics/statistics. Within Asian Americans, differences in choosing STEM fields did exist. East Asian Americans were more likely to choose biological/agricultural sciences, followed by engineering/engineering technologies, physical sciences, computer sciences, and then mathematics/statistics. Southeast Asian American students were more likely to choose biological/agricultural sciences, followed by engineering/engineering technologies, physical sciences, mathematics/statistics, and then computer sciences. South Asian Americans were more likely to choose engineering/engineering technologies, followed by biological/agricultural sciences, computer sciences, physical sciences, and then mathematics/statistics.

As for the Asian American generational subgroups, first-generation Asian American students were more likely to choose biological/agricultural sciences, followed by engineering/engineering technologies, computer sciences, physical sciences, and then mathematics/statistics. Second-generation Asian American students were more likely to choose biological/agricultural sciences, followed by engineering/engineering technologies, physical sciences, computer sciences, and then mathematics/statistics. Third-generation Asian Americans were more likely to choose engineering/engineering technologies, followed by physical sciences, biological/agricultural sciences, computer sciences, and then mathematics/statistics.

Overall, among both Asian American and White students, the rates of earning a degree in STEM fields were lower than the rates of choosing a major in STEM fields. Asian American students had a higher STEM completion rate than White students. The gap between Asian American and White students in STEM choice was narrower than the gap between the two racial groups in STEM completion. [83] Among Asian Americans, South Asian American students had the highest rate of degree completion in STEM fields, followed by East and then Southeast Asian Americans. First-generation Asian American students had the highest rate of degree completion in STEM fields, followed by third- and then second- generation Asian American students. Generally, the patterns for STEM choice and STEM completion were not the same.

Among the five STEM fields, Asian American students were more likely to earn a degree in biological/agricultural sciences and engineering/engineering technologies, followed by computer sciences, physical sciences, and mathematics/statistics. White students were more likely to obtain a degree in biological/agricultural sciences, followed by engineering/engineering technologies, physical sciences, computer sciences, and mathematics/statistics. Within Asian Americans, members of the East Asian American subgroup were more likely to have a degree in biological/agricultural sciences, followed by engineering/engineering technologies, physical sciences, computer sciences, and mathematics/statistics. With a similar pattern, Southeast Asian American students were more likely to gain a degree in biological/agricultural sciences, followed by engineering/engineering technologies, computer sciences, physical sciences, and mathematics/statistics. South Asian Americans were more likely to obtain a degree in biological/agricultural sciences, followed by engineering/engineering technologies, computer sciences, mathematics/statistics, and physical sciences.

[83] For STEM choice, the gap between Asian Americans and Whites was 13.1 percent; for STEM completion, the gap between Asian Americans and Whites was 7.4 percent.

For the Asian American generational subgroups, first-generation Asian American students were more likely to earn a degree in biological/agricultural sciences, followed by engineering/engineering technologies, physical sciences, computer sciences, and mathematics/statistics. Second-generation Asian American students were more likely to gain a degree in biological/agricultural sciences, followed by engineering/engineering technologies, computer sciences, physical sciences, and mathematics/statistics. Third-generation Asian Americans were more likely to obtain a degree in engineering/engineering technologies, followed by biological/agricultural sciences, physical sciences, computer sciences, and mathematics/statistics. Basically, the patterns for STEM major choice and STEM major completion did not fully match; however, for both STEM major choice and STEM major completion, biological/agricultural sciences as well as engineering/engineering technologies seems to be the STEM fields that drew students.

Once choosing a STEM field, both Asian American and White students were likely to persist in that field. Within Asian Americans, a closer examination shows that South Asian American students were most likely to persist in the same STEM field, followed by their East and then Southeast Asian American peers. On the other hand, second- and third- generation Asian Americans were slightly more likely to persist in the same STEM field than first-generation Asian American students.

Independent and dependent variables for inferential analysis

Table 4.9 indicates, among the three geographical subgroups, East and South Asian Americans were closer in the values of explanatory variables. For example, the average SES was 0.28 for South Asian Americans, 0.18 for East Asian American, and -0.24 for Southeast Asian

Americans.[84] Among the generational subgroups, first- and second- generation Asian Americans were closer in the values of explanatory variables.[85] For instance, the mean parental expectation level was 5.70 for first-generation, 5.52 for second-generation, and 4.73 for third-generation students. Table 4.10 shows geographical subgroup gaps in postsecondary enrollment, STEM choice, and STEM completion were small between East and South Asian Americans (postsecondary enrollment: gap = 3.9%; STEM choice: gap = -4.9%; STEM completion: gap = -7.5%[86]). Generational subgroup gaps in STEM choice and STEM completion were small between first- and third- generation Asian Americans (STEM choice: gap = 1.5%; STEM completion: gap = 2.2%), while the generational subgroup gaps in postsecondary enrollment were small between first- and second- generation Asian Americans (gap = -3.8%).

Based on the above, third-generation Asian Americans were dropped from the generational subgroups when conducting the inferential analyses. More specifically, one of the reasons is that Table 4.9 suggests there were more similarities between first- and second-generation Asian Americans, while Table 4.10 implies there were more similarities between first- and third- generation Asian Americans. Thus, no combination of the Asian American generational subgroups is ideal when doing the analyses. The other reason is the small sample size of the third-generation Asian Americans.

Additionally, three dependent variables—STEM major choice, STEM major completion, and STEM major persistence—were excluded from inferential analyses. On one hand, the

[84] This order is similar to the results obtained based on Goyette and Xie's (1999) research.
[85] It is worth to note that third generation Asian Americans had the highest SES and first generation Asian Americans had the lowest SES level. This is somewhat different from the results derived from the study of Kaufman, Chavez, and Lauen (1998).
[86] The gap between East and Southeast Asian Americans (gap = 7.1%) was slightly smaller than the gap between East and South Asian Americans in STEM completion.

analytic sample sizes between Asian American subgroups and these three dependent variables were small.[87] On the other hand, the crosstab results inform variations in the three dependent variables by different Asian American subgroups, which makes it less feasible to lump the Asian American subgroups.

In sum, when carrying out the inferential analyses, Asian American geographical subgroups contained East/South and Southeast Asian Americans; Asian American generational subgroups contained first- as well as second- generation Asian Americans. In terms of the dependent variables, postsecondary enrollment, STEM choice, and STEM completion were analyzed. Eventually, there are six logistic regression models. In particular, model 1 and 2 are the regression models with postsecondary enrollment as the dependent variable. Model 3 and 4 have STEM choice as the dependent variable. Model 5 and 6 have STEM completion as the dependent variable. In terms of the independent variables, model 1, 3, and 5 studied Asian American students as a whole in comparison with White students, while model 2, 4, and 6 examined differences within Asian American students (i.e., Asian American geographical and generational subgroups).

[87] The unweighted sample sizes for the crosstabs between Asian American geographical subgroups and dependent variables are—STEM major choice: N = 260, STEM major completion: N = 187, and STEM major persistence: N = 111. The unweighted sample sizes for the crosstabs between Asian American generational subgroups and dependent variables are—STEM major choice: N = 191, STEM major completion: N = 142, and STEM major persistence: N = 89.

Table 4.9 Weighted means of explanatory variables by independent variables

	Geographical subgroups			Generational subgroups		
	East Asian Americans	Southeast Asian Americans	South Asian Americans	First generation	Second generation	Third generation
Female	0.45	0.48	0.39	0.48	0.52	0.34
SES	0.18	-0.24	0.28	-0.18	0.09	0.19
English proficiency	0.54	0.39	0.32	0.17	0.49	0.80
Private high school	0.10	0.08	0.09	0.07	0.10	0.13
Parental participation	0.26	0.22	0.25	0.20	0.25	0.28
Family communication	2.25	2.13	2.24	2.11	2.18	2.28
Family rules	0.79	0.82	0.81	0.77	0.81	0.86
Parental expectation	5.41	5.19	5.84	5.70	5.52	4.73
Math pipeline	6.27	5.40	6.10	6.07	6.15	5.02
Science pipeline	5.77	5.19	5.75	5.69	5.75	4.61
Academic achievement (math)	0.65	-0.04	0.32	0.32	0.48	0.06
High school STEM occupation expectation	0.15	0.11	0.11	0.12	0.14	0.11
4-year institution	0.73	0.60	0.65	0.61	0.69	0.69

Table 4.10 Subgroups differences based on weighted crosstabs between independent and dependent variables

		Geographical subgroups			Generational subgroups		
		East-Southeast	East-South	Southeast-South	First-Second	First-Third	Second-Third
Postsecondary enrollment	PSE (vs. No PSE)	8.3%	3.9%	-4.4%	-3.8%	13.1%	16.9%
STEM choice	STEM (vs. Non STEM)	9.8%	-4.9%	-14.7%	-3.3%	1.5%	4.8%
STEM major choice	Biology	-3.0%	-0.9%	2.1%	0.7%	33.1%	32.4%
	Computer	1.4%	0.9%	-0.5%	-1.2%	2.9%	4.1%
	Engineering	6.7%	-14.7%	-21.4%	6.3%	-7.2%	-13.5%
	Math	-9.8%	1.6%	11.4%	-3.1%	1.4%	4.5%
	Physics	4.8%	13.0%	8.2%	-2.7%	-30.2%	-27.5%
STEM completion	STEM (vs. Non STEM)	7.1%	-7.5%	-14.6%	8.3%	2.2%	-6.1%
STEM major completion	Biology	-1.5%	3.5%	5.0%	4.9%	17.5%	12.6%
	Computer	-3.5%	-9.9%	-6.4%	-2.9%	-3.4%	-0.5%
	Engineering	-1.0%	-10.6%	-9.6%	-11.8%	-11.4%	0.4%
	Math	0.1%	2.9%	2.8%	-1.3%	5.6%	6.9%
	Physics	5.8%	14.2%	8.4%	11.0%	-8.4%	-19.4%
STEM major persistence	Persist (vs. Not persist)	7.4%	-9.4%	-16.8%	-1.8%	-1.3%	0.5%

Correlations

Appendix F provides six correlation tables by independent and dependent variables.[88] More specifically, for each of the three dependent variables (i.e., postsecondary enrollment, STEM choice, and STEM completion) utilized for inferential analysis, there are two correlation tables—one involving Asian Americans as a whole (versus White students), the other involving Asian American geographical (East/South versus Southeast Asian Americans) and generational (first- versus second- generation Asian Americans) subgroups.[89] For instance, the variables in Table F.1 are postsecondary enrollment, Asian Americans, and the explanatory variables[90]. The variables in Table F.2 are postsecondary enrollment, East/South Asian Americans, first-generation Asian Americans, and the explanatory variables[91].

In this section, correlations among explanatory variables were first examined with the aim of obtaining a preliminary view on which explanatory variables can be kept. Next, relationships between all of the predictors (i.e., independent and explanatory variables) and the dependent variables were studied for the purpose of having a hint about the regression results.

Correlations between explanatory variables

In terms of the correlations among the explanatory variables, generally speaking, the math pipeline was positively and strongly associated with academic achievement in math, with *r* ranging from 0.66 to 0.72 (Table F.1 to Table F.6). That is, taking higher levels of math courses was associated with better math performance. The math pipeline was positively and moderately to strongly associated with the science pipeline, with *r* ranging from 0.50 to 0.68 (Table F.1 to

[88] Since some of the variables were dummy coded, with Pearson correlation, the magnitude of the relationships of these variables were not meaningful. Rather, the directions of these relationships could provide some glimpse on how the variables were related.
89 Listwise deletion was used when running the correlations.
[90] The variable, the 4-year institution, was not included in that this variable did not contain the no postsecondary enrollment data.
[91] 4-year institution was not included.

Table F.6). This means taking higher levels of math courses related to taking higher levels of science courses. Additionally, the science pipeline was positively and moderately associated with academic achievement in math, with r ranging from 0.46 to 0.60 (Table F.1 to Table F.6), which means taking higher levels of science courses related to better math performance.

Correlations among the explanatory variables did vary under different independent and dependent variables. For example, for correlation tables that were limited to Asian American subgroups (Table F.2, Table F.4, and Table F.6), parental participation was positively and moderately associated with family communication, with r ranging from 0.40 to 0.48. That is, higher levels of parental participation in children's education were associated with higher levels of family communication in children's education. Also, the correlation between parental expectation and the math pipeline was moderate and positive with postsecondary enrollment as the dependent variable and Asian Americans as the independent variable, $r = 0.51$, which indicates higher levels of parental expectation were associated with taking higher levels of math courses (Table F.1). The magnitude of such correlation was slightly reduced with postsecondary enrollment as the dependent variable and Asian American subgroups as the independent variables, $r = 0.45$ (Table F.2), and with STEM choice as the dependent variable and Asian Americans as the independent variable, $r = 0.42$ (Table F.3). Parental expectation was weakly though still positively associated with the math pipeline with STEM choice as the dependent variable and Asian American subgroups as the independent variables, $r = 0.26$ (Table F.4) as well as with STEM completion as the dependent variable and Asian American subgroups as the independent variables, $r = 0.28$ (Table F.6).

In sum, the strongest correlation among the explanatory variables was between the math pipeline and academic achievement in math, which was followed by the correlations between the math pipeline and the science pipeline, and between the science pipeline and academic achievement in math. Further analyses are required to determine whether to keep all of these three variables or to remove some of them when conducting the inferential analyses. On the other hand, with different pairs of independent and dependent variables (i.e., Table F.1 through Table F.6), correlations between explanatory variables did vary. Moreover, most of the explanatory variables were none to weakly correlate with each other.

Relationships between predictors[92] and the dependent variables

The relationships between independent and dependent variables were all statistically significant, though the magnitude of these relationships was between none and weak. However, since the involved variables were dummy coded, the magnitude of the relationships was not that meaningful. More specifically, being Asian American was positively associated with postsecondary enrollment, r = 0.05 (Table F.1). That is, Asian American students were more likely to enroll into a postsecondary institution than White students. Likewise, being Asian American was positively associated with STEM choice, r = 0.08 (Table F.3), which means Asian American students were more likely to choose a major in STEM fields than their White peers. Furthermore, being Asian American was positively associated with STEM completion, r = 0.04 (Table F.5). Namely, Asian American students were more likely to complete a major in STEM fields than White students.

Within Asian Americans, East and South Asian Americans were more likely to enter into postsecondary schools than Southeast Asian Americans, r = 0.14 (Table F.2). They were more likely to choice a major in STEM fields than Southeast Asian Americans, r = 0.06 (Table F.4). Moreover, they were more likely to earn a degree in STEM fields than their Southeast Asian

[92] In this study, predictors equaled to independent and explanatory variables.

American peers, *r* = 0.09 (Table F.6). In terms of the Asian American generational subgroups, first-generation Asian Americans were less likely to enter postsecondary schools than second-generation Asian Americans, *r* = -0.07 (Table F.2). First-generation Asian Americans were less likely to choice a major in STEM fields than second-generation Asian Americans, *r* = -0.08 (Table F.4). In comparison, they were more likely to obtain a degree in STEM fields than second-generation Asian Americans, *r* = 0.11 (Table F.6).

Disparities in the relationships between predictors and dependent variables existed for the six different pairs of independent and dependent variables (Table F.1 through Table F.6). For example, as mentioned above, first-generation Asian Americans were less likely to enroll into postsecondary education as well as to choose a major in STEM fields than second-generation Asian Americans; nevertheless, they were more likely to earn a degree in STEM fields than second-generation Asian Americans. Female students were more likely than male students to enter into postsecondary education.[93] But, they were less likely than male students to choose and to complete a major in STEM fields.[94] Another example lies in the relationships between family rules and dependent variables. Regardless to examine Asian Americans as a whole or as subgroups, students in families with more rules were less likely to enter into a postsecondary institution.[95] When Asian Americans were studied as a whole (versus White students), students

[93] With Asian Americans (vs. Whites) as the independent variable, the relationship between being female and postsecondary enrollment was 0.07 (Table F.1); and, with Asian American subgroups as the independent variables, the relationship between being female and postsecondary enrollment was 0.10 (Table F.2). Although the magnitude of these two relationships were close to none, they were statistically significant. Also, because the involved variables were all dummy coded, to interpret these relationships in their magnitude was not meaningful.
[94] With Asian Americans as the independent variable, the relationship between being female and STEM choice was -0.23 (Table F.3) and the relationship between being female and STEM completion was -0.24 (Table F.5). With Asian American subgroups as the independent variables, the relationship between being female and STEM choice was -0.16 (Table F.4) and the relationship between being female and STEM completion was -0.15 (Table F.6). While the magnitude of these relationships were weak, they were statistically significant.
[95] With Asian Americans as the independent variable, the relationship between family rules and postsecondary enrollment was -0.01 (Table F.1). With Asian American subgroups as the independent variables, the relationship

in families with more rules were less likely to choose a major as well as to obtain a degree in STEM fields.[96] Nonetheless, within Asian American students, students in families with more rules were more likely to choose a major and to earn a degree in STEM fields.[97]

In terms of the strongest correlations for each pair of independent and dependent variables, similarities can be found. With Asian Americans as the independent variable, the magnitude of four correlations is stronger than the rest. In particular, parental expectation (r = 0.31), the math pipeline (r = 0.30), the science pipeline (r = 0.24), and academic achievement in math (r = 0.28) were positively and weakly associated with postsecondary enrollment (Table F.1).[98] In other words, students who enjoyed higher levels of parental expectation, took higher levels of math and science courses, and performed better in math were more likely to enroll into postsecondary education. Although the magnitudes of these four correlations were reduced when Asian American subgroups were the independent variables, they were still among the highest correlations. More specifically, parental expectation (r = 0.11), the math pipeline (r = 0.19), the science pipeline (r = 0.15), and academic achievement in math (r = 0.15) were positively and weakly associated with postsecondary enrollment (Table F.2).[99]

With STEM choice and STEM completion as the dependent variables, the above pattern was slightly altered. That is, in comparison with the correlations that involve the math and science pipelines as well as the academic achievement in math, the magnitude of the one that

between family rules and postsecondary enrollment was -0.06 (Table F.2). While the magnitude of the relationships were close to none, they were statistically significant.

[96] With Asian Americans as the independent variable, the relationship between family rules and STEM choice was -0.04 (Table F.3); and, the relationship between family rules and STEM completion was -0.07 (Table F.5). Although the magnitude of the relationships were close to none, they were statistically significant.

[97] With Asian American subgroups as the independent variables, the relationship between family rules and STEM choice was 0.08 (Table F.4); and, the relationship between family rules and STEM completion was 0.04 (Table F.6). While the magnitude of the relationships were close to none, they were statistically significant.

[98] All the correlations were statistically significant.

[99] All the correlations were statistically significant.

involved parental expectation was smaller (Table F.3 through Table F.6). The correlations that involved high school STEM occupation expectation were among the strongest with STEM choice and STEM completion as the dependent variables (Table F.3 through Table F.6). Basically, students who took higher levels of math and science courses, performed better in math, and expected to have an occupation in STEM fields at age 30 were more likely to choose and finish a major in STEM fields. To be more specific, with Asian Americans as the independent variable, math (r = 0.27) and science (r = 0.28) pipelines as well as academic achievement in math (r = 0.29) were positively and weakly associated with STEM choice; and, high school STEM occupation expectation (r = 0.48) was positively and moderately associated with STEM choice (Table F.3).[100] Likewise, with Asian American subgroups as the independent variable, math (r = 0.22) and science (r = 0.22) pipelines as well as academic achievement in math (r = 0.23) were positively and weakly associated with STEM choice; and, high school STEM occupation expectation (r = 0.44) was positively and moderately associated with STEM choice (Table F.4).[101] With Asian Americans as the independent variable, math (r = 0.25) and science (r = 0.24) pipelines as well as academic achievement in math (r = 0.28) were positively and weakly associated with STEM completion; and, high school STEM occupation expectation (r = 0.50) was positively and moderately associated with STEM completion (Table F.5).[102] Similarly, with Asian American subgroups as the independent variable, math (r = 0.23) and science (r = 0.31) pipelines, academic achievement in math (r = 0.34), and high school STEM occupation expectation (r = 0.31) were positively and weakly associated with STEM completion (Table F.6)[103]

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[100] All the correlations were statistically significant.
[101] All the correlations were statistically significant.
[102] All the correlations were statistically significant.
[103] All the correlations were statistically significant.

Multicollinearity

Variance inflation factors (VIF) were used to detect multicollinearity. The VIFs were calculated for six models.[104] Table 4.11 provides the VIF values for each of the six models. Only Model 2 contained VIF values that were larger than 5. After removing the science pipeline along with academic achievement in math from Model 2, none of the VIF values was larger than 5. Therefore, the science pipeline and academic achievement in math were excluded from the logistic regression analysis, when postsecondary enrollment was the dependent variable and Asian American subgroups were the independent variables.

Table 4.11 Variance inflation factors (VIF) for model 1 through 6

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Asian Americans	2.20		3.05		3.03	
East/South Asian Americans		2.97		2.28		1.68
First-generation Asian Americans		2.31		1.55		1.62
Female	1.07	2.96	1.28	1.63	1.28	2.08
SES	1.25	5.02	1.28	1.71	1.32	2.04
English proficiency	2.22	2.05	3.14	2.19	3.35	2.60
Private high school	1.04	2.83	1.26	1.34	1.21	1.35
Parental participation	1.14	2.70	1.31	2.13	1.43	1.79
Family communication	1.22	2.77	1.29	2.41	1.45	3.29
Family rules	1.12	5.03	1.24	1.85	1.24	3.69
Parental expectation	1.78	2.88	1.18	1.25	1.38	1.88
Math pipeline	2.32	5.28	1.73	4.95	1.48	4.63
Science pipeline	1.64	3.64	1.24	3.22	1.25	2.55
Academic achievement (math)	2.09	5.68	1.80	3.00	1.56	2.57
High school STEM occupation expectation	1.08	3.63	1.15	1.39	1.13	1.53
4-year institution			1.23	2.07	1.35	2.32

Notes:

[104] Variables present in each of these six models are shown in Appendix G.

1. After excluding the science pipeline and academic achievement (math) from the model 2, none of the VIF values is greater than 5.[105]
2. Weight, stratum, and cluster were used in the analyses.

Variables Involved in Inferential Analysis

Stepwise logistic regressions were planned, which required the analytic sample sizes for each step being the same. To cope with this, listwise deletion was used. Nevertheless, with listwise deletion, a further reduction in the already small sample sizes could occur. To deal with this, three steps[106] of the six models were run separately (Appendix H), which means the sample size for each step can be different. Then, variables showed no significant results, except for independent variables, in either of the three steps were removed from stepwise logistic regression analyses.

Table H.1 presents results for Model 1. With no variables being held constant, race (being Asian American students versus being White students) was not related to postsecondary enrollment. Nonetheless, after controlling for demographic, family, and school variables, Asian American students were more likely than White students to enroll into postsecondary enrollment. It is unknown whether this phenomenon results from controlling variables or the differences in analytic sample sizes. On the other hand, English proficiency exhibited no statistically significant relationship with postsecondary enrollment. Also, private high school attendance, levels of parental participation, and number of family rules did not relate to postsecondary enrollment after controlling for all the other variables.

[105] That is, East/South Asian Americans: 2.16; First-generation Asian Americans: 2.29; Female: 1.80; SES: 2.32; English proficiency: 2.72; private high school: 2.39; Parental participation: 2.73; family communication: 2.24; family rules: 1.35; parental expectation: 2.99; the math pipeline: 4.30; high school STEM occupation expectation: 2.51

[106] Step 1: race variables (Asian Americans or Asian American subgroup variables); step 2: adding demographic variables (i.e., female, SES, and English proficiency) to step 1; and step 3: adding parental influence variables, high school variables (i.e., high school course taking and achievement variables, high school STEM occupation expectation, and private high school), and postsecondary education level to step 2.

Table H.2 shows results for Model 2. Without controlling for any explanatory variables, East/South Asian American students were more likely than Southeast Asian American students to enroll into postsecondary schools; however, there was no statistically significant difference between first- and second- generation Asian American students in postsecondary enrollment. Similar to Model 1, English proficiency exhibited no statistically significant relationship with postsecondary enrollment. Besides, after holding constant all the other variables, parental participation, family communication, family rules, parental expectation, the math pipeline as well as high school STEM occupation expectation were not associated with postsecondary enrollment.

Table H.3 shows results for Model 3. Without controlling for any explanatory variables, Asian American students were more likely to choose a major in STEM fields than White students. Similar to Model 1 and Model 2, English proficiency did not relate to choosing a major in STEM fields. Additionally, after holding constant all the other variables, high school type, parental participation, family communication, family rules, parental expectation, academic achievement in math, and postsecondary education level were not associated with choosing a major in STEM fields.

Table H.4 presents results for Model 4. Without holding constant any explanatory variables, there was no statistically significant difference between East/South and Southeast American students in choosing a major in STEM fields; likewise, there was no statistically significant difference between first- and second- generation Asian American students in choosing a major in STEM fields. SES, high school type, parental participation, family communication, family rules, parental expectation, the math pipeline, the science pipeline, academic achievement in math, and postsecondary education level did not statistically significantly relate to choosing a major in STEM fields.

Table H.5 shows results for Model 5. Without controlling for any explanatory variables, Asian American students were more likely to obtain a degree in STEM fields than White students. After controlling for race and gender, SES and English proficiency were not significantly associated with obtaining a degree in STEM fields. Moreover, by controlling for all the other variables, high school type, family communication, family rules, parental expectation, and postsecondary education level were not related to gaining a degree in STEM fields.

Table H.6 exhibits results for Model 6. Without holding constant any explanatory variables, there was no statistically significant difference between East/South and Southeast American students in gaining a degree in STEM fields; likewise, there was no statistically significant difference between first- and second- generation Asian American students in obtaining a degree in STEM fields. After controlling for race and gender, SES were not significantly associated with obtaining a degree in STEM fields. Also, by holding constant all the other variables, high school type, parental participation, family communication, family rules, parental expectation, the math pipeline, and postsecondary education level were not related to gaining a degree in STEM fields.

Overall, based on the above results, English proficiency, high school type, parental participation, and family rules were excluded from Model 1 when conducting stepwise logistic regression using listwise deletion method. English proficiency, parental participation, family communication, family rules, parental expectation, the math pipeline, and high school STEM occupation expectation were excluded from Model 2. English proficiency, high school type, parental participation, family communication, family rules, parental expectation, and academic achievement in math, and postsecondary education level were excluded from Model 3. SES, high school type, parental participation, family communication, family rules, parental expectation, the math pipeline, the science pipeline, academic achievement in math, and postsecondary education level were excluded from Model 4. SES, English proficiency, high school type, family communication, family rules, parental expectation, and postsecondary education level were excluded from Model 5. Last, SES, high school type, parental participation, family communication, family rules, parental expectation, the math pipeline, and postsecondary education level were not included into Model 6. Table 4.12 lists out variables involved in stepwise logistic regressions which used listwise deletion.

Table 4.12 Variables used for stepwise logistic regressions (applying listwise deletion)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Asian Americans	✓		✓		✓	
East/South Asian Americans		✓		✓		✓
First-generation Asian Americans		✓		✓		✓
Female	✓	✓	✓	✓	✓	✓
SES	✓	✓	✓			
English proficiency				✓		✓
Private high school		✓				
Parental participation					✓	
Family communication	✓					
Family rules						
Parental expectation	✓					
Math pipeline	✓		✓		✓	
Science pipeline	✓		✓		✓	✓
Academic achievement (math)	✓				✓	✓
High school STEM occupation expectation	✓		✓	✓	✓	✓
4-year institution						

Notes:

1. ✓ indicates the corresponding variable was included in the analysis.
2. Model 1 and 2 had postsecondary enrollment as the dependent variable; Model 3 and 4 had STEM choice as the dependent variable; and, Model 5 and 6 had STEM completion as the dependent variable.

3. The unweighted analytic sample size after listwise deletion for Model 1 was 3,924; for Model 2 was 1,019; for Model 3 was 2,749; for Model 4 was 373; for Model 5 was 2,026; and for Model 6 was 268.

Logistic Regression

Stepwise logistic regression was carried out for six models. Each model contained three nested steps. The nested steps indicated the analytic sample sizes for steps of the same model were the same. To guarantee this, listwise deletion was executed for the six logistic regression models

Model 1

Table 4.13 provides results from stepwise logistic regression for model 1 (i.e., Asian American students as a whole as the independent variable and postsecondary enrollment as the dependent variable).

Without controlling for any covariates, Asian American students, in general, were significantly more likely to enroll into a postsecondary institution than White students, β_1=1.14, p<0.05.[107] The odds of postsecondary enrollment for Asian American students was 213% higher than the odds of postsecondary enrollment for White students. After controlling for students' gender and SES, Asian American students were more likely to enroll into a postsecondary institution than White students, β_1=1.41, p<0.05. The odds of postsecondary enrollment for Asian American students was 308% higher than the odds of postsecondary enrollment for White students. When controlled for gender and SES, this gap in postsecondary enrollment between

[107] This disagreed with the findings from the descriptive analysis. According to Table 4.3, 88.8 percent of Asian American students versus 87.2 percent of White students enrolled in postsecondary institutions, which implied a similarity in postsecondary enrollment rates. The gap between descriptive and inferential analyses might result from the deletion of missing values. That is, after deleting all the missing values from the variables in Model 1, 97.5 percent of Asian American students versus 92.7 percent of White students enrolled in postsecondary institutions.

Asian American and White students became even larger. Last, after holding constant all the covariates, Asian American students were still more likely to enroll into a postsecondary institution than White students, $\beta_1=1.00$, $p<0.05$. The odds of postsecondary enrollment for Asian American students was 172% higher than the odds of postsecondary enrollment for White students. In other words, the expected odds of postsecondary enrollment for Asian American students was 2.72 times the odds of postsecondary enrollment for White students.

All the covariates exhibited statistically significant relationship with postsecondary enrollment.[108] After controlling for all the other variables, female students were more likely to enroll into postsecondary education than male students, $\beta_2=0.71$, $p<0.05$. The odds of postsecondary enrollment for female students was 103% higher than the odds of postsecondary enrollment for male students. SES was positively associated with postsecondary enrollment, $\beta_3=0.74$, $p<0.05$. One unit increase in SES increased the log-odds of postsecondary enrollment by 0.74. In other words, the expected odds of postsecondary enrollment for students with higher SES was 2.09 times the odds of postsecondary enrollment for students with lower SES. Higher levels of family communication were significantly associated with a higher chance to enroll into postsecondary education, $\beta_4=0.43$, $p<0.05$. The expected odds of postsecondary enrollment for students with higher levels of family communication was 1.54 times the odds of postsecondary enrollment for students who experienced a lower level of family communication. Higher levels of parental expectation were significantly associated with a higher chance to enroll into postsecondary education, $\beta_5=0.34$, $p<0.05$. The expected odds of postsecondary enrollment for students with higher parental expectations was 1.40 times the odds of postsecondary enrollment for students who experienced lower parental expectations. Taking higher levels of math courses

[108] This was as expected in that only covariates with significant findings from the preliminary analysis were kept.

was related to a higher chance of enrolling into postsecondary education, β_6=0.28, p<0.05. The expected odds of postsecondary enrollment for students taking more advanced math courses was 1.32 times the odds of postsecondary enrollment for students taking less advanced math courses. Also, the higher levels of the science pipeline were associated with a higher chance of enrolling into postsecondary education, β_7=0.18, p<0.05. The expected odds of postsecondary enrollment for students taking more advanced science courses was 1.20 times the odds of postsecondary enrollment for students taking less advanced science courses. Academic achievement in math was positively associated with postsecondary enrollment, β_8=0.53, p<0.05. The odds of postsecondary enrollment for students with higher academic achievement in math was 1.69 times the odds of postsecondary enrollment for students with lower academic achievement in math. Finally, high school STEM occupation expectation was positively associated with postsecondary enrollment, β_9=1.12, p<0.05. The odds of postsecondary enrollment for students who expected to have their future occupations in STEM fields was 207% higher than the odds of postsecondary enrollment for students who did not expect to have their future occupations in STEM fields.

Generally speaking, being Asian American, being female, having higher SES, enjoying higher levels of family communication, receiving higher levels of parental expectation, choosing higher levels of math and science courses, achieving higher in math, and expecting to have a future occupation in STEM fields were all associated with a higher tendency to enroll into postsecondary education.

As for model fit, being Asian American students (versus being White students) alone (step 1) explained 1% of the variance in postsecondary enrollment. After adding the demographic covariates (step 2), the model explained 14% of the variance in postsecondary enrollment, which means gender and SES explained 13% of the variance in postsecondary enrollment. Then, with all the variables in the model (step 3), the model explained 34% of the variance in postsecondary enrollment in which all the covariates took account of 33% of the variance in postsecondary enrollment. Therefore, step 3 of model 1 was more useful in explaining the variance in postsecondary enrollment, which was further proved by the smallest AIC of step 3 in relation to step 1 and 2.

A comparison between Table 4.13 and Table H.1 reveals that the reason for the lack of significant relationship between Asian American students and postsecondary enrollment in step 1 of Table H.1, but the presence of a significant relationship in step 2 and 3 of Table H.1 could result from the difference in analytic sample sizes for the steps in Table H.1.

Table 4.13 Weighted logistic regressions for Model 1 (DV = postsecondary enrollment)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
Asian Americans	1.14** (3.13)	1.41*** (4.08)	1.00* (2.72)
Female		0.73*** (2.06)	0.71*** (2.03)
SES		1.49*** (4.44)	0.74*** (2.09)
Family communication			0.43* (1.54)
Parental expectation			0.34*** (1.40)
Math pipeline			0.28** (1.32)
Science pipeline			0.18* (1.20)
Academic achievement (math)			0.53*** (1.69)
High school STEM occupation expectation			1.12* (3.07)
Nagelkerke R^2	1%	14%	34%
AIC	1894	1701	1380

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Model 2

Table 4.14 shows results from stepwise logistic regression for model 2 (i.e., Asian American subgroups as the independent variables and postsecondary enrollment as the dependent variable).

Regardless whether Asian American students belonged to the first or second generation, East and South Asian American students were more likely to enroll into postsecondary education than Southeast Asian American students, β_1=0.92, $p<0.05$. In other words, the odds of postsecondary enrollment for East and South Asian American students was 151% higher than the odds of postsecondary enrollment for Southeast Asian American students. However, with further controlling for the covariates, there was no statistically significant difference between East/South and Southeast Asian American students in postsecondary enrollment, β_1=0.43, $p>0.05$ (step 2), β_1=0.44, $p<0.05$ (step 3). That is, East/South Asian American students were equally likely to enroll into postsecondary education as their Southeast Asian American peers.

There was no statistically significant difference between first- and second- generation Asian American students in postsecondary enrollment, β_2= -0.40, $p>0.05$. In other words, first- and second- generation Asian American students were equally likely to enroll into a postsecondary institution. Likewise, further controlling for the covariates, first- and second- generation Asian American students were still equally likely to enroll into postsecondary education, β_2= -0.01, $p>0.05$ (step 2), β_2= -0.03, $p>0.05$ (step 3).

All the covariates presented statistically significant relationship with postsecondary enrollment. [109] More specifically, after controlling for Asian American subgroups and SES,

[109] This was as expected in that only covariates with significant findings from the preliminary analysis were kept.

female Asian American students were significantly more likely to enroll into a postsecondary institution than male Asian American students, $\beta_3 = 0.87$, $p<0.05$. The odds of postsecondary enrollment for female Asian American students was 138% higher than the odds of postsecondary enrollment for male Asian American students. Similarly, further controlling for high school type, the odds of postsecondary enrollment for female Asian American students was 146% higher than the odds of postsecondary enrollment for male Asian American students. After controlling for Asian American subgroups and students' gender, Asian American students with higher SES were associated with a higher chance to enroll into postsecondary education, $\beta_4 = 1.37$, $p<0.05$. That is, the odds of postsecondary enrollment for students with higher SES was 3.93 times the odds of postsecondary enrollment for students with lower SES. Likewise, with further holding constant high school type, the odds of postsecondary enrollment for Asian American students with higher SES was 3.68 times the odds of postsecondary enrollment for Asian American students with lower SES. With controlling for all the other variables, Asian American students in private high schools were more likely to enroll into postsecondary education than Asian Americans in public high schools, $\beta_5 = 16.15$, $p<0.05$. The expected odds of postsecondary enrollment for students in private high schools was 10282973 times the expected odds of postsecondary enrollment for students in public high schools.[110]

In general, while Asian Americans were more likely than White students to enroll into postsecondary education, with everything being equal, there was no difference between East/South and Southeast Asian American students in postsecondary enrollment; and, there was no difference between first- and second- generation Asian American students in postsecondary

[110] The relative small sample size might result in the large odds ratio.

enrollment. Nevertheless, being female Asian American students, having higher SES, and being in private high schools all related to a higher tendency to enroll in a postsecondary institution.

In terms of the model fit, Asian American subgroups explained 4% of the variance in postsecondary enrollment (step 1). After adding the demographic covariates (step 2), the model explained 20% of the variance in postsecondary enrollment, which indicates gender and SES explained 16% of the variance in postsecondary enrollment. Furthermore, with all the variables in the model, the model explained 22% of the variance in postsecondary enrollment, in which high school type accounted for 2% of the variance in postsecondary enrollment (step 3). Considering the large odds ratio of high school type and the relative small percentage of variance in postsecondary enrollment explained by high school type, it might be ideal to remove high school type from the model. This conclusion could be proved by AIC in that the AICs for the three steps of model 2 shows step 1 had the largest AIC (537.4), while step 2 (468.9) and 3 (462.7) had similar AICs.

In addition, results from Table 4.14 and Table H.2 are similar.

Table 4.14 Weighted logistic regressions for Model 2 (DV = postsecondary enrollment)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
East/South Asian Americans	0.92** (2.51)	0.43 (1.54)	0.44 (1.55)
First-generation Asian Americans	-0.40 (0.67)	-0.01 (0.99)	-0.03 (0.97)
Female		0.87* (2.38)	0.90* (2.46)
SES		1.37*** (3.93)	1.30*** (3.68)
Private high schools			16.15*** (10282973)
Nagelkerke R^2	4%	20%	22%
AIC	537.4	468.9	462.7

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Model 3

Table 4.15 presents results from stepwise logistic regression for model 3 (i.e., Asian American students as a whole as the independent variable and STEM choice as the dependent variable).

Without holding constant any covariates, Asian American students were more likely than White students to choose a major in STEM fields, $\beta_1= 0.79$, $p<0.05$. The odds of choosing a major in STEM fields for Asian American students was 121% higher than the odds of choosing a major in STEM fields for White students. Moreover, after controlling for students' gender and SES, Asian American students were more likely than White students to choose a major in STEM fields, $\beta_1=0.80$, $p<0.05$. The odds of choosing a major in STEM fields for Asian Americans students was 123% higher than the odds of choosing a major in STEM fields for White students. With holding constant all the covariates, the gap between Asian American and White students in choosing a major in STEM fields still existed, though a reduction in the gap is observed, $\beta_1= 0.56$, $p<0.05$. That is, the odds of choosing a major in STEM fields for Asian American students was 75% higher than the odds of choosing a major in STEM fields for White students.

All the covariates had statistically significant results at step 3, though SES was only significant at step 2.[111] Regardless of students' race and SES, female students were less likely than male students to choose a major in STEM fields, $\beta_2= -1.20$, $p<0.05$. The odds of choosing a major in STEM fields for female students was 70% lower than the odds of choosing a major in

[111] This is consistent with the results from Table H.3. Further, this is as expected, because covariates that showed at least one significant result in Table H.3 were kept.

STEM fields for male students. After holding constant all the other variables, female students were less likely to choose a major in STEM fields than male students, β_2= -0.71, p<0.05. The odds of choosing a major in STEM fields for female students was 51% lower than the odds of choosing a major in STEM fields for male students. Regardless of students' race and gender, SES was positively associated with STEM choice, β_3= 0.22, p<0.05. One unit increase in SES increased in the log-odds of choosing a major in STEM fields by 0.22. The odds of choosing a major in STEM fields for students with higher SES was 1.25 times the odds of choosing a major in STEM fields for students with lower SES. However, after controlling for all the other variables, there was no significant difference between students with lower and higher SES in choosing a major in STEM fields. With all other variables being equal, students who took more advanced math courses were more likely to choose a major in STEM fields than students who took less advanced math courses, β_4= 0.31, p<0.05. The odds of choosing a major in STEM fields for students who took more advanced math courses was 1.37 times the odds of choosing a major in STEM fields for students who took less advanced math courses. Likewise, students who took more advanced science courses were more likely to choose a major in STEM fields than students who took less advanced science courses, β_5=0.38, p<0.05. The odds of choosing a major in STEM fields for students who took more advanced science courses was 1.47 times the odds of choosing a major in STEM fields for students who took less advanced science courses. Students who expected to have their future occupations in STEM fields were more likely to choose a major in STEM fields than students who did not expect to have their future occupations in STEM fields, β_6= 2.49, p<0.05. The odds of choosing a major in STEM fields for students who expected to have their future occupations in STEM fields was 1108% higher than the odds of choosing a major in STEM fields for students who did not expect to have their future occupations in STEM fields.

Basically, being Asian American, being male, taking higher levels of math and science courses, and expecting to have future occupation in STEM fields were all related to a higher tendency to choose a major in STEM fields. It is worth to notice that female students were more likely than male students to enroll into postsecondary education, but female students were less likely than male students to choose a major in STEM fields.

The model only contains Asian Americans (versus White students) as the predictor explained 2% of the variance in STEM choice (step 1). After adding the demographic covariates, the model explained 11% of the variance in STEM choice, which means students' gender and SES explained 9% of the variance in STEM choice (step 2). Finally, with all the variables in model, the model explained 38% of the variance in STEM choice (step 3). This indicates the math and science pipelines as well as high school STEM occupation expectation explained 27% of the variance in STEM choice; all the covariates together explained 36% of the variance in STEM choice. Thus, step 3 of model 3 was the ideal model, which was also proved by the smallest AIC of step 3 (1894) in relation to step 1 (2568) and 2 (2412).

Results from Table 4.15 and Table H.3 are similar.

Table 4.15 Weighted logistic regressions for Model 3 (DV = STEM choice)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
Asian Americans	0.79*** (2.21)	0.80*** (2.23)	0.56** (1.75)
Female		-1.20*** (0.30)	-0.71*** (0.49)
SES		0.22* (1.25)	-0.03 (0.97)
Math pipeline			0.31*** (1.37)
Science pipeline			0.38*** (1.47)
High school STEM occupation expectation			2.49*** (12.08)
Nagelkerke R^2	2%	11%	38%
AIC	2568	2412	1894

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Model 4

Table 4.16 provides results from stepwise logistic regression for model 4. That is, Asian American subgroups as the independent variables and STEM choice as the dependent variable.

No matter whether Asian American students were first- or second- generation, there was no statistically significant difference between East/South and Southeast Asian American students in choosing a major in STEM fields, $\beta_1=0.32$, $p>0.05$. So, East/South Asian American students were equally likely to choose a major in STEM fields as Southeast Asian American students. This was also true when all the covariates being equal for Asian American students, $\beta_1=0.26$, $p>0.05$ (step 2), $\beta_1=0.08$, $p>0.05$ (step 3). On the other hand, there was no statistically significant difference between first- and second- generation Asian American students in choosing a major in STEM fields, $\beta_2= -0.31$, $p>0.05$. Namely, first- and second- generation Asian American students were equally likely to choose a major in STEM fields. When all the covariates being equal for

Asian American students, this was still true, β_2= -0.47, p>0.05 (step 2), β_2= -0.44, p>0.05 (step 3).

Model 4 contained three covariates: gender, English proficiency, and high school STEM occupation expectation. Controlling for Asian American subgroups and English proficiency, female Asian Americans were less likely to choose a major in STEM fields than their male peers, β_3= -0.78, p<0.05. The odds of choosing a major in STEM fields for female Asian American students was 54% lower than the odds of choosing a major in STEM fields for male Asian American students. However, with further controlling for high school STEM occupation expectation, there was no significant difference between female and male Asian American students in choosing a major in STEM fields, β_3= -0.39, p>0.05. After holding constant Asian American subgroups and gender, there was no significant difference between Asian Americans who had English as their native language and Asian Americans who did not have English as their native language in choosing a major in STEM fields, β_4= -0.51, p>0.05. Similarly, with controlling for all the other variables, Asian American students who were either native English speaker or non-native English speaker were equally likely to choose a major in STEM fields, β_4= -0.57, p>0.05. Asian American students who expected to have their future occupations in STEM fields were more likely to choose a major in STEM fields than Asian American students who did not expect to have their future occupations in STEM fields, β_5= 2.08, p<0.05. The odds of choosing a major in STEM fields for Asian American students who expected to have their future occupations in STEM fields was 702% higher than the odds of choosing a major in STEM fields for Asian Americans who did not expect to have their future occupations in STEM fields.

Generally, East/South and Southeast Asian Americans were equally likely to choose a major in STEM fields; and, first- and second- generation Asian Americans were equally likely to choose a major in STEM fields. Without controlling for high school STEM occupation expectation, Asian American female students were less likely than their male peers to choose a major in STEM fields. But, such gender gap disappeared when high school STEM occupation expectation was considered. Among Asian Americans, English proficiency was not associated with choosing a major in STEM fields. In comparison, Asian Americans who expected to have occupations in STEM fields were more likely to choose a major in STEM fields than Asian Americans who did not expect to have occupations in STEM fields.

The model only included Asian American subgroups as the predictors explained 1% of the variance in STEM choice (step 1). By adding the demographic covariates, the model explained 7% of the variance in STEM choice, which indicates gender and English proficiency explained 6% of the variance in STEM choice (step 2). With all the predictors in the model, the model explained 23% of the variance in STEM choice, which means 16% of the variance in STEM choice was accounted for by high school STEM occupation expectation (step 3). Therefore, step 3 of model 4 was the ideal model, which also provided the smallest AIC (403.8).

English proficiency exhibited significant effect in step 2 of Table H.4, but it did not show any significant effect in Table 4.16. Difference in the analytic sample sizes might be the reason. Other than the difference in English proficiency, findings from Table 4.16 and Table H.4 are similar.

Table 4.16 Weighted logistic regressions for Model 4 (DV = STEM choice)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
East/South Asian Americans	0.32 (1.38)	0.26 (1.30)	0.08 (1.09)
First-generation Asian Americans	-0.31 (0.74)	-0.47 (0.63)	-0.44 (0.65)
Female		-0.78* (0.46)	-0.39 (0.68)
English proficiency		-0.51 (0.60)	-0.57 (0.57)
High school STEM occupation expectation			2.08*** (8.02)
Nagelkerke R^2	1%	7%	23%
AIC	463.4	453.5	403.8

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Model 5

Table 4.17 shows results from stepwise logistic regression for model 5 with Asian American students as a whole (versus White students) as the independent variable and STEM choice as the dependent variable.

Without controlling for any covariates, Asian American students were more likely than White students to obtain a degree in STEM fields, $\beta_1= 0.35$, $p<0.05$. The odds of gaining a degree in STEM fields for Asian American students was 42% higher than the odds of gaining a degree in STEM fields for White students. After controlling for gender, Asian American students were still more likely than White students to earn a degree in STEM fields, $\beta_1= 0.43$, $p<0.05$. The odds of obtaining a degree in STEM fields for Asian American students was 53% higher than the odds of obtaining a degree in STEM fields for White students. Interestingly, the odds ratio for race (including Asian Americans and Whites) became larger after controlling for gender. Then, after holding constant all the covariates, there was no significant difference between Asian American and White students in obtaining a degree in STEM fields, $\beta_1 = 0.21$, $p>0.05$. In other words, the odds of earning a degree in STEM fields for Asian American students was similar to the odds of earning a degree in STEM fields for White students.

All of the covariates showed statistically significant results.[112] Without considering students' race, female students were less likely than male students to obtain a degree in STEM fields, $\beta_2 = -1.26$, $p<0.05$. The odds of obtaining a degree in STEM fields for female students was 0.72% lower than the odds of obtaining a degree in STEM fields for male students. Moreover, after controlling for all the other variables, female students were still less likely than their male peers to gain a degree in STEM fields, $\beta_2 = -0.76$, $p<0.05$. The odds of earning a degree in STEM fields for female students was 53% lower than the odds of earning a degree in STEM fields for male students. Parental participation was negatively associated with STEM completion, $\beta_3 = -0.59$, $p<0.05$. The odds of obtaining a degree in STEM fields for students with higher parental participation level was 45% lower than the odds of obtaining a degree in STEM fields for students with lower parental participation level. In comparison, with all the other variables be holding constant, taking higher levels of math courses was associated with higher likelihood of obtaining a degree in STEM fields, $\beta_4 = 0.20$, $p<0.05$. The odds of earning a degree in STEM fields for students who took more advanced math courses was 1.22 times the odds of earning a degree in STEM fields for students who took less advanced math courses. Likewise, taking higher levels of science courses was related to a higher chance of gaining a degree in STEM fields, $\beta_5 = 0.25$, $p<0.05$. The odds of obtaining a degree in STEM fields for students who took more advanced science courses was 1.28 times the odds of obtaining a degree in STEM fields for students who took less advanced science courses. Higher academic achievement in math was

[112] This is as expected in that only covariates with significant findings from the preliminary analysis are kept.

associated with a higher chance of earning a degree in STEM fields, $\beta_6= 0.31$, $p<0.05$. The odds of earning a degree in STEM fields for students with higher math achievement was 1.37 times the odds of earning a degree in STEM fields for students with lower math achievement. Last, students who expected to have their future occupations in STEM fields were more likely to earn a degree in STEM fields than students who did not expect to have their future occupations in STEM fields, $\beta_7= 2.39$, $p<0.05$. The odds of gaining a degree in STEM fields for students who expected to have their future occupations in STEM fields was 989% higher than the odds of gaining a degree in STEM fields for students who did not expect to have their future occupations in STEM fields.

Overall, when gender, parental participation, the math and science pipelines, academic achievement in math, and high school STEM occupation expectation were equal among students, there was no difference between Asian American and White students in earning a degree in STEM fields. In contrast, being male, having lower level of parental participation, taking more advanced math and science courses, achieving higher in math, and expecting to have future occupations in STEM fields were associated with a higher chance to obtain a degree in STEM fields.

When race (containing Asian Americans and Whites) was the sole predictor, the model explained 0.3% of the variance in STEM completion (step 1). After adding the demographic covariates, the model explained 9% of the variance in STEM completion, which implies that students' gender explained 8.7% of the variance in STEM completion (step 2). Moreover, with all the variables in the model, the model explained 37% of the variance in STEM completion (step 3). More specifically, all of the covariates explained 36.7% of the variance in STEM completion in which parental participation, the math and science pipelines, academic achievement in math, and high school STEM occupation expectation explained 28% of the variance in STEM completion. Step 3 of model 5 was ideal, which also had the smallest AIC (1364) in comparison with step 1 (1832) and 2 (1726).

Results from Table 4.17 and Table H.5 are similar, except that race did not have a significant effect on STEM completion at step 2 in Table H.5, but it did relate to STEM completion at step 2 in Table 4.17. Such difference results from the difference in analytic sample sizes.

According to Table 4.15 (model 3) and Table 4.17 (model 5), findings based on STEM choice and STEM completion are not the same. In Table 4.15, even after controlling for all the other variables, the gap between Asian American and White students still existed. But, in table 4.17, the racial gap disappeared after all the other variables being controlled. In addition, the predictors involved in Table 4.15 and Table 4.17 are not identical. In particular, the six predictors in Table 4.15 contain race, gender, SES, the math and science pipelines, and high school STEM occupation expectation; the seven predictors in Table 4.17 include race, gender, parental participation, the math and science pipelines, academic achievement in math, and high school STEM occupation expectation. One of the possible reasons for the disparities between Table 4.15 and Table 4.17 was the difference between STEM choice and STEM completion in real life; the other possible reason is the difference in the analytic sample sizes.

Table 4.17 Weighted logistic regressions for Model 5 (DV = STEM completion)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
Asian Americans	0.35* (1.42)	0.43* (1.53)	0.21 (1.24)
Female		-1.26*** (0.28)	-0.76*** (0.47)
Parental participation			-0.59* (0.55)
Math pipeline			0.20* (1.22)
Science pipeline			0.25** (1.28)
Academic achievement (math)			0.31* (1.37)
High school STEM occupation expectation			2.39*** (10.89)
Nagelkerke R^2	0.3%	9%	37%
AIC	1832	1726	1364

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Model 6

Table 4.18 presents stepwise logistic regression results for model 6 where Asian American subgroups as the independent variables and STEM completion as the dependent variable.

Without holding constant any covariates, East/South and Southeast Asian American students were equally likely to obtain a degree in STEM fields, β_1=0.34, p>0.05. Namely, there was no difference between East/South and Southeast Asian Americans in terms of earning a degree in STEM fields. When the demographic covariates were controlled, there was still no significant difference between East/South and Southeast Asian American students in gaining a degree in STEM fields, β_1=0.19, p>0.05. Likewise, after holding constant all the covariates, no statistically significant difference between East/South and Southeast Asian American students was found, $\beta_1 = -0.41$, $p > 0.05$.

Regardless of Asian American students' geographical subgroups, there was no statistically significant difference between first- and second- generation Asian American students in receiving a degree in STEM fields, $\beta_2 = 0.53$, $p > 0.05$. After controlling for the demographic covariates (including gender and English proficiency), there was still no significant difference between first- and second- generation Asian American students in earning a degree in STEM fields, $\beta_2 = 0.21$, $p > 0.05$. Similarly, with taking account of all the covariates, no difference between first- and second- generation Asian Americans students in obtaining a degree in STEM fields was found, $\beta_2 = 0.33$, $p > 0.05$.

After controlling for Asian American subgroups and English proficiency, Asian American female students were less likely than Asian American male students to earn a degree in STEM fields, $\beta_3 = -0.87$, $p < 0.05$. The odds of earning a degree in STEM fields for Asian American female students was 58% lower than the odds of earning a degree in STEM fields for Asian American male students. Nonetheless, with holding constant Asian American subgroups and all the other covariates, there was no significant difference between Asian American female and male students in obtaining a degree in STEM fields, $\beta_3 = -0.46$, $p > 0.05$. With controlling for Asian American subgroups and gender, Asian Americans who had English as the native language were less likely than those who did not have English as their native language to obtain a degree in STEM fields, $\beta_4 = -1.01$, $p < 0.05$. The odds of gaining a degree in STEM fields for Asian American students with English as their native language was 64% lower than the odds of gaining a degree in STEM fields for Asian American students who did not have English as their native language. But, with holding constant Asian American subgroups and all the other covariates, there was no significant difference between Asian American students who had and did not have English as their native language in obtaining a degree in STEM fields, β_4= -0.78, *p*>0.05. With all the other variables being equal, taking higher levels of science courses was related to a higher chance of gaining a degree in STEM fields, β_5= 0.44, *p*<0.05. The odds of obtaining a degree in STEM fields for Asian American students who took more advanced science courses was 1.56 times the odds of obtaining a degree in STEM fields for Asian American students who took less advanced science courses. After controlling for all the other variables, higher academic achievement in math was associated with a higher chance of earning a degree in STEM fields, β_6= 0.82, *p*<0.05. The odds of gaining a degree in STEM fields for Asian American students with higher math achievement was 2.26 times the odds of gaining a degree in STEM fields for Asian American students with lower math achievement. Finally, Asian American students who expected to have their future occupations in STEM fields were more likely to earn a degree in STEM fields than those who did not expect to have their future occupations in STEM fields, β_7= 2.55, *p*<0.05. The odds of obtaining a degree in STEM fields for Asian American students who expected to have their future occupations in STEM fields was 1182% higher than the odds of gaining a degree in STEM fields for those who did not expect to have their future occupations in STEM fields.

Generally, there was no difference between East/South and Southeast Asian American students in obtaining a degree in STEM fields; similarly, there was no disparity between first- and second- generation Asian American students in earning a degree in STEM fields. Among Asian American students, taking higher levels of science courses, high achievement in math, and expecting to have future occupations in STEM fields were related to a higher chance to gain a degree in STEM fields; in comparison, after controlling for Asian American subgroups, the science pipeline, academic achievement in math, and high school STEM occupation expectation, there was no significant difference between female and male students as well as between students with or without English proficiency in gaining a degree in STEM fields.

Asian American subgroups explained 3% of the variance in STEM completion (step 1). After adding the demographic covariates, the model explained 12% of the variance in STEM completion in which 9% of the variance in STEM completion was explained by gender and English proficiency (step 2). Last, for the model that contains all the variables, 42% of the variance in STEM completion was explained by the model in which 30% of the variance in STEM completion was explained by the science pipeline, academic achievement in math, and high school STEM occupation expectation. Thus, step 3 of model 6 fits better than step 1 and 2. This could further be proved by AICs where the AIC for step3 (227.7) was the smallest in comparison with step 1(307.2) and 2 (292.6).

Results from Table 4.18 and Table H.6 are similar.

Disparities exist between Table 4.16 (model 4) and Table 4.18 (model 6). First, unlike Table 4.18, Table 4.16 does not contain the science pipeline and academic achievement in math. This implies the disparity between Table H.4 and Table H.6. Second, at step 2 of Table 4.16, English proficiency did not have a significant effect on STEM choice, while at step 2 of Table 4.18, there was a negative relationship between English proficiency and STEM choice. If the differences between Table 4.16 and Table 4.18 did not accurately reflect the reality, then such differences might result from the disparity in analytic sample sizes.

Table 4.18 Weighted logistic regressions for Model 6 (DV = STEM completion)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
East/South Asian Americans	0.34 (1.40)	0.19 (1.20)	-0.41 (0.67)
First-generation Asian Americans	0.53 (1.69)	0.21 (1.23)	0.33 (1.39)
Female		-0.87* (0.42)	-0.46 (0.63)
English proficiency		-1.01* (0.36)	-0.78 (0.46)
Science pipeline			0.44* (1.56)
Academic achievement (math)			0.82* (2.26)
High school STEM occupation expectation			2.55*** (12.82)
Nagelkerke R^2	3%	12%	42%
AIC	307.2	292.6	227.7

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Chapter 5. Discussion and Conclusion

In today's world, it is hard to live without professionals in the STEM fields. Imagine what one's life could be without things such as a smart phone, a computer, and the internet. The giant leap in STEM has resulted in the faster growth rate of STEM over non-STEM jobs, and STEM jobs are projected to continue to grow faster than the non-STEM jobs in the future (Fayer, Lacey, & Watson, 2017; Langdon, McKittrick, Beede, Khan, & Doms, 2011). What is more appealing for many people is that the average salary for STEM jobs tends to be higher than the non-STEM jobs (Fayer, et al., 2017; Koc, Koncz, Tsang, & Longenberger, 2016; Langdon, et al., 2011). All of these state the vital status of STEM. Achieving a postsecondary education in STEM is the main way to enter STEM fields (Langdon, et al., 2011, p. 4) and a large number of STEM jobs require some type of postsecondary education (Fayer, et al., 2017). By understanding the postsecondary STEM education pathways and related factors, this study not only contributes its findings to the current research, but also delivers useful information and guidance for people who are interested and intend to pursue professions in STEM. What is more, by focusing on Asian Americans who are often regarded as one academic high achieving group, this study provides a possibility to both understand the postsecondary STEM education pathways in general and such pathways in Asian Americans in particular.

In the following sections, an overview of this study is provided, findings are presented, conclusions and implications based on those findings are reached, and the limitations of this study are stated and explained.

Overview

This study examined the postsecondary STEM education pathways of Asian American students. These students as a whole were compared with their White peers with the aim of understanding where Asian American students stood in relation to White students. More importantly, the within-group Asian American differences were examined, which were usually understudied. The postsecondary STEM education pathways consisted of postsecondary enrollment, STEM choice, STEM major choice, STEM completion, STEM major completion, and STEM persistence. In particular, postsecondary enrollment was examined to determine whether students enrolled in postsecondary institutions or not. I examined STEM choice to know whether students chose a major in STEM fields or not. STEM major choice was used to understand the differences within STEM education in terms of choosing STEM majors. In terms of STEM completion, I looked at whether students obtained a degree in STEM fields or not. STEM major completion was utilized to understand the differences within STEM education in terms of obtaining degrees. Finally, by studying STEM persistence, I aimed to know whether students persisted in the same STEM field or went on to major in different fields.

In order to refine this study, subcategories were created based on prior research and analyses to examine elements in more depth. Asian American students were examined in two ways—through geographical and generational classifications. The Asian American geographical subgroups included East, South, and Southeast Asian American students, while their generational subgroups contained first-, second-, and third- generation Asian American students. Moreover, postsecondary STEM education was classified into five fields—biological/agricultural sciences, computer/information sciences, engineering/engineering technologies, mathematics/ statistics, and physical sciences.

To guide this study, prior literature was reviewed. Few studies focused on Asian American students' postsecondary STEM education experience. Thus, while doing the literature review, I analyzed the existing results. The literature review indicated that Asian American students had a higher tendency to choose STEM fields than White students. In particular, biological/agricultural sciences, engineering/engineering technologies, and computer/information sciences were the STEM fields that Asian American students preferred. However, in terms of the within Asian American STEM education experience, there was a lack of research.

Prior studies implied high school academic achievement and course taking, students' high school STEM expectations and plans, parental influence, SES, English proficiency, gender, high school type, and postsecondary education level were the factors that might relate to students' STEM education. More specifically, expecting oneself to be in the STEM fields might weigh more than taking more advanced courses and having better high school academic achievement in determining receiving postsecondary STEM education. Also, male students had a larger presence in STEM education than their female peers, though the magnitude of the gender gap varied in different STEM fields. As for parental influence, SES, English proficiency, high school type, and postsecondary level, few studies focused on the relationship between these factors and students' STEM education experience. Among the research that touched upon students' STEM education experience, disagreement existed concerning the effects of these factors that determine STEM education experience. In sum, there was a lack of prior research that paid attention to which factors related to postsecondary STEM education experience, especially the ones that focused on Asian American students and shared the same classification and definition of the STEM fields as this study. This study filled this gap. I wanted to use the results of this study to determine ways to encourage students of all racial groups to enter the STEM fields.

Key Research Findings

This study contained six research topics. Due to the small analytic sample sizes, research topics of STEM major choice, STEM major completion, and STEM major persistence were only examined by using descriptive statistics. Thus, it was not possible to provide firm answers on the factors that related to the relationships between the independent variables and those dependent variables. On the other hand, while research topics about postsecondary education enrollment, STEM choice as a whole, and STEM completion as a whole were scrutinized by employing both descriptive and inferential analyses, due to the limitation of the relatively small analytic sample sizes, the findings of those topics needed to be taken with caution.

Topic one—postsecondary education enrollment

The research questions are shown below:

1.1. Were Asian American students more likely than White students to enroll in postsecondary education? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

1.2. Were there differences among Asian American geographical and generational subgroups in postsecondary education enrollment? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

The findings indicated that Asian American students, in general, were more likely than White students to enroll in postsecondary education. Factors including family communication, parental expectation, math and science course taking pipelines, academic achievement in math, and high school STEM occupation expectation reduced the postsecondary enrollment gap between Asian American and White students, though the gap still existed.

Within Asian Americans, East and South Asian American students were more likely than Southeast Asian American students to enter into postsecondary education. However, without considering students' gender and SES, the gap between East/South and Southeast Asian American students disappeared. In comparison, there was no difference between first- and second- generation Asian American students in postsecondary education enrollment.

Topic two—postsecondary STEM choice as a whole

The research questions are:

2.1. Were Asian American students more likely than White students to choose a major in STEM fields (versus non-STEM fields)? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

2.2. Were there differences among Asian American geographical and generational subgroups in choosing a major in STEM fields (versus non-STEM fields)? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Generally speaking, Asian American students were more likely than White students to choose a major in STEM fields, but this gap was reduced by factors of students' math and science course taking pipelines as well as their high school STEM occupation expectation.

Asian American geographical and generational subgroups presented no difference in choosing a major in STEM fields. More specifically, East/South and Southeast Asian American students were equally likely to choose a major in STEM fields. Additionally, first- and second-generation Asian American students were equally likely to choose a major in STEM fields.

Topic three—postsecondary STEM as an individual major choice

The research questions are as follows:

3.1. Were Asian American students more likely than White students to choose all kinds of STEM fields? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

3.2. Were there differences among Asian American geographical and generational subgroups in choosing different STEM fields? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

No inferential analysis was run for this topic.

Results from descriptive analyses suggested Asian American and White students shared similar STEM major choice patterns. Specifically, biological/agricultural sciences were the STEM fields that attracted most Asian American and White students, closely followed by engineering/engineering technologies. This was followed by computer/information and physical sciences. Mathematics/statistics was the STEM field that Asian American and White students were least likely to choose.

Disparities existed among Asian American geographical and generational subgroups in choosing different STEM fields. For instance, East Asian American students were least likely to choose mathematics/statistics, while Southeast Asian American students were least likely to choose computer/information sciences. On the other hand, both East and Southeast Asian American students were most likely to choose biological/agricultural sciences, while South Asian American students were most likely to choose engineering/engineering technologies. In terms of the Asian American generational subgroups, first- and second- generation Asian Americans were most likely to choose biological/agricultural sciences, while third- generation Asian Americans were most likely to choose engineering/engineering technologies. In addition, third- generation Asian American students were more likely than their first- and second- generation peers to choose majors in the field of physical sciences.

Topic four—postsecondary STEM completion as a whole

The research questions are presented below:

4.1. Were Asian American students more likely than White students to obtain a degree in STEM fields (versus non-STEM fields)? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

4.2. Were there differences among Asian American geographical and generational subgroups in obtaining STEM degrees (versus non-STEM degrees)? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

On average, Asian American students were more likely than White students to gain a degree in STEM fields. However, this gap was reduced by factors of parental participation, math and science course taking pipelines, academic achievement in math, and high school STEM occupation expectation.

Asian American geographical and generational subgroups exhibited similarities in obtaining STEM degrees. That is, East/South and Southeast Asian American students were equally likely to earn degrees in STEM fields. First- and second- generation Asian American students were equally likely to gain degrees in STEM fields.

Topic five—postsecondary STEM individual major completion

The research questions are as follows:

5.1. Were Asian American students more likely than White students to earn degrees in all STEM fields? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

5.2. Were there differences among Asian American geographical and generational subgroups in earning degrees in STEM fields? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Inferential analysis was not run for this topic.

Results from descriptive analyses indicated among the five STEM fields, Asian American students were more likely to earn degrees in biological/agricultural sciences, followed by engineering/engineering technologies, physical and computer/information sciences, and mathematics/statistics. White students were more likely to obtain degrees in both biological/agricultural sciences and engineering/engineering technologies, followed by computer/information sciences, physical sciences, and mathematics/statistics. In general, among Asian American students, close to half of them obtained degrees in biological/agricultural sciences; among White students, about one third of them gained degrees in this STEM field. Thus, Asian American students were more likely to earn degrees in biological/agricultural sciences than White students. On the other hand, among Asian American students, about one fourth of them earned degrees in engineering/engineering technologies; among White students, about one third of them gained degrees in this STEM field. Therefore, Asian American students were less likely to earn degrees in engineering/engineering technologies than their White peers. The gaps between Asian American and White students in the other three STEM fields were not as large as the ones being mentioned.

Differences existed among Asian American geographical and generational subgroups in obtaining degrees in STEM fields. South Asian American students were more likely to gain degrees in engineering/engineering technologies and computer/information sciences than Southeast and East Asian American students. East Asian American students were more likely to obtain degrees in physical sciences than Southeast and South Asian American students. Basically, among the five STEM fields, East Asian American students were least likely to earn degrees in computer/information sciences and mathematics/statistics. Southeast and South Asian American students were least likely to obtain degrees in physical sciences and mathematics/statistics. As for the Asian American generational subgroups, biological/agricultural sciences was the STEM field first- and second- generation Asian Americans students were most likely to obtain degrees in, while engineering/engineering technologies was the STEM field third- generation Asian American students were most likely to earn degrees in. Third- generation Asian American students were more likely than first- and then second- generation Asian American students to obtain degrees in the field of physical sciences. Second- as well as third- generation Asian American students were more likely than first- generation Asian American students to gain degrees in the field of engineering/engineering technologies.

Topic six—postsecondary STEM individual major persistence

The research questions are shown below:

6.1. Were Asian American students more likely than White students to persist in all STEM fields? What factors of student, family and school characteristics accounted for the differences between Asian American and White students, if any?

6.2. Were there differences among Asian American geographical and generational subgroups in persisting in STEM fields? What factors of student, family and school characteristics accounted for Asian American subgroup differences, if any?

Inferential analysis was not conducted for this topic.

Generally speaking, Asian American and White students were equally likely to persist in the STEM fields they chose.

Moreover, Asian American geographical and generational subgroups were equally likely to persist in the STEM fields they chose. Nonetheless, among the Asian American geographical subgroups, close to 100 percent of South Asian American students persisted in the STEM fields they chose, while with somewhat lower values about 90 percent of East Asian American students persisted and about 80 percent of Southeast Asian American students persisted.

Summary of the key findings

Table 5.1 summarizes the key research findings based on Table 4.5, 4.7, 4.8 as well as Table 4.13 through 4.18. One major drawback of Table 5.1 is that among the results from the descriptive analyses, even the subtle differences between different categories were ranked. For example, 89.8 percent of White students versus 89.2 percent of Asian American students persisted in the same STEM fields.

Table 5.1 Key research findings from descriptive and inferential analyses

			Independent Variables							
					Asian American subgroups					
					Geographical			Generational		
			Asian Americans	Whites (ref.)	East	South	Southeast (ref.)	First	Second (ref.)	Third (del.)
Dependent Variables	Postsecondary enrollment (vs. no enrollment)		+		=			=		
	STEM major (vs. non-STEM major)		+		=			=		
	STEM individual major choice	Biological/ agricultural sciences	1	1	1	2	1	1	1	3
		Computer/ information sciences	4	3	4	3	5	3	4	4
		Engineering/ engineering technologies	2	2	2	1	2	2	2	1
		Mathematics/statistics	5	5	5	5	4	5	5	5
		Physical sciences	3	4	3	4	3	4	3	2
	STEM degree (vs. non-STEM degree)		=		=			=		
	STEM individual major completion	Biological/ agricultural sciences	1	1	1	1	1	1	1	2
		Computer/ information sciences	4	3	4	3	3	4	3	4
		Engineering/ engineering technologies	2	2	2	2	2	2	2	1
		Mathematics/statistics	5	5	5	4	5	5	4	5
		Physical sciences	3	4	3	5	4	3	5	3
	STEM persistence (vs. non-persistence)		2	1	2	1	3	3	1	2

Notes: 1. Only step 3 results from the stepwise logistic regressions were used;
2. + indicates significant positive findings;
3. = indicates non-significant findings;
4. the categories being marked as ref. mean that during the inferential analyses they were the reference groups in their respective variables;
5. the categories being marked as del. mean that during the inferential analyses they were excluded from the analyses;
6. numbers 1 through 5 were used to rank percentages from the descriptive analyses, with 1 being the highest and 5 being the lowest;
7. With STEM persistence being the dependent variable, the comparisons in the table should be viewed horizontally.

Conclusions and Implications

Overall, Asian American students were more likely to enter into postsecondary institutions than their White peers. Similar to the research of Chen and Weko (2009), this study also found Asian American students were more likely than White students to major in STEM fields. In addition, Asian American students were more likely than White students to obtain degrees in STEM fields. Biological/agricultural sciences and engineering/engineering technologies were the two STEM fields that most attracted Asian American and White students, which was also similar to the findings of Chen and Weko (2009). Currently, people who earned Bachelor's degrees in biological/agricultural sciences are more likely to find their jobs as research assistants, research specialists, and laboratory technologists/technicians.[113] People who earned Bachelor's degrees in engineering/engineering technologies are more likely to find their jobs as engineers.[114] Among the Asian American and White students that were in the STEM fields, they were equally likely to persist in the same STEM fields that they initially chose.

Knowing Asian American students showed more enrollment in STEM education than White students, this study also examined the within-group Asian American differences. In particular, without considering students' gender and SES, East/South Asian American students were equally likely to enter into postsecondary institutions as Southeast Asian American students. First-generation Asian American students were equally likely to enroll in postsecondary institutions as second- generation Asian American students. Further, no big difference was found among Asian American geographical and generational subgroups in choosing a major in STEM fields. This contradicted my hypothesis drawn from the study conducted by Bagasao (1983) which implied first-generation Asian American students had a higher chance of choosing STEM

[113] This was based on the information from indeed.com.
[114] This was based on the information from indeed.com.

majors than second- and third- generation Asian Americans. Additionally, Asian American subgroups presented similarities in obtaining a degree and persisting in their chosen major in STEM fields. However, disparities among Asian American subgroups were observed in choosing different STEM fields. For example, first- and second- generation Asian American students were more likely than third- generation Asian American students to choose majors in biological/agricultural science, while third- generation Asian American students were more likely than first- and second- generation Asian American students to choose majors in engineering/engineering technologies. This did not agree with my hypothesis, based on the research of Bagasao (1983), which suggested first- generation Asian American students were more likely than second- and third- generation Asian American students to major in engineering/engineering technologies. Asian American subgroups exhibited dissimilarities in obtaining degrees in STEM fields. For instance, South Asian American students had higher chances of obtaining degrees in both engineering/engineering technologies and computer/information sciences than their Southeast and East Asian peers.

Among Asian American and White students several factors were related to a higher likelihood of enrolling in postsecondary institutions. These included: being female, having higher SES, enjoying a higher level of family communication, having parents who expected more education for their children, taking more advanced math and science courses, achieving higher scores in math testing, and expecting to have their future occupations in STEM fields. Among Asian Americans, being female, enjoying higher SES, and being in private high schools were associated with higher likelihood of entering into postsecondary colleges. In comparison, among Asian American and White students, being male, taking higher levels of math and science courses, and expecting to have their future occupations in STEM fields were associated with higher likelihood of choosing majors in STEM fields. Among Asian American students, with everything being equal, expecting to have their future occupations in STEM fields was related to higher chances of choosing majors in STEM fields. In addition, among Asian American and White students, being male, having a lower level of parental participation, taking higher levels of math and science courses, performing better in math testing, and expecting to have their future occupations in STEM fields were associated with higher chances of earning degrees in STEM fields. Among Asian American students, with everything being equal, taking higher levels of science courses, performing better in math test, and expecting to have their future occupations in STEM fields were related to a higher likelihood of obtaining degrees in STEM fields.

It is worth noting that female students were more likely to enter into postsecondary education than their male peers, but they were less likely to major in STEM education than their male peers; this finding coincided with the research of Mann and DiPrete (2013). Additionally, the expectation in high school of a STEM occupation played a less vital role in predicting the enrollment of postsecondary education than in predicting STEM education. Furthermore, students' high school STEM occupation expectation tended to weigh more than their course taking and test performance in predicting postsecondary STEM education. This agreed with my hypothesis reached based on the study of Maltese and Tai (2011).

The results of this study suggest variations within Asian Americans, which result from Asian American differences in Asian country origins and the length of time spent in the US. This challenges the idea of regarding Asian Americans as one monolithic academically high-achieving group (Lee, 2009). Therefore, Asian American students may also be in need of resources and assistance in education. Teachers should identify and assist Asian American students who are academically disadvantaged. Counselors should provide advice and guidance (e.g., on college application) to Asian American students based on their individual needs and qualifications. Colleges and universities should not increase their admission standards for Asian American applicants (Asian American Coalition for Education, n.d.). Further, researchers should differentiate Asian American subgroups when examining the educational experiences related to Asian Americans.

Although this study focused on Asian American students, its findings have implications for the all the racial groups. Rather than perceiving STEM education as one inseparable area, this study suggests we view STEM education as consisting of different fields. Accordingly, among students who are interested in devoting themselves to STEM fields, school counselors should explain to students the differences between STEM fields. They should offer clear guidance on, for example, the pathways from high school course taking to postsecondary STEM majors and future STEM job positions. Additionally, parents should pay attention to their children's academic preferences so as to provide valuable and specialized advice and information to their children on, for instance, the different STEM pathways. Researchers who have interests in understanding STEM education should examine STEM education as different majors or fields with the purpose of reaching more practical results.

Moreover, the findings of this study suggest ways to increase postsecondary enrollment. Good communication between parents and their children is one way. Parents who actively provide advice to their children on issues relating to course/program selection, college application as well as future education and occupation plans can encourage their children to enroll in postsecondary education. In order to be efficient and productive, this academically-oriented advice requires parents to equip themselves with proper and up-to-date information about education and its outcome. Parents' involvement in their children's everyday life can also boost the postsecondary enrollment. This includes discussing with and informing their children of community, national, and world events, which requires parents to first broaden their own view and knowledge. Children who are submerged in a variety of information and knowledge can have a clearer view of where they are now and what they can be. They can be better motivated to pursue higher levels of education with the purpose of learning more and realizing their expectations. Additionally, parents who notice and advise on the things that trouble their children signal good communication. This not only requires parents to be alert if their children face troubles, but also asks them to offer valuable suggestions to their children. Robert M. Hutchins (*The University of Chicago Magazine*, n.d.) once said "the purpose of higher education is to unsettle the minds of young men, to widen their horizons, to inflame their intellects." I believe the communication between parents and their children can also bear this goal.

Parents who expect their children to receive higher levels of education are more likely to have their kids receiving postsecondary education. This requires that parents recognize the importance of higher education and know how to realize their expectations. For example, based on their own experiences, parents may discuss with their children the importance of higher education, they may adopt different methods to improve and guarantee the better academic performances of their children, and they may try to put their children in a better education environment. Therefore, here, expectation leads to actions that can realize the expectation.

Students who take higher levels of high school math and science courses tend to enroll in postsecondary institutions. According to this, students should be prepared and encouraged to take more advanced math and science courses. This asks parents to be involved in their children's education by, for instance, paying attention to their children's academic performance, providing assistance in their children's coursework, and giving suggestions on course selection. On the other hand, schools should be involved in this process by offering more challenging courses. Advanced Placement (AP) courses[115] are one example. College Board claims one of the benefits of taking AP courses is to let students "stand out in college admissions" (College Board, n.d.a). Nonetheless, not every high school offers AP courses. Thus, such schools should have counselors that guide students in need to take AP courses through other channels, such as taking online AP courses, other advanced courses (e.g., International Baccalaureate (IB) courses), and courses from local colleges. In general, all students are not at the same development level, thus, not every student can handle the most advanced courses. However, schools and teachers, along with parents should strive to realize students' potential development by providing guidance and assistance, which in turn calls for the recognition of students' zone of proximal development.[116]

Students' good performance in math standardized tests can lead to postsecondary enrollment. This implies the importance of standardized tests, including SAT and ACT. Parents can provide assistance and support to improve and secure their children's test performance. However, parental support can be a source of inequality. Children from families with higher income may be more likely to take private courses and enjoy private tutors than kids from lower income families (Buchmann, Condron, & Roscigno, 2010). Therefore, teachers and schools also need to assist students to obtain better performances in standardized tests. For example, teachers can adopt teaching strategies that promote learning. Also, teaching students testing strategies can be a way to yield better performances, though teaching to the test should not be the only aim.

[115] Currently, there are 38 AP courses under 7 areas. The area of math and computer science contains 5 kinds of AP courses (i.e., AP Calculus AB, AP Calculus BC, AP Computer Science A, AP Computer Science Principles, and AP Statistics). The area of sciences includes 7 kinds of AP courses (i.e., AP Biology, AP Chemistry, AP Environmental Science, AP Physics C: Electricity and Magnetism, AP Physics C: Mechanics, AP Physics 1: Algebra-Based, and AP Physics 2: Algebra-Based).

[116] Zone of proximal development is a concept put forward by Lev Vygotsky. It indicates the distance between people's actual development level and their potential development level (i.e., a level people can reach with guidance and assistance).

In addition, high school students who expect or plan to have a job in STEM fields in the future tend to enroll in postsecondary education. This may result from the required qualifications of STEM jobs. More specifically, these jobs may require people who have at least an Associate's or Bachelor's degree. Also, the required skills and knowledge of these jobs may be more effectively acquired through postsecondary education. Thus, parents with children who plan to have future jobs in STEM fields should prepare and encourage their children to enroll in postsecondary education. For instance, parents can provide their children with the job qualifications of the intended or interested jobs. In addition, counselors can offer guidance and suggestions to students. For example, they can inform students that taking the AP Calculus BC course can lead to a computer science major in college which in turn can result in a job in the area of computer programmers (College Board, n.d.b).

Among the above ways to grow postsecondary enrollment for high school students, emphasis should be given to taking higher levels of math and science courses, performing better in math standardized tests, and, most importantly, expecting and planning to have a job in STEM fields in the future, with the purpose of encouraging students to enter into as well as to complete postsecondary STEM education.

This study has implications for future research. First, studies that use more recent and complete data can be done with the purpose of finding out the postsecondary STEM education patterns among current students and determining whether there is any change in the STEM education patterns. Second, research that separates the STEM pathway analyses by postsecondary education levels should be carried out, because the findings of Wang (2013) suggested the existence of discrepancies between different postsecondary education levels. Further, future studies that examine different college types within each postsecondary education level (e.g., different 4-year college competitive levels) can yield an even clearer view. Third, other methods of analysis such as structural equation modeling (SEM) can be applied to give a more thorough examination of the postsecondary STEM education pathways. Fourth, with enough data, the within-Asian American as well as the within-STEM education differences can be examined in more detailed and complete ways. Fifth, reasons and factors that relate to the larger presence of Asian American students, in relation to White students, in STEM education fields can be further explored and tested. Sixth, reasons and factors associated with the within-Asian American student disparities in STEM education can be further examined.

Limitations

The limitations of this study mainly originated from the relatively small analytic sample sizes which in turn resulted from the relatively small sample size of Asian Americans and the missing data. There were eight main limitations. First, considering the small sample size, this study did not divide the analyses by postsecondary education levels. While the postsecondary education level variable was considered as a covariate during the inferential analyses, students from 2- and 4- year colleges were examined together. Second, the relatively large amount of missing data limited the ability to impute the missing values. Third, to save the analytic sample sizes, different analysis models of this study did not share the same variables, which adversely affected the understanding of the STEM education pathways. Fourth, different analysis models embraced different analytic sample sizes, which did not offer a positive influence on the understanding of the STEM education pathways. Fifth, due to the small analytic sample sizes, the within-Asian American and STEM education differences could not be examined in more details. Sixth, the descriptive and inferential analyses shared different analytic sample sizes, which negatively affected the understanding of Asian American students' STEM education experiences. Seventh, due to the small sample size, research topics such as Asian American students' postsecondary STEM individual major completion could not be tested utilizing inferential analysis methods, which limited the understanding of the STEM education pathways. Eighth, the small analytic sample sizes limited the generalizability of the findings of this study.

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Appendix A Comparing secondary school academic performance between Asian and White students

Author	Reading	Math	Science	Grade/GPA
Aldous (2006)	Same	Asian	—	—
Chen & Stevenson (1995)	—	Asian	—	—
Eaton & Dembo (1997)	Same	—	—	—
Goyette & Xie (1999)	Same	Same	Same	—
Kao (1995)	Same	Asian	—	Asian
Nation's Report Card (2012)	—	—	Same	—
Witkow & Fuligni (2007)	—	—	—	Same
Yan & Lin (2005)	—	Same	—	—

Notes: 1. "Same" refers to the notion that there is no statistically significant difference between Asian American and White students;

2. The term "Asian" refers to the notion that Asian American students have a statistically significant higher mean than White students.

3. When studies do not provide statistical comparison between Asian Americans and Whites, t-test and/or effect size (practical significance) formula is used.

$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{SE_1{}^2 + SE_2{}^2}}$, where $\bar{X}_1$=mean for Asian Americans, $\bar{X}_2$=mean for Whites, SE_1=standard error for Asian Americans, SE_2 =standard error for Whites.

$d = \frac{\bar{X}_1 - \bar{X}_2}{SD}$, where $\bar{X}_1$= mean for Asian Americans; $\bar{X}_2$ = mean for Whites; SD=pooled standard deviation (SD) or SD for the group having larger SD.

According to the table, Asian Americans do not perform universally better than White people in all subjects, though, on average, they have somewhat better overall academic performance. It is math, and not science, that Asian Americans perform better than Whites. Actually, because Asian Americans have similar reading and science performance as White people and better math performance, it is probably the math edge of Asian American students that makes their overall academic performance superior to that of White students.

Appendix B Information of variables being used in the paper

Variable Name	Variable Description	Original Variable(s)	Recoding	Variable Coding
		Dependent variables		
F3EVRATT	College enrollment	F3EVRATT(Ever attended a postsecondary institution till 2012) 0=No postsecondary enrollment 1=Has some postsecondary enrollment RACE1 [See above, RACE1, for coding information.]	F3EVRATT 0=0=No postsecondary enrollment 1=1=Postsecondary enrollment Then, only include Asian Americans and Whites in F3EVRATT through utilizing RACE1.	0=No postsecondary enrollment 1=Postsecondary enrollment
STEM1ALL	STEM choice	F2MAJOR2 (Major in 2006) 1=Agriculture/natural resources/related 2=Architecture and related services 3=Area/ethnic/cultural/gender studies 4=Arts-visual and performing 5=Biological and biomedical sciences 6=Business/management/marketing/related 7=Communication/journalism/comm tech 8=Computer/info sciences/support tech 9=Construction trades 10=Education 11=Engineering technologies/technicians 12=English language and literature/letters 13=Family/consumer sciences, human sciences 14=Foreign languages/literature/linguistics 15=Health professions/clinical sciences 16=Legal professions and studies	F2MAJOR2 1,5,8,11,18,25,28=1=STEM The rest=0=Non-STEM Then, only include Asian Americans and Whites in F2MAJOR2 through utilizing RACE1.	1=STEM 0=Non-STEM

		18=Mathematics and statistics 19=Mechanical/repair technologies/techs 20=Multi/interdisciplinary studies 21=Parks/recreation/leisure/fitness studies 22=Precision production 23=Personal and culinary services 24=Philosophy, religion & theology 25=Physical sciences 26=Psychology 27=Public administration/social services 28=Science technologies/technicians 29=Security & protective services 30=Social sciences (except psychology) 31=Transportation & materials moving 32=Other 33=Liberal arts/sci, gen studies/humanities RACE1 [See above, RACE1, for coding information.]		
STEM2ALL	STEM major choice (5 categories)	F2MAJOR2 (Major in 2006) [See above, STEM1, for coding information.] RACE1 [See above, RACE1, for coding information.]	F2MAJOR2 1,5=1=Biological/agricultural Sciences 8=2=Computer/information sciences/support technicians 11=3=Engineering technologies/technicians 18=4=Math and statistics 25=5=Physical sciences The rest (including 28)=Missing Then, only include Asian Americans and	1=Biological/Agricultural Sciences 2=Computer/information sciences/support technicians 3=Engineering technologies/technicians 4=Math and statistics 5=Physical sciences

			Whites in F2MAJOR2 through utilizing RACE1.	
CompletionSTEM1	STEM completion	F3ICREDTYPE_1 (Highest/only credential from this institution: credential type) 1=Undergraduate certificate or diploma 2=Associate's degree 3=Bachelor's degree 4=Post-baccalaureate certificate 5=Master's degree 6=Post-master's certificate 7=Doctoral degree-research/scholarship 8=Doctoral degree-professional practice 9=Doctoral degree-other F3ICREDTYPE_2 (Additional credential from this institution: credential type) 1=Undergraduate certificate or diploma 2=Associate's degree 3=Bachelor's degree 4=Post-baccalaureate certificate 5=Master's degree F3ICREDGEN_1 (Highest/only credential from this institution: field of study) 1=Agriculture, agriculture operations, and related sciences 3=Natural resources and conservation 4=Architecture and related services 5=Area, ethnic, cultural, and gender studies 9=Communication, journalism, and related programs	F3ICREDTYPE_1 2,3=1=An Associate's or Bachelor's degree The rest codings are excluded. F3ICREDTYPE_2 2,3=1=An Associate's or Bachelor's degree The rest codings are excluded. F3ICREDGEN_1 1,3,11,14,15,26,27,40,41=1=STEM The rest=0=Non-STEM	0=Associate/Bachelor's degrees in non-STEM fields 1=Associate/Bachelor's degrees in STEM fields

10=Communications technologies/technicians and support services
11=Computer and information sciences and support services
12=Personal and culinary services
13=Education
14=Engineering
15=Engineering technologies/technicians
16=Foreign languages, literatures, and linguistics
19=Family and consumer sciences/human sciences
22=Legal professions and studies
23=English language and literature/letters
24=Liberal arts and sciences, general studies and humanities
25=Library sciences
26=Biological and biomedical sciences
27=Mathematics and statistics
29=Military technologies
30=Multi/interdisciplinary studies
31=Parks, recreation, leisure, and fitness studies
38=Philosophy and religious studies
39=Theology and religious vocations
40=Physical sciences
41=Science technologies/technicians
42=Psychology
43=Security and protective services
44=Public administration and social service professions
45=Social sciences
46=Construction trades
47=Mechanic and repair technologies/technicians
48=Precision production

	49=Transportation and materials moving 50=Visual and performing arts 51=Health professions and related clinical sciences 52=Business, management, marketing, and related support services 54=History 60=Residency programs	
	F3ICREDGEN_2 (Additional credential from this institution: field of study) 1=Agriculture, agriculture operations, and related sciences 3=Natural resources and conservation 4=Architecture and related services 5=Area, ethnic, cultural, and gender studies 9=Communication, journalism, and related programs 10=Communications technologies/technicians and support services 11=Computer and information sciences and support services 12=Personal and culinary services 13=Education 14=Engineering 15=Engineering technologies/technicians 16=Foreign languages, literatures, and linguistics 19=Family and consumer sciences/human sciences 22=Legal professions and studies 23=English language and literature/letters 24=Liberal arts and sciences, general studies and humanities	F3ICREDGEN_2 1,3,11,14,15,26,27,40,41=1=STEM The rest=0=Non-STEM Then, through both SPSS and manual recoding variables are prepared to form the new variable.

	26=Biological and biomedical sciences 27=Mathematics and statistics 29=Military technologies 30=Multi/interdisciplinary studies 31=Parks, recreation, leisure, and fitness studies 39=Theology and religious vocations 40=Physical sciences 41=Science technologies/technicians 42=Psychology 43=Security and protective services 44=Public administration and social service professions 45=Social sciences 46=Construction trades 47=Mechanic and repair technologies/technicians 48=Precision production 49=Transportation and materials moving 50=Visual and performing arts 51=Health professions and related clinical sciences 52=Business, management, marketing, and related support services 54=History F3IFIRSTINST (Institution is your first-attended postsecondary institution) 0=No 1=Yes		
CompletionSTEM2	F3ICREDTYPE_1 (Highest/only credential from this institution: credential type) [See above, CompletionSTEM1, for coding information.] F3ICREDTYPE_2 (Additional credential from	F3ICREDTYPE_1 2,3=1=An Associate's or Bachelor's degree The rest codings are excluded. F3ICREDTYPE_2 2,3=1=An Associate's or Bachelor's degree	1=Biological/Agricultural Sciences 2=Computer/information sciences/support technicians 3=Engineering technologies/technicians

		this institution: credential type) [See above, CompletionSTEM1, for coding information.] F3ICREDGEN_1 (Highest/only credential from this institution: field of study) [See above, CompletionSTEM1, for coding information.] F3ICREDGEN_2 (Additional credential from this institution: field of study) [See above, CompletionSTEM1, for coding information.] F3IFIRSTINST (Institution is your first-attended postsecondary institution) [See above, CompletionSTEM1, for coding information.]	The rest codings are excluded. F3ICREDGEN_1 1,3,26=1=Biological/Agricultural Sciences 11=2=Computer/information sciences/support technicians 14,15=3=Engineering technologies/technicians 27=4=Math and statistics 40=5=Physical sciences F3ICREDGEN_2 1,3,26=1=Biological/Agricultural Sciences 11=2=Computer/information sciences/support technicians 14,15=3=Engineering technologies/technicians 27=4=Math and statistics 40=5=Physical sciences Then, through both SPSS and manual recoding variables are prepared to form the new variable.	4=Math and statistics 5=Physical sciences
		Independent variables		
Asian Americans	Students' race—five categories	F1ASIAN (F1 student's Asian subgroup-composite (restricted)) 1=Chinese 2=Filipino 3=Japanese 4=Korean 5=Southeast Asian 6=South Asian	F1ASIAN 1,2,3,4,5,6=Asian Americans	0=Whites 1=Asian Americans

		F1RACE (F1 student's race/ethnicity-composite) 1=American Indian/Alaska Native, non-Hispanic 2=Asian, Hawaii/Pacific Islander, non-Hispanic 3=Black or African American, non-Hispanic 4=Hispanic, no race specified 5=Hispanic, race specified 6=More than one race, non-Hispanic 7=White, non-Hispanic Generation (Students' generational status) 1=First Generation 2=Second Generation 3=Third Generation	F1RACE 7=1=Whites 1,2,3,4,5,6=0=Other Use Generation to exclude Whites (F1RACE) that were first and second generations. Then, The two variables (F1ASIAN & F1RACE) are combined.	
Geographical subgroups1	Asian Americans' geographical subgroups-four categories	F1ASIAN (F1 student's Asian subgroup-composite (restricted)) 1=Chinese 2=Filipino 3=Japanese 4=Korean 5=Southeast Asian 6=South Asian	F1ASIAN 1,3,4,=1=East Asian 2=2=Filipino 5=3=Southeast 6=4=South	1=East Asian 2=Filipino 3=Southeast Asian 4=South Asian
Geographical subgroups2	Asian Americans' geographical subgroups-three categories	Geographical subgroups1	1=1=East Asian 2, 3=2=Southeast Asian 4=3=South Asian	1=East Asian 2=Southeast Asian 3=South Asian
Southeast	Geographical subgroups2 (Dummy)			1=Southeast Asian 0=The rest
South	Geographical subgroups2 (Dummy)			1=SouthAsian 0=The rest
Generation	Asian Americans'	BYP17 (Whether 10th grader's mother's birthplace in US or elsewhere)	1=1=United States 3=2=Another country/area	1=First Generation

	generational status	1=United States 2=Puerto Rico 3=Another country/area BYP20 (Whether 10th grader's father's birthplace in US or elsewhere), 1=United States 2=Puerto Rico 3=Another country/area BYP23 (Whether 10th grader's birth place in US or elsewhere) 1=United States 2=Puerto Rico 3=Another country/area AsianAmericans (Whether students are Asian Americans) 0=Whites 1=Asian Americans	2=System missing Then, The three variables are combined. At the end, AsianAmericans is used to make sure the newly combined variable is limited to Asian Americans.	2=Second Generation 3=Third Generation
Female	Students' gender	F1SEX 1=Male 2=Female	1=0=Male 2=1=Female	0=Male 1=Female
F1SES2	Socio-economic status			F1SES2 is a continuous variable, which used 1989 GSS occupational prestige scores.
BYS67	English is student's native language			0=No 1=Yes
Private	High school sector	BYSCTRL (school control) 1=Public 2=Catholic 3=Other private	BYSCTRL 1=0=Public 2,3=1=Private	0=Public 1=Private
BYP54	Parental participation	BYP54A (belong to parent-teacher organization) 0=No 1=Yes BYP54B (attend parent-teacher organization meetings) 0=No 1=Yes	Mean is ran if any 3 of the 5 variables is observed.	Parental participation is a continuous variable.

		BYP54C (take part in parent-teach organization activities) 0=No 1=Yes BYP54D (act as a volunteer at the school) 0=No 1=Yes BYP54E (belong to other organization with parents from school) 0=No 1=Yes		
BYP56	Family communi cation	BYP56A (provide advice about selecting courses or programs) 1=Never 2=Sometimes 3=Often BYP56B (provide advice about plans for college entrance exams) 1=Never 2=Sometimes 3=Often BYP56C (provide advice about applying to college/school after high school) 1=Never 2=Sometimes 3=Often BYP56D (provide advice about jobs to apply for after high school) 1=Never 2=Sometimes 3=Often BYP56E (provide information about community/national/world events) 1=Never	Missing value imputation by using EM is applied before obtaining the mean of the variables.	Family communication is a continuous variable.

		2=Sometimes 3=Often BYP56F (provide advice about things troubling 10th grader) 1=Never 2=Sometimes 3=Often		
BYP69	Family rules	BYP69A (family rules for 10th grader about maintaining grade average) 0=No 1=Yes BYP69B (family rules for 10th grader about doing homework) 0=No 1=Yes BYP69C (family rules for 10th grader about doing household chores) 0=No 1=Yes BYP69D (family rules for 10th grader about watching TV) 0=No 1=Yes	Missing value imputation by using EM is applied before obtaining the mean of the variables.	Family rules is a continuous variable.
BYP81	Parental expectation (How far in school you expect your tenth grader will go?)			1=less than high school graduation 2=high school graduation or GED only 3=attend or complete 2-year college/school 4=attend college, 4-year degree incomplete 5=graduate from college 6=obtain master's degree or equivalent 7=obtain PhD,

				MD, or other advanced degree
F1RMAPIP	Math course taking pipeline			1=No math 2=Non-academic 3=Low academic 4=Middle academic 5=Middle academic II 6=Advanced I 7=Advanced II/Pre-calculus 8=Advanced III/Calculus
F1RSCPIP	Science course taking pipeline			1=No science 2=Primary physical science 3=Secondary physical science and basic biology 4=General biology 5=Chemistry 1 or physics 1 6=Chemistry 1 and physics 1 7=Chemistry 2 or physics 2 or advanced biology 8=Chemistry and physics and level 7
zF1TXMSTD	F1 math standardized score (z score)			This is a continuous variable.
Occupation	STEM occupation expectation	F1S57 This is a verbatim variable that asked people's occupation expectations at age 30.	Answers in F1S57 were manually recoded.	0=Non-STEM 1=STEM
PSELEVEL	Level of first-attended postsecondary institution	F3PS1LVL (Level of first-attended postsecondary institution) 1=4-year institution 2=At least 2, but less-than-4-year institution	F3PS1LVL 1=1=4-year institution 2=0=At least 2, but less-than-4-year institution 3=missing	1=4-year institution 0=2-year institution

		3=Less-than-2-year institution RACE1 [See above, RACE1, for coding information.]	Then, only include Asian Americans and Whites in F3PS1LVL through utilizing RACE1.
F1QWT	First follow-up questionnaire (cross-sectional) weight		
F3BYPNLWT	Third follow-up base year panel weight		

Appendix C Missing value coding scheme from ELS: 2002

According to the user's manual of Education Longitudinal Study of 2002 (ELS: 2002): Base-year to first follow-up data file documentation (Ingels, Praat, Rogers, Siegel & Stutts, 2005), the coding and meaning of the missing values are presented in Table C.1.

Table C.1 Scheme for missing value coding

Coding	Meaning
-1=Don't know	It represents respondents who indicated that they did not know the answer to the question.
-2=Refused	It represents respondents who indicated that they refused to answer the question.
-3=Item legitimate skip/NA	It is filled for questions that are not answered because prior answers route the respondent elsewhere.
-4=Nonrespondent	It is filled for all variables across the entire questionnaire when a sample member did not respond to the questionnaire.
-5=Out of range	It represents hardcopy questionnaire respondents who reported values that are out of range.
-6=Multiple response	It represents hardcopy questionnaire respondents who clearly reported more than one response for an item that requires only on response.
-7=Partial interview-breakoff	It if filled for questions that are not answered because the respondent does not wish to continue the interview or they have run out of time. This also includes particular items that are not included on an abbreviated version questionnaire.
-8=Survey component legitimate skip/NA	It is filled for all items within a survey component for sample members who were not administered that component by design for one of the following reasons: (1) the component was not administered based on their status, (2) the sample member was not yet included in the study at this of administration, or (3) the sample member was not capable of completing the survey component.
-9=Missing	It is filled for questions that are not answered within the hardcopy questionnaire when the routing suggests that they should have filled a response.

Note: Information in this table came from Education Longitudinal Study of 2002 (ELS: 2002): Base-year to first follow-up data file documentation (Ingels, et al., 2005)

Appendix D Crosstabs between Asian American geographical subgroups and dependent variables using unweighted data

Table D.1 Crosstab between Asian American geographic subgroups (two grouping methods) and postsecondary enrollment

<table>
<tr><th></th><th colspan="2">Postsecondary enrollment</th><th colspan="2">Postsecondary enrollment</th></tr>
<tr><th></th><th>No PSE</th><th>PSE</th><th>No PSE</th><th>PSE</th></tr>
<tr><td>East Asian</td><td>30</td><td>681</td><td>30</td><td>681</td></tr>
<tr><td>% within row</td><td>4.2%</td><td>95.8%</td><td>4.2%</td><td>95.8%</td></tr>
<tr><td>Filipino</td><td>20</td><td>221</td><td rowspan="4">76
12%</td><td rowspan="4">555
88%</td></tr>
<tr><td>% within row</td><td>8.3%</td><td>91.7%</td></tr>
<tr><td>Southeast Asian</td><td>56</td><td>334</td></tr>
<tr><td>% within row</td><td>14.4%</td><td>85.6%</td></tr>
<tr><td>South Asian</td><td>18</td><td>224</td><td>18</td><td>224</td></tr>
<tr><td>% within row</td><td>7.4%</td><td>92.6%</td><td>7.4%</td><td>92.6%</td></tr>
</table>

Order by % within row for PSE:

East>South>Filipino>Southeast

East>South>Southeast

Table D.2 Crosstab between Asian American geographic subgroups (two grouping methods) and STEM choice

<table>
<tr><th></th><th colspan="2">STEM choice</th><th colspan="2">STEM choice</th></tr>
<tr><th></th><th>Non-STEM</th><th>STEM</th><th>Non-STEM</th><th>STEM</th></tr>
<tr><td>East Asian</td><td>296</td><td>134</td><td>296</td><td>134</td></tr>
<tr><td>% within row</td><td>68.8%</td><td>31.2%</td><td>68.8%</td><td>31.2%</td></tr>
<tr><td>Filipino</td><td>99</td><td>28</td><td rowspan="4">231
77%</td><td rowspan="4">69
23%</td></tr>
<tr><td>% within row</td><td>78%</td><td>22%</td></tr>
<tr><td>Southeast Asian</td><td>132</td><td>41</td></tr>
<tr><td>% within row</td><td>76.3%</td><td>23.7%</td></tr>
<tr><td>South Asian</td><td>97</td><td>60</td><td>97</td><td>60</td></tr>
<tr><td>% within row</td><td>61.8%</td><td>38.2%</td><td>61.8%</td><td>38.2%</td></tr>
</table>

Order by % within row for STEM:

South>East>Southeast>Filipino

South>East>Southeast

Table D.3 Crosstab between Asian American geographic subgroups (two grouping methods) and STEM major choice

	STEM major choice				
	Biological/agricultural sciences	Computer/information sciences/support technicians	Engineering technologies/technicians	Mathematics and statistics	Physical sciences
Grouping method 1					
East Asian	58	17	43	3	11
% within row	43.9%	12.9%	32.6%	2.3%	8.3%
Filipino	11	2	9	2	4
% within row	39.3%	7.1%	32.1%	7.1%	14.3%
Southeast Asian	22	2	8	4	5
% within row	53.7%	4.9%	19.5%	9.8%	12.2%
South Asian	29	6	19	2	3
% within row	49.2%	10.2%	32.2%	3.4%	5.1%
Grouping method 2					
East Asian	58	17	43	3	11
% within row	43.9%	12.9%	32.6%	2.3%	8.3%
Southeast Asian	33	4	17	6	9
% within row	47.8%	5.8%	24.6%	8.7%	13%
South Asian	29	6	19	2	3
% within row	49.2%	10.2%	32.2%	3.4%	5.1%

Order by % within row for Biological/agricultural sciences:

Southeast>South>East>Filipino

South>Southeast>East

Order by % within row for Computer/information sciences/support technicians:

East>South>Filipino>Southeast

East>South>Southeast

Order by % within row for Engineering technologies/technicians:

East>South>Filipino>Southeast

East>South>Southeast

Order by % within row for Mathematics and statistics:

Southeast>Filipino>South>East

Southeast>South>East

Order by % within row for Physical sciences:

Filipino>Southeast>East>South

Southeast>East>South

Table D.4 Crosstab between Asian American geographic subgroups (two grouping methods) and STEM completion

	STEM completion		STEM completion	
	Non-STEM degree	STEM degree	Non-STEM degree	STEM degree
East Asian	270	92	270	92
% within row	74.6%	25.4%	74.6%	25.4%
Filipino	99	14		
% within row	87.6%	12.4%	205	48
Southeast Asian	106	34	81%	19%
% within row	75.7%	24.3%		
South Asian	85	47	85	47
% within row	64.4%	35.6%	64.4%	35.6%

Order by % within row for STEM degree:

South>East>Southeast>Filipino

South>East>Southeast

Table D.5 Crosstab between Asian American geographic subgroups (two grouping methods) and STEM major completion

	STEM major completion				
	Biological/agricultural sciences	Computer/information sciences/support technicians	Engineering technologies/technicians	Mathematics and statistics	Physical sciences
		Grouping method 1			
East Asian	39	11	29	7	6
% within row	42.4%	12%	31.5%	7.6%	6.5%
Filipino	7	1	4	1	1
% within row	50%	7.1%	28.6%	7.1%	7.1%
Southeast Asian	15	4	8	3	4
% within row	44.1%	11.8%	23.5%	8.8%	11.8%
South Asian	21	7	16	2	1
% within row	44.7%	14.9%	34%	4.3%	2.1%
		Grouping method 2			
East Asian	39	11	29	7	6
% within row	42.4%	12%	31.5%	7.6%	6.5%
Southeast Asian	22	5	12	4	5
% within row	45.8%	10.4%	25%	8.3%	10.4%
South Asian	21	7	16	2	1
% within row	44.7%	14.9%	34%	4.3%	2.1%

Order by % within row for Biological/agricultural sciences:

Filipino>South>Southeast>East

Southeast>South>East

Order by % within row for Computer/information sciences/support technicians:

South>East>Southeast>Filipino

South>East>Southeast

Order by % within row for Engineering technologies/technicians:

South>East>Filipino>Southeast

South>East>Southeast

Order by % within row for Mathematics and statistics:

Southeast>East>Filipino>South

Southeast>East>South

Order by % within row for Physical sciences:

Southeast>Filipino>East>South

Southeast>East>South

Table D.6 Crosstab between Asian American geographic subgroups (two grouping methods) and STEM persistence

<table>
<tr><th></th><th colspan="2">STEM persistence</th><th colspan="2">STEM completion</th></tr>
<tr><th></th><th>Not persist</th><th>Persist</th><th>Not persist</th><th>Persist</th></tr>
<tr><td>East Asian</td><td>9</td><td>47</td><td>9</td><td>47</td></tr>
<tr><td>% within row</td><td>16.1%</td><td>83.9%</td><td>16.1%</td><td>83.9%</td></tr>
<tr><td>Filipino</td><td>0</td><td>8</td><td rowspan="4">4
14.8%</td><td rowspan="4">23
85.2%</td></tr>
<tr><td>% within row</td><td>0%</td><td>100%</td></tr>
<tr><td>Southeast Asian</td><td>4</td><td>15</td></tr>
<tr><td>% within row</td><td>21.1%</td><td>78.9%</td></tr>
<tr><td>South Asian</td><td>1</td><td>27</td><td>1</td><td>27</td></tr>
<tr><td>% within row</td><td>3.6%</td><td>96.4%</td><td>3.6%</td><td>96.4%</td></tr>
</table>

Order by % within row for Persist:

Filipino>South>East>Southeast

South>Southeast>East

Appendix E Crosstabs between Asian American generational subgroups and dependent variables using unweighted data

Table E.1 Crosstab between Asian American generational subgroups and postsecondary enrollment

	Postsecondary enrollment	
	No PSE	PSE
First generation	31	407
% within row	7.1%	92.9%
Second generation	36	546
% within row	6.2%	93.8%
Third generation	24	136
% within row	15%	85%

Table E.2 Crosstab between Asian American generational subgroups and STEM choice

	STEM choice	
	Non-STEM	Non-STEM
First generation	184	68
% within row	73%	27%
Second generation	242	108
% within row	69.1%	30.9%
Third generation	55	18
% within row	75.3%	24.7%

Table E.3 Crosstab between Asian American generational subgroups and STEM major choice

	STEM major choice				
Grouping method 1	Biological/agricultural sciences	Computer/information sciences/support technicians	Engineering technologies/technicians	Mathematics and statistics	Physical sciences
First generation	30	6	24	2	5
% within row	44.8%	9%	35.8%	3%	7.5%
Second generation	47	10	33	6	10
% within row	44.3%	9.4%	31.1%	5.7%	9.4%
Third generation	5	2	8	0	3
% within row	27.8%	11.1%	44.4%	0%	16.7

Table E.4 Crosstab between Asian American generational subgroups and STEM completion

	STEM completion	
	Non-STEM degree	STEM degree
First generation	141	56
% within row	71.6%	28.4%
Second generation	224	69
% within row	76.5%	23.5%
Third generation	50	17
% within row	74.6%	25.4%

Table E.5 Crosstab between Asian American generational subgroups and STEM degree completion

	STEM degree completion				
Grouping method 1	Biological/agricultural sciences	Computer/information sciences/support technicians	Engineering technologies/technicians	Mathematics and statistics	Physical sciences
First generation	25	7	14	4	6
% within row	44.6%	12.5%	25%	7.1%	10.7%
Second generation	28	9	24	7	1
% within row	40.6%	13%	34.8%	10.1%	1.4%
Third generation	6	3	7	0	1
% within row	35.3%	17.6%	41.2%	0%	5.9%

Table E.6 Crosstab between Asian American generational subgroups and STEM persistence

	STEM persistence	
	Not persist	Not persist
First generation	4	27
% within row	12.9%	87.1%
Second generation	4	43
% within row	8.5%	91.5%
Third generation	2	9
% within row	18.2%	81.8%

Appendix F Correlation tables utilizing weighted data

Table F.1 Correlations among the variables prepared for the inferential analyses (postsecondary enrollment as the dependent variable; Asian Americans as the independent variable)

	Enroll	Asians	Female	SES	English	Private	Participate	Communicate	Rules	Expect	Math	Science	Achieve
Asians	0.05												
Female	0.07	0.01											
SES	0.21	0.01	-0.05										
English	-0.01	-0.63	-0.01	0.05									
Private	0.07	0.03	-0.05	0.18	0.03								
Participate	0.10	-0.05	0.00	0.29	0.07	0.16							
Communicate	0.10	-0.06	-0.01	0.18	0.09	0.02	0.23						
Rules	-0.01	0.01	-0.01	-0.00	-0.00	0.02	0.12	0.19					
Expect	0.31	0.14	0.10	0.34	-0.12	0.11	0.15	0.19	-0.02				
Math	0.30	0.07	0.00	0.35	-0.06	0.11	0.14	0.11	-0.05	0.51			
Science	0.24	0.09	0.00	0.31	-0.08	0.08	0.14	0.10	-0.04	0.43	0.60		
Achieve	0.28	0.05	-0.13	0.37	-0.01	0.11	0.11	0.08	-0.08	0.47	0.72	0.54	
Occupation	0.07	0.02	-0.24	0.05	-0.02	0.00	-0.02	-0.00	-0.00	0.09	0.21	0.16	0.24

Notes:

1. Enroll = Postsecondary enrollment (vs. no postsecondary enrollment); Asians = Asian Americans (vs. Whites); Female = Female (vs. male); English = English proficiency (vs. no English proficiency); Private = Private high school (vs. public high school); Participate = Parental participation; Communication = Family communication; Rules = Family rules; Expect = Parental expectation; Math = Math pipeline; Science =Science pipeline; Achieve = Academic achievement (math); Occupation =High school STEM occupation expectation (vs. no STEM occupation expectation)
2. All of the correlations were significant at the 0.001 level. Nonetheless, the relationships between family rules and English proficiency, between the science pipeline and female, and between high school STEM occupation expectation and family communication were significant at 0.01 level. The relationship between high school STEM occupation expectation and family rules was significant at 0.05 level. On the other hand, there were no statistically significant relationships between family rules and SES, and between the math pipeline and female, and between high school STEM occupation expectation and private high school.
3. The variable, 4-year institution, was not included in that this variable was for people with postsecondary education.
4. The results were weighted.
5. Listwise deletion was applied.

Table F.2 Correlations among the variables prepared for the inferential analyses (postsecondary enrollment as the dependent variable; Asian American subgroups as the independent variables)

	Enroll	East/ South	First	Female	SES	English	Private	Participate	Communicate	Rules	Expect	Math	Science	Achieve
East/South	0.14													
First	-0.07	0.11												
Female	0.10	-0.06	-0.11											
SES	0.14	0.23	-0.03	-0.05										
English	0.03	-0.11	-0.35	0.05	0.18									
Private	0.05	-0.07	-0.04	-0.16	0.15	0.18								
Participate	-0.00	0.01	-0.07	-0.02	0.22	0.20	0.23							
Communicate	0.11	0.17	-0.05	-0.02	0.34	0.17	0.10	0.40						
Rules	-0.06	-0.14	-0.16	0.02	0.07	0.11	0.01	0.20	0.33					
Expect	0.11	0.24	0.18	-0.01	0.23	-0.10	0.06	0.09	0.20	0.06				
Math	0.19	0.34	0.05	-0.00	0.25	-0.25	0.01	0.06	0.16	-0.13	0.45			
Science	0.15	0.25	0.11	0.00	0.22	-0.25	-0.07	-0.00	0.10	-0.14	0.38	0.68		
Achieve	0.15	0.31	0.07	-0.12	0.32	-0.12	0.01	0.02	0.11	-0.19	0.39	0.71	0.60	
Occupation	-0.01	0.05	0.01	-0.21	0.07	-0.06	-0.02	-0.01	0.04	0.01	0.05	0.11	0.11	0.16

Notes:

1. Enroll = Postsecondary enrollment (vs. no postsecondary enrollment); East/South = East/South Asian Americans (vs. Southeast Asian Americans); First = First-generation Asian Americans (vs. second-generation Asian Americans); Female = Female (vs. male); English = English proficiency (vs. no English proficiency); Private = Private high school (vs. public high school); Participate = Parental participation; Communication = Family communication; Rules = Family rules; Expect = Parental expectation; Math = Math pipeline; Science =Science pipeline; Achieve = Academic achievement (math); Occupation =High school STEM occupation expectation (vs. no STEM occupation expectation)

2. All of the correlations were significant at the 0.001 level. Nonetheless, the relationships between parental participation and East/South Asian Americans, between high school STEM occupation expectation and first-generation Asian Americans, and between high school STEM occupation expectation and parental participation were significant at 0.01 level. The relationship between academic achievement (math) and private high school was significant at 0.05 level. On the other hand, there were no statistically significant relationships between parental participation and postsecondary enrollment, between high school STEM occupation expectation and postsecondary enrollment, between parental expectation and female, between the math pipeline and female, between the science pipeline and female, between family rules and private high school, between the math pipeline and private high school, between the science pipeline and parental participation, and between high school STEM occupation expectation and family rules.

3. The variable, 4-year institution, was not included in that this variable was for people with postsecondary education.

4. The results were weighted.

5. Listwise deletion was applied.

Table F.3 Correlations among the variables prepared for the inferential analyses (STEM choice as the dependent variable; Asian Americans as the independent variables)

	Choice	Asians	Female	SES	English	Private	Participate	Commun	Rules	Expect	Math	Science	Achieve	Occupation
Asians	0.08													
Female	-0.23	-0.02												
SES	0.08	-0.02	-0.06											
English	-0.05	-0.67	0.01	0.09										
Private	-0.02	-0.01	-0.05	0.15	0.04									
Participate	-0.04	-0.08	0.00	0.23	0.11	0.15								
Commun	0.02	-0.10	-0.02	0.18	0.13	-0.01	0.21							
Rules	-0.04	-0.01	-0.02	-0.04	0.02	0.02	0.12	0.18						
Expect	0.14	0.14	0.05	0.24	-0.11	0.08	0.11	0.17	-0.07					
Math	0.27	0.07	-0.05	0.24	-0.06	0.06	0.06	0.08	-0.08	0.42				
Science	0.28	0.13	-0.05	0.23	-0.10	0.03	0.07	0.08	-0.07	0.35	0.52			
Achieve	0.29	0.07	-0.18	0.26	-0.04	0.06	0.03	0.04	-0.11	0.39	0.68	0.48		
Occupation	0.48	0.01	-0.30	0.01	-0.02	-0.02	-0.07	-0.04	-0.01	0.01	0.19	0.15	0.25	
4-year	0.10	0.02	0.00	0.28	-0.01	0.09	0.12	0.08	-0.05	0.29	0.39	0.32	0.37	0.06

Notes:

1. Choice = STEM choice (vs. non-STEM); Asians = Asian Americans (vs. Whites); Female = Female (vs. male); English = English proficiency (vs. no English proficiency); Private = Private high school (vs. public high school); Participate = Parental participation; Commun = Family communication; Rules = Family rules; Expect = Parental expectation; Math = Math pipeline; Science =Science pipeline; Achieve = Academic achievement (math); Occupation =High school STEM occupation expectation (vs. no STEM occupation expectation); 4-year =4-year institution (vs. 2-year institution)
2. All of the correlations were significant at the 0.001 level. Nonetheless, the relationships between parental participation and female, and between family communication and private high school were significant at the 0.01 level. The relationship between 4-year institution and female was significant at 0.05 level.
3. The results were weighted.
4. Listwise deletion was applied.

Table F.4 Correlations among the variables prepared for the inferential analyses (STEM choice as the dependent variable; Asian American subgroups as the independent variables)

	Choice	East/ South	First	Female	SES	English	Private	Partici	Commun	Rules	Expect	Math	Science	Achieve	Occupa
East/South	0.06														
First	-0.08	0.21													
Female	-0.16	-0.11	-0.01												
SES	0.12	0.20	0.01	-0.06											
English	-0.06	-0.23	-0.36	0.08	0.16										
Private	0.12	-0.08	-0.06	-0.09	0.17	0.20									
Partici	0.08	0.02	-0.14	-0.01	0.32	0.28	0.20								
Commun	0.10	0.11	-0.04	-0.03	0.31	0.21	0.13	0.45							
Rules	0.08	-0.14	-0.17	0.00	0.11	0.11	0.00	0.15	0.37						
Expect	0.10	0.11	0.16	0.06	0.14	-0.05	0.06	0.11	0.12	0.03					
Math	0.22	0.23	0.07	0.01	0.20	-0.22	0.02	0.11	0.11	-0.13	0.26				
Science	0.22	0.20	0.14	0.01	0.20	-0.21	-0.11	0.00	0.08	-0.12	0.19	0.62			
Achieve	0.23	0.27	0.08	-0.07	0.29	-0.12	0.06	0.06	0.08	-0.17	0.29	0.67	0.54		
Occupa	0.44	0.05	0.02	-0.24	0.03	-0.11	-0.04	-0.07	0.02	-0.03	-0.04	0.16	0.19	0.18	
4-year	0.12	-0.10	-0.03	0.04	0.18	-0.02	0.16	0.14	0.23	-0.02	0.27	0.42	0.38	0.27	0.09

Notes:

1. Choice = STEM choice (vs. non-STEM); East = East/South Asian Americans (vs. Southeast Asian Americans); First = First-generation Asian Americans (vs. second-generation Asian Americans); Female = Female (vs. male); English = English proficiency (vs. no English proficiency); Private = Private high school (vs. public high school); Partici = Parental participation; Commun = Family communication; Rules = Family rules; Expect = Parental expectation; Math = Math pipeline; Science =Science pipeline; Achieve = Academic achievement (math); Occupa =High school STEM occupation expectation (vs. no STEM occupation expectation); 4-year =4-year institution (vs. 2-year institution)

2. All of the correlations were significant at the 0.001 level. Nonetheless, the relationships between parental participation and East/South Asian Americans, between high school STEM occupation expectation and first-generation Asian Americans, between high school STEM occupation expectation and family communication, and between 4-year institution and family rules were significant at 0.01 level. The relationship between 4-year institution and English proficiency was significant at 0.05 level. On the other hand, there were no statistically significant relationships between female and first-generation Asian Americans, between SES and first-generation Asian Americans, between parental participation and female, between family rules and female, between the math pipeline and female, between the science pipeline and female, between family rules and private high school, and between the science pipeline and parental participation.

3. The results were weighted.

4. Listwise deletion was applied.

Table F.5 Correlations among the variables prepared for the inferential analyses (STEM completion as the dependent variable; Asian Americans as the independent variables)

	Completion	Asians	Female	SES	English	Private	Partici	Commun	Rules	Expect	Math	Science	Achieve	Occupation
Asians	0.04													
Female	-0.24	0.01												
SES	0.03	-0.03	-0.08											
English	-0.04	-0.69	-0.02	0.08										
Private	-0.03	0.01	-0.05	0.15	0.04									
Partici	-0.07	-0.08	-0.03	0.25	0.10	0.16								
Commun	0.01	-0.08	0.00	0.15	0.11	-0.02	0.19							
Rules	-0.07	0.01	0.01	-0.04	0.01	0.01	0.14	0.20						
Expect	0.08	0.13	0.10	0.26	-0.09	0.07	0.14	0.13	-0.06					
Math	0.25	0.05	-0.05	0.23	-0.05	0.06	0.07	0.03	-0.08	0.37				
Science	0.24	0.10	-0.06	0.22	-0.10	0.04	0.08	0.06	-0.08	0.32	0.50			
Achieve	0.28	0.04	-0.19	0.26	-0.02	0.06	0.05	-0.00	-0.14	0.36	0.68	0.46		
Occupation	0.50	0.01	-0.27	-0.00	-0.00	-0.01	-0.05	-0.04	-0.03	0.03	0.21	0.16	0.25	
4-year	0.05	0.02	-0.01	0.26	0.01	0.08	0.11	-0.00	-0.07	0.24	0.32	0.24	0.34	0.07

Notes:

1. Completion = STEM completion (vs. non-STEM Associate/Bachelor's degrees); Asians = Asian Americans (vs. Whites); Female = Female (vs. male); English = English proficiency (vs. no English proficiency); Private = Private high school (vs. public high school); Partici = Parental participation; Commun = Family communication; Rules = Family rules; Expect = Parental expectation; Math = Math pipeline; Science =Science pipeline; Achieve = Academic achievement (math); Occupation =High school STEM occupation expectation (vs. no STEM occupation expectation); 4-year =4-year institution (vs. 2-year institution)
2. All of the correlations were significant at the 0.001 level. Nonetheless, the relationships between academic achievement (math) and family communication, and between high school STEM occupation expectation and SES were significant at the 0.01 level. The relationship between high school STEM occupation expectation and English proficiency was significant at 0.05 level. On the other hand, there were no statistically significant relationships between family communication and female, and between 4-year institution and family communication.
3. The results were weighted.
4. Listwise deletion was applied.

Table F.6 Correlations among the variables prepared for the inferential analyses (STEM completion as the dependent variable; Asian American subgroups as the independent variables)

	Completion	East/ South	First	Female	SES	English	Private	Partici	Commu	Rules	Expect	Math	Science	Achieve	Occupa
East/South	0.09														
First	0.11	0.16													
Female	-0.15	-0.15	0.01												
SES	-0.02	0.21	-0.08	-0.10											
English	-0.21	-0.20	-0.38	0.07	0.18										
Private	-0.05	-0.13	-0.13	-0.10	0.06	0.20									
Partici	-0.09	0.02	-0.20	0.05	0.24	0.27	0.15								
Commu	-0.09	0.14	-0.05	-0.01	0.38	0.24	0.05	0.48							
Rules	0.04	-0.07	-0.21	0.07	0.09	0.14	0.06	0.27	0.46						
Expect	0.14	0.18	0.13	0.05	0.16	0.05	0.08	0.09	0.19	0.04					
Math	0.23	0.32	0.09	-0.02	0.19	-0.19	-0.01	0.09	0.11	-0.08	0.28				
Science	0.31	0.21	0.16	-0.01	0.18	-0.23	-0.09	-0.03	0.01	-0.08	0.27	0.59			
Achieve	0.34	0.27	0.10	-0.20	0.25	-0.07	-0.03	-0.06	0.00	-0.18	0.34	0.66	0.53		
Occupa	0.31	0.07	-0.04	-0.17	-0.04	-0.06	-0.02	-0.13	0.08	0.08	0.03	0.03	-0.02	0.08	
4-year	0.09	0.02	-0.09	-0.06	0.13	0.09	0.07	0.04	0.19	-0.05	0.27	0.43	0.37	0.34	0.12

Notes:

1. Completion = STEM completion (vs. non-STEM Associate/Bachelor's degrees); East = East/South Asian Americans (vs. Southeast Asian Americans); First = First-generation Asian Americans (vs. second-generation Asian Americans); Female = Female (vs. male); English = English proficiency (vs. no English proficiency); Private = Private high school (vs. public high school); Partici = Parental participation; Commu = Family communication; Rules = Family rules; Expect = Parental expectation; Math = Math pipeline; Science =Science pipeline; Achieve = Academic achievement (math); Occupa =High school STEM occupation expectation (vs. no STEM occupation expectation); 4-year =4-year institution (vs. 2-year institution)

2. All of the correlations were significant at the 0.001 level. Nonetheless, the relationships between SES and STEM completion, between parental participation and East/South Asian Americans, between the math pipeline and female, and between 4-year institution and East/South Asian Americans were significant at 0.01 level. The relationship between high school STEM occupation expectation and the science pipeline was significant at 0.05 level. On the other hand, there were no statistically significant relationships between female and first-generation Asian Americans, between family communication and female, between the science pipeline and female, between the math pipeline and private high school, between the science pipeline and family communication, and between academic achievement (math) and family communication.

3. The results were weighted.

4. Listwise deletion was applied.

Appendix G Variables in model 1 through model 6 utilized for obtaining VIFs

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Asian Americans	✓		✓		✓	
East/South Asian Americans		✓		✓		✓
First-generation Asian Americans		✓		✓		✓
Female	✓	✓	✓	✓	✓	✓
SES	✓	✓	✓	✓	✓	✓
English proficiency	✓	✓	✓	✓	✓	✓
Private high school	✓	✓	✓	✓	✓	✓
Parental participation	✓	✓	✓	✓	✓	✓
Family communication	✓	✓	✓	✓	✓	✓
Family rules	✓	✓	✓	✓	✓	✓
Parental expectation	✓	✓	✓	✓	✓	✓
Math pipeline	✓	✓	✓	✓	✓	✓
Science pipeline	✓	✓	✓	✓	✓	✓
Academic achievement (math)	✓	✓	✓	✓	✓	✓
High school STEM occupation expectation	✓	✓	✓	✓	✓	✓
4-year institution			✓	✓	✓	✓

Notes:

1. ✓ indicates the corresponding variable was included in the analysis.
2. Model 1 and 2 had postsecondary enrollment as the dependent variable; Model 3 and 4 had STEM choice as the dependent variable; and, Model 5 and 6 had STEM completion as the dependent variable.
3. The unweighted analytic sample size after listwise deletion for Model 1 was 3,815; for Model 2 was 400; for Model 3 was 2,226; for Model 4 was 248; for Model 5 was 1,962; and for Model 6 was 221.

Appendix H Stepwise weighted logistic regression tables for Model 1 through 6 (each step bears different analytic sample sizes)

Table H.1 Weighted logistic regressions for Model 1, with different analytic sample size for each step (DV = postsecondary enrollment)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
Asian Americans	0.15 (1.16)	0.45* (1.57)	1.26* (3.52)
Female		0.82*** (2.27)	0.73*** (2.07)
SES		1.59*** (4.91)	0.72*** (2.05)
English proficiency		-0.30 (0.74)	0.72 (2.05)
Private high school			0.64 (1.90)
Parental participation			0.33 (1.40)
Family communication			0.43* (1.54)
Family rules			-0.32 (0.72)
Parental expectation			0.33*** (1.40)
Math pipeline			0.31** (1.36)
Science pipeline			0.17* (1.18)
Academic achievement (math)			0.47** (1.60)
High school STEM occupation expectation			1.13* (3.09)

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Table H.2 Weighted logistic regressions for Model 2, with different analytic sample size for each step (DV = postsecondary enrollment)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
East/South Asian Americans	0.73* (2.08)	0.41 (1.50)	1.74 (5.70)
First-generation Asian Americans	-0.55 (0.58)	-0.03 (0.97)	-0.40 (0.67)
Female		0.89* (2.45)	1.80* (6.08)
SES		1.41*** (4.11)	1.02* (2.77)
English proficiency		-0.02 (0.98)	-0.31 (0.73)
Private high school			16.34*** (12468560)
Parental participation			-1.65 (0.19)
Family communication			1.62 (5.03)
Family rules			-1.07 (0.34)
Parental expectation			0.09 (1.09)
Math pipeline			0.67 (1.96)
High school STEM occupation expectation			-0.82 (0.44)

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table H.3 Weighted logistic regressions for Model 3, with different analytic sample size for each step (DV = STEM choice)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
Asian Americans	0.72*** (2.04)	0.51** (1.66)	0.66* (1.93)
Female		-1.14*** (0.32)	-0.67*** (0.51)
SES		0.23** (1.26)	0.03 (1.03)
English proficiency		-0.26 (0.77)	0.48 (1.62)
Private high school			-0.26 (0.77)
Parental participation			-0.30 (0.74)
Family communication			0.16 (1.17)
Family rules			-0.13 (0.88)
Parental expectation			0.17 (1.18)
Math pipeline			0.26** (1.30)
Science pipeline			0.39*** (1.48)
Academic achievement (math)			0.10 (1.11)
High school STEM occupation expectation			2.50*** (12.1)
4-year institution			-0.25 (0.78)

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Table H.4 Weighted logistic regressions for Model 4, with different analytic sample size for each step (DV = STEM choice)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
East/South Asian Americans	0.42 (1.52)	0.36 (1.43)	0.03 (1.03)
First-generation Asian Americans	-0.20 (0.82)	-0.38 (0.68)	-0.71 (0.49)
Female		-0.76** (0.47)	-0.23 (0.80)
SES		0.15 (1.17)	0.05 (1.05)
English proficiency		-0.57* (0.56)	-0.38 (0.69)
Private high school			1.22 (3.39)
Parental participation			0.49 (1.64)
Family communication			0.10 (1.11)
Family rules			1.06 (2.88)
Parental expectation			0.27 (1.31)
Math pipeline			0.10 (1.10)
Science pipeline			0.24 (1.28)
Academic achievement (math)			0.21 (1.23)
High school STEM occupation expectation			2.74*** (15.54)
4-year institution			-0.47 (0.62)

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Table H.5 Weighted logistic regressions for Model 5, with different analytic sample size for each step (DV = STEM completion)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
Asian Americans	0.44*** (1.56)	0.13 (1.14)	0.25 (1.28)
Female		-1.12*** (0.33)	-0.76*** (0.47)
SES		0.06 (1.06)	-0.13 (0.88)
English proficiency		-0.36 (0.70)	0.03 (1.03)
Private high school			-0.30 (0.74)
Parental participation			-0.56* (0.57)
Family communication			0.30 (1.34)
Family rules			-0.37 (0.69)
Parental expectation			0.03 (1.04)
Math pipeline			0.22* (1.25)
Science pipeline			0.28*** (1.32)
Academic achievement (math)			0.39** (1.47)
High school STEM occupation expectation			2.41*** (11.11)
4-year institution			-0.42 (0.66)

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$

Table H.6 Weighted logistic regressions for Model 6, with different analytic sample size for each step (DV = STEM completion)

	Step 1 Coefficient (Odds ratio)	Step 2 Coefficient (Odds ratio)	Step 3 Coefficient (Odds ratio)
East/South Asian Americans	0.43 (1.53)	0.39 (1.48)	-0.15 (0.86)
First-generation Asian Americans	0.43 (1.54)	0.12 (1.13)	0.59 (1.81)
Female		-0.82** (0.44)	-0.28 (0.75)
SES		-0.04 (0.96)	-0.24 (0.78)
English proficiency		-0.78* (0.46)	-0.67 (0.51)
Private high school			-0.13 (0.88)
Parental participation			1.12 (3.05)
Family communication			-1.02 (0.36)
Family rules			2.64 (13.98)
Parental expectation			0.22 (1.25)
Math pipeline			-0.11 (0.89)
Science pipeline			0.57* (1.77)
Academic achievement (math)			1.19** (3.29)
High school STEM occupation expectation			2.62*** (13.78)
4-year institution			-0.91 (0.40)

Notes: 1. Strata, cluster as well as weight were considered during the analyses;
2.* $p< 0.05$, ** $p<0.01$, *** $p<0.001$