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Dismantling the Asian Monolith: Examining Southeast Asian Students' Science Self-Efficacy and Science Identity

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Dismantling the Asian Monolith:

Examining Southeast Asian Students' Science Self-Efficacy and Science Identity

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Philosophy

in Education

by

Chantra Nhien

2022

ABSTRACT OF THE DISSERTATION

Dismantling the Asian Monolith:

Examining Southeast Asian Students' Science Self-Efficacy and Science Identity

by

Chantra Nhien

Doctor of Philosophy in Education

University of California, Los Angeles, 2022

Professor Linda J. Sax, Chair

Scholarship suggests that science self-efficacy and science identity are associated with improved experiences and outcomes of postsecondary science, technology, engineering, and mathematics students, especially those who are underrepresented within these fields. Yet, Southeast Asian students have largely been excluded from this scholarly discourse. This exclusion has been driven by the reporting of enrollment and degree attainment data that aggregates nearly 48 Asian American & Pacific Islander ethnic groups which has perpetually obscured the unique dispositions and experiences of Southeast Asian students. Thus, this study aimed to investigate the development of science self-efficacy and science identity of Southeast Asian STEM students during their first year of college. Additionally, this study compared Southeast Asian students with their AAPI peers to illuminate and underscore the unique experiences of these students.

This study utilized four years of longitudinal data between 2016-2020 from the Higher Education Research Institute's CIRP Freshman Survey and Your First College Year Survey, two surveys that were respectively administered at the start and end of students' first college year. Guided by a conceptual framework that synthesized Lent and colleagues' social cognitive career theory, Carlone and Johnson's science identity model, and Yosso's community cultural wealth, this study first sought to explore differences between Southeast Asian students and their AAPI peers across various pre-college characteristics and experiences. Next, this study examined changes in science self-efficacy and science identity of Southeast Asian students and investigated if and how these changes differed from their AAPI peers. This study concluded with inferential analyses aimed at unpacking predictors that were most salient for science self-efficacy and science identity development of Southeast Asian students.

Results from this study suggest that Southeast Asian students entered college with statistically significant differences in their socioeconomic and generational statuses when compared to their AAPI peers. Furthermore, findings indicated that while Southeast Asian students maintained their confidence in completing science-related tasks during their first year of college, their identity as a scientist decreased significantly. Lastly, various environmental influences and learning experiences emerged as salient predictors of science self-efficacy and science identity development for Southeast Asian students. Overall, these findings suggest that preparing Southeast Asian students to become future STEM professionals and leaders requires the acknowledgment of a distinct sociopolitical history that heavily influences how Southeast Asian students learn and make decisions about college, how their community cultural assets strengthen their adjustment to and experiences in college, and the types of environments that bolster their science self-efficacy and science identity development.

The dissertation of Chantra Nhien is approved.

M. Kevin Eagan Jr.

Robert T. Teranishi

Federick Ngo

Linda J. Sax, Committee Chair

University of California, Los Angeles

2022

DEDICATION

To my father and late mother. For assembling a warm and wondrous home where we drew an enchanted map brimming with infinite discoveries. For forging and tempering the rainbow sword and prismatic shield that protected me as I charged into the battlefield of new truths. For building and holding steady the magical ladder that I climbed to touch the inspiring lights of wishing stars. This achievement is yours just as much as it is mine.

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Nhien, C (2022, April) *Underrepresented and Understudied: A quantitative longitudinal examination of science identity of first year Southeast Asian STEM college students (forthcoming).* Roundtable presentation for the 2022 American Educational Research Association (AERA) conference.

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Nhien, C. (2020, April). *Beyond the Classroom: Predicting Science Self-Efficacy of First-Year STEM Students.* (*Accepted*) Paper presentation at the 2020 American Educational Research Association (AERA) Annual Meeting, San Francisco, California (*meeting cancelled*).

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CHAPTER ONE: INTRODUCTION

As a first-generation Cambodian student, I had full autonomy over my educational journey from pre-school through college, but this independence was more of a byproduct of limited access to resources and capital. I exclusively studied independently and directly associated my study habits with my grades. While this approach got me through high school, I faced many challenges entering college as a STEM major. On the one hand, I was saturated with stereotypes about how Cambodians were mostly known for performing poorly in school and joining gangs. On the other hand, I was also seen, broadly, as an Asian student who was expected to perform well in school. Therefore, attending college, I felt a sense of accomplishment that I had made it past high school as a Cambodian, yet I also dealt with the pressure of having to perform well because I was seen as Asian. This peculiar paradox would haunt me throughout my college career and contribute to a cycle of self-doubt and disappointment.

Attending UCLA for my undergraduate studies, I struggled to get through my STEM coursework, going through an iterative process of studying hard, then performing poorly on examinations, followed by telling myself to study harder next time, then performing poorly on subsequent examinations, and finally cycling back to telling myself to study harder. Through this ineffective cycle of navigating my academic endeavors within college and convincing myself that I did not need to seek help, I barely graduated with my B.S. degree. Unfortunately, what followed was my inability to acquire a STEM job after college due to my low GPA and limited science skills and, therefore I ended up leaving STEM altogether, thus devaluing the five years of time I spent completing my bachelor's degree in biology.

I think a lot about why asking for help or accessing resources during college was so difficult. I was raised by two brilliant parents who came to the US in the early 1980s as refugees

from the war in Cambodia. My parents were not given the opportunity to attend college, therefore most of their educational guidance was comprised of encouraging me to study hard, to go to college, and to become a medical doctor. To be honest, I never actually thought about or questioned their lack of knowledge about college. I thought it was normal to not have educational guidance from parents. Furthermore, I was raised to not burden others and this value translated to not asking for help when it came to school.

Eight years after completing my undergraduate studies, I returned to STEM in a different capacity when I accepted a position as a student affairs professional for a STEM department's student success center at a California State University Long Beach (CSULB), a large comprehensive teaching institution. It was in this position that I learned about educational experiences beyond studying and performance on examinations that contributes to STEM student success. The department I worked for relied on research to implement first- and second-year interventions centered on growth mindset, academic grit, sense of belonging, early alert, and resource mapping to provide STEM students with tools to succeed in their major. This was also the first time I was introduced to the concept of self-confidence within STEM and science identity, two psychosocial constructs that I never thought about when I was a STEM college student. I began to understand why it was so easy for me to leave STEM after graduating: I never had enough confidence in my science skills, nor did I feel that I identified as a scientist. Lastly, as the coordinator of federally-funded biomedical research programs, I learned that Southeast Asian students were finally recognized as underrepresented in STEM at CSULB, a classification that was not given enough attention when I was a college student. Unfortunately, while CSULB acknowledged the underrepresentation of many Asian American and Pacific Islander subgroups, national initiatives within the U.S. still excluded these students from their

definition of underrepresented populations within STEM. Given all of my life experiences and as a higher education scholar, I am now focused on examining the psychosocial development of underrepresented students in college STEM, paying special attention to Southeast Asian students.

Statement of the Problem

In response to the continued shortage of STEM professionals within the US (with only 18% of all bachelor's degrees conferred coming from STEM fields (de Brey, Musu, McFarland, Wilkinson-Flicker, Diliberti, Zhang, Branstetter, & Wang, 2019)), scholars have focused on the factors that contribute to students' success in these fields. This work has revealed the importance of science self-efficacy and science identity for STEM success, with additional attention being paid to underrepresented minority students (URM) (e.g., Ballen, Wieman, Salehi, Searle, & Zamudio, 2017; Chemers, Zurbriggen, Syed, Goza, & Bearman, 2011). Yet, within this line of research on science-specific psychosocial factors, it is rare that Southeast Asian students (e.g., Hmong, Cambodian, Laotian, Vietnamese) are categorized as URM, despite their low representation within higher education. To further complicate URM designation, while federal agencies such as the National Science Foundation (NSF) and National Institutes of Health (NIH) do not explicitly state that Southeast Asian students fall under their definition of underrepresented groups in STEM-related fields (National Institutes of Health, 2022; National Science Foundation, 2017), some scholars identify Southeast Asian students as URM in their studies (e.g., Byars-Winston, Estrada, Howard, Davis, & Zalapa, 2010; Vang, 2018). Southeast Asian students enter college with unique backgrounds, predispositions, and experiences influenced by historical, cultural, and sociopolitical factors, yet there is a dearth of research that examines these students in higher education. This is even more alarming when we consider that

the National Center for Education Statistics (NCES) (2017) reported that attainment of a bachelor's degree or higher for adults over the age of 25 saw little growth between 2010 and 2016 for Hmong Americans (14.5% to 18.4%), Cambodian Americans (16.1% to 16.4%), Laotian Americans (13.5% to 18.0%), and Vietnamese Americans (25.6% to 29.5%). To exacerbate this problem further, it is unknown what proportion of these bachelor's degrees obtained by Southeast Asians are from STEM fields, since they are often grouped with all other Asian students in national statistics. As research on college STEM continues, it is important to consider Southeast Asian students and examine what experiences are most salient in their development within these fields.

In general, Asian American and Pacific Islander (AAPI) students are often described as "overrepresented" in higher education relative to their representation within the broader U.S. population, and especially in STEM fields. These descriptions are often driven by enrollment and degree attainment data which suggest, for example, that of all bachelor's degrees conferred to Asian students, 33% were from STEM, which is nearly double of the 18% of overall bachelor's degrees coming from STEM (de Brey et al., 2019). While many argue these findings are conclusive evidence for AAPI's success in higher education, scholars have recently suggested that these educational statistics aggregate nearly 48 ethnic subgroups and obfuscate important differences among AAPI students that mask disparities (Teranishi, 2012). Such misrepresentation gave rise to the Asian "model minority" myth, comprised of misconceptions which paints AAPIs in America as successful, countering any argument that this highly diverse group needs resources or experiences challenges and barriers to success (Museus & Chang, 2009; Museus & Kiang, 2009). Further, scholars have provided empirical evidence for the necessity of disaggregating data concerning AAPI students' postsecondary educational

experiences, illuminating that hidden stories behind aggregated data for AAPI subgroups has largely contributed to the erasure of this diverse group's true experiences within higher education (Museus & Truong, 2009).

The disaggregated data that does exist suggests inequitable college enrollment and degree attainment among AAPI subgroups, broadly and in STEM. For example, Southeast Asian students (e.g., Vietnamese, Hmong, Cambodian, Lao) occupy a rapidly growing proportion of the AAPI U.S. college student population, yet 2017 NCES data suggests lower rates of attaining at least a bachelor's degree among Southeast Asians aged 25 or older (ranging from 16.4% to 49.6% with an average of 28.6%) when compared to their AAPI counterparts such as East Asians (ranging from 49.7% to 56.3%) and South Asians (ranging from 42.1% to 74.2%). Notably, data disaggregation is so rare that rates of STEM degree attainment specifically for Southeast Asians are unknown.

Thus, while it may seem that AAPI students are well represented in STEM, current aggregated data obscures which AAPI subgroups are actually represented in STEM and which subgroups have been erased by this uniform aggregation. Further, given the lack of disaggregated findings on Southeast Asian students in general and in STEM, it is also unknown whether the dispositions and experiences that are associated with positive outcomes in the broader student population apply to Southeast Asian students. For example, research suggests that science self-efficacy (e.g., Luzzo, Hasper, Albert, Bibby, & Martinelli, 1999) and science identity (e.g., Chemers, 2011) are critical in both early persistence and long-term commitment within STEM fields. Science self-efficacy is defined as an individual-level belief that a person can complete a specific task and is further enhanced by independent and collaborative learning experiences (Bandura, 1977). Further, science identity focuses on the salience of social identities

and how an individual sees themselves within the field of science (Carlone & Johnson, 2007). Science identity is primarily concerned with how individuals make meaning of their experiences within science, in addition to the social contexts that inform those meanings.

While there is expansive literature on science self-efficacy and science identity among college students broadly, little empirical evidence speaks to the salience of these psychosocial constructs for Southeast Asian students. Of the studies examining science self-efficacy (e.g., Ballen et al., 2017; Chemers et al., 2011) and science identity (e.g., Chemers et al., 2011; Hazari, Sadler, & Sonnert, 2013; Lu, 2015) that included race, and more specifically URM students in their analyses, all Asian college students were grouped together with non-URM students (e.g., Ballen et al., 2017, Chemers et al., 2011). Importantly, scholars have illuminated that science self-efficacy and science identity are especially salient for URM students' integration into and persistence through STEM, yet Southeast Asian students were not categorized as URM within these studies (e.g., Estrada, Hernandez, Woodcock, & Schultz, 2011; Estrada, Young, Nagy, Goldstein, Ben-Zeey, Márquez-Magaña, & Eroy-Reveles, 2019). In actuality, these studies aggregated all Asian students, making it nearly impossible to determine if Southeast Asian students were even included in the sample. As a consequence of these aggregations, it is difficult to understand if science self-efficacy and science identity are salient for Southeast Asian students. Additionally, these aggregations further perpetuate the Asian model minority myth and discount the unique experiences of diverse ethnic groups such as Southeast Asian students. Considering the important role of science self-efficacy and science identity in shaping students' interests in science-related careers as well as the need to understand whether and how this construct applies to Southeast Asian students, my study examines what experiences are most salient in the development of these psychosocial constructs for Southeast Asian students.

Objectives

Using student survey data from The University of California Los Angeles (UCLA) Higher Education Research Institute's (HERI) CIRP Freshman Survey (TFS) and Your First College Year (YFCY) survey, two multi-institutional and nationwide surveys that are respectively administered at the start and end of the first college year for first-time, first-year college students, this dissertation study quantitatively examined the development of science identity and science self-efficacy of Southeast Asian college students. Further, this study employed multiple regression models allowing for comparison of similarities and differences between Southeast Asian students and their AAPI peers. To center Southeast Asian students, this study was guided by a conceptual framework that integrated Lent, Brown, and Hackett's (1994, 2000, 2002) social cognitive career theory (SCCT), Carlone and Johnson's (2007) science identity, and Yosso's (2005) community cultural wealth, and investigated the following research questions:

1. What are the academic, background, and psychosocial (e.g., science self-efficacy, science identity) characteristics of first-time, first-year Southeast Asian STEM college students? Do these characteristics differ when compared to other AAPI subgroups?

2. How does science self-efficacy change during the first year of college for Southeast Asian STEM students? Does change in science self-efficacy differ across AAPI subgroups?

3. How does science identity change during the first year of college for Southeast Asian STEM students? Does change in science identity differ across AAPI subgroups?

4. Among first-time, first-year Southeast Asian STEM students, what personal inputs (e.g., gender, race/ethnicity), environments, assets in the form of various types of capital, and learning experiences predict changes in science self-efficacy at the end of their first college year?

Do the predictors of science self-efficacy vary in direction and/or salience between Southeast Asian students and all AAPI students?

5. Among first-time, first-year Southeast Asian STEM students, what personal inputs (e.g., gender, race/ethnicity), environments, assets in the form of various types of capital, and learning experiences predict changes in science identity at the end of their first college year? Do the predictors of science identity vary in direction and/or salience between Southeast Asian students and all AAPI students?

Study Significance

Building upon prior scholarly work, this study aimed to better understand what factors and experiences were most salient in the early development of science self-efficacy and science identity of first-time first-year Southeast Asian STEM college students. Although scholars have provided evidence suggesting that science self-efficacy and science identity are important in the persistence and success of STEM students, there is scant literature that examines these psychosocial constructs for Southeast Asian students. Of the literature that examines science self-efficacy and science identity of STEM college students, only a handful illuminate the salience of these constructs for underrepresented minority students which usually do not include Southeast Asian students, who are often grouped with other Asian college students or not mentioned at all. In fact, there is limited attention given to Southeast Asian and other AAPI subgroups within higher education research and only recently have scholars gained traction in examining this diverse group of students. Thus, my study adds to the continued research efforts of illuminating the unique characteristics and experiences of Southeast Asian college students, specifically in relation to their science-specific psychosocial development.

Following in the footsteps of higher education scholars conducting research on AAPI

college students, this study also aimed to provide important historical context for Southeast Asian students that contribute to their unique educational trajectory into and through college. By shedding light on their unique histories, this study sought to 1) emphasize the unique background and experiences of Southeast Asian students to further breakdown the monolith constructed by the "model minority" myth and 2) examine the development of science self-efficacy and science identity of Southeast Asian STEM college students by incorporating backgrounds and experiences unique to their development during college.

Summary

As described in this chapter, this study sought to expand knowledge on early science self-efficacy and science identity development of Southeast Asian STEM college students, a group that has historically been understudied. Chapter two reviews literature centered on the importance of data disaggregation for AAPI students, the salience of science self-efficacy and science identity for STEM student success, and the unique histories of and research on Southeast Asian college students. Further, I also provide a conceptual framework that guides the methodological decisions for this study. Finally, chapter three describes the data source, analytic sample, and methodological decisions that was utilized to answer this study's research questions.

CHAPTER TWO:

REVIEW OF THE LITERATURE AND CONCEPTUAL FRAMEWORK

This chapter reviews the prior scholarly work that contributes to the urgency and importance of examining the development of science self-efficacy and science identity of Southeast Asian STEM college students as compared to other AAPI subgroups (e.g., East Asian, Filipinx, South Asian, Native Hawaiian, Pacific Islander, other Asians). Importantly, this chapter will also construct a conceptual framework for examining and understanding the background characteristics and first-year college experiences that are salient in Southeast Asian students' development of science self-efficacy and science identity. To accomplish this goal, I will focus on scholarship that informs the research questions for this dissertation study. Subsequently, the literature reviewed in this chapter will also guide the conceptualization of this study's framework by weaving in prior scholarly work and culturally relevant theories to guide the methodological decisions and discussions of this study's analytic procedures and results by ensuring that the narrative is centered on Southeast Asian students.

The first section of this chapter will explore the broader problem of racial/ethnic data aggregation in research and set the stage for emphasizing the importance of data disaggregation for this study's population of interest, Southeast Asian students. The second section will briefly examine literature that has provided empirical evidence for the importance of first-year experiences within STEM, providing an argument for exploring this study's primary focus on science identity and science self-efficacy within the first year of college. The third section will examine prior research on science identity and science self-efficacy of undergraduate STEM students, laying a foundation for how this study will contribute to scholarship in this area. While the first three sections set up the broader context for this dissertation study, the fourth and fifth

sections of this chapter inform the conceptual framing (and subsequent methodological decisions) for this study. Section four will dive into the social, political, and historical contexts of Southeast Asians, with a specific focus on immigration waves and cultural differences that may be potentially associated with Southeast Asian college experiences. Lastly, section five will examine the scant but important literature on Southeast Asian college students.

How Data Disaggregation Tells a Deeper and Truer Story

The U.S. is a nexus of diverse groups of people from varying racial and ethnic backgrounds, yet much of the discourse neglects to include the cornucopia of ethnic subgroups within each race or ethnicity that comprise of a multitude of important and intersecting cultures and histories. For example, Black students in the U.S. include a diverse spectrum of ethnic subgroups, with differing roots and/or immigration histories that have generationally informed patterns of social, political, and economic movements within each group (Ladson-Billings, 2020). This diversity of histories also holds true when we consider students from Latinx ethnic backgrounds (Fraga & Perez, 2020). Put another way, the current racial and ethnic classifications employed in data collection and analyses obscures the diversity that is represented within each race and/or ethnic categories. Therefore, in much of the national discourse, a few stories from a small ethnic subset are often used to wholly represent an entire racial or ethnic group (Fraga & Perez, 2020; Ladson-Billings, 2020). What subsequently occurs is an amalgamation of mostly inaccurate narratives that dually misrepresent an entire racial or ethnic group and masks the true experiences of subgroups within. This phenomenon of data aggregation has had similar effects in misrepresenting the experiences of Asian American and Pacific Islanders, especially in higher education (Nguyen, Nguyen, Teranishi, & Hune, 2015; Teranishi, 2010, 2012).

Southeast Asians (e.g., Burmese, Cambodian, Hmong, Lao, Thai, Vietnamese) occupy a

rapidly growing proportion of the AAPI college student population which consists of at least 48 ethnic groups (Teranishi, 2010, 2012). Over the past two decades, scholars have made major strides in providing empirical evidence of the necessity to disaggregate AAPI students' postsecondary educational experiences, illuminating that aggregating data on AAPI college students has largely contributed to the misrepresentation and erasure of the true experiences of this diverse student body within higher education (e.g., Museus & Truong, 2009; Suyemoto, Kim, Tanabe, Tawa, & Day, 2009). Such misrepresentation gave rise to the Asian "model minority" myth, which paints AAPIs in America as successful, countering any argument that this highly diverse group should be prioritized in research and support (Museus & Kiang, 2009). The "model minority" myth was exclusively derived from aggregated data on college degree attainment of Asian Americans (Maramba, 2011; Museus & Kiang, 2009) that extensive research has proven to be inadequate in tackling inequities in higher education. In their powerful narrative toward complicating and deconstructing the Asian "model minority" myth, Museus and Kiang (2009) outline five major misconceptions of Asian Americans that include: (1) the micro-aggressive assumption that all Asians are the same, (2) the exclusion of AAPI students as ethnic minorities, (3) the inaccurate belief that their race is a protective factor from facing challenges, (4) that resources and support are not necessary for their success, and (5) the overutilization of their college degree completion as the primary measure for overall success. Given that AAPI communities (and each of the 48 subgroups' diverse languages, histories, and cultures) in America are projected to double in size to nearly 40 million by 2050 (and by extension, postsecondary enrollment may also increase by this magnitude), it is imperative that higher education researchers accelerate the generation of more precise knowledge about this diverse group (Teranishi & Nguyen, 2011). As higher education continues to broaden diversity of

students from varying and intersecting identities, it is crucial that research and practice avoid viewing and treating AAPI students as a monolithic group. Instead, research should examine each AAPI subgroup as unique by embracing and supporting the differing backgrounds and histories that each group brings with them to college and subsequently affect the challenges that each group endures during their postsecondary pursuits.

Over the past two decades, higher education scholars have unpacked important differences among AAPI subgroups across varying markers of college preparation, college access, and college success (e.g., Museus & Truong, 2009; Suyemoto, et al., 2009; Teranishi, Ceja, Antonio, Allen, & McDonough, 2004). Examination of these differences has contributed to the breakdown of false assumptions based off of prior aggregated degree attainment data, as "conclusive evidence," to deprioritize support and educational research that centers AAPI students. Prior to these discoveries, discussed below, knowledge about these subgroup differences were locked within data collection and analyses of aggregated racial data, which, in turn, has largely contributed to the misrepresentation of experiences for AAPI subgroups prior to college, accessing college, during college, and post-college.

Since the advent of the Asian "model minority" myth which (1) used degree attainment as a primary marker for success and (2) used aggregated data to inaccurately speak for diverse groups of people, scholars employed data disaggregation in their research to counter these two points. Among the U.S. AAPI population, Southeast Asians earned lower proportions of high school diplomas than East Asians, South Asians, and Pacific Islanders as outlined in the Table 2.1 (Teranishi, 2010). These disaggregated findings illuminate the differences in ability to access college across varying AAPI subgroups, countering the mainstream narrative that all AAPI are a "model minority" who are successful.

Table 2.1
Proportion of AAPI Adults, Ages 18 to 64, Without a High School Diploma or Equivalent, by Ethnicity, 2000

AAPI Ethnic Subgroup	Percentage without a High School Diploma (2000)
Total Asian American	*19.6%*
Total Pacific Islander	*21.7%*
Southeast Asian	
Hmong	59.6%
Cambodian	53.5%
Laotian	49.6%
Vietnamese	38.1%
Thai	20.9%
East Asian	
Chinese	23.0%
Korean	20.9%
Japanese	8.9%
Asian Indian	*13.3%*
Filipino	*12.7%*
Native Hawaiian & Pacific Islander	
Tongan	34.7%
Fijian	33.2%
Samoan	24.2%
Native Hawaiian	16.8%

Note. Data from *Asians in the Ivory Tower, Dilemmas of Racial Inequality in American Higher Education* (Teranishi, 2010).

Although the U.S. Census Bureau has not released a report describing more recent high school graduation rates, there are more current disaggregated findings on college degree attainment that tell a similar and concerning story. Southeast Asians held a bachelor's or higher degree in lower proportions than East Asians, South Asians, and Pacific Islanders, as outlined in Table 2.2 (NCES, 2017). Table 2.2 also shows a troubling trend where these proportions of degree attainment saw little increase between 2010-2016 for almost all Southeast Asian ethnic subgroups and remained much lower when compared to bachelor's or higher degree attainment

for East Asian and South Asians. This trend further stresses the importance in focusing on disaggregated data to illuminate what is actually happening for each AAPI ethnic subgroup.

Table 2.2
Proportions of AAPI Adults, Ages 25 and Over, Holding a Bachelor's Degree or Higher, 2010, 2016

AAPI Ethnic Subgroup	**Percentage with a Bachelor's Degree or Higher (2010)**	**Percentage with a Bachelor's Degree or Higher (2016)**
Southeast Asian		
Hmong	14.5%	18.4%
Cambodian	16.1%	16.4%
Laotian	13.5%	18.0%
Vietnamese	25.6%	29.5%
Thai	44.1%	49.6%
East Asian		
Chinese	52.0%	55.4%
Korean	53.2%	56.3%
Japanese	46.8%	51.6%
South Asian		
Asian Indian	71.2%	74.2%
Bangladeshi	49.1%	48.7%
Pakistani	55.0%	56.2%
Filipino	48.9%	55.4%

Source. Data from NCES' Digest of Education Statistics' degree attainment reports for 2010 and 2016.

Focusing exclusively on degree attainment data across varying educational levels, we find that, in actuality, subgroups within AAPI racial categories differ greatly, thereby providing evidence for the misleading nature of prior aggregated reporting and subsequent assumptions for AAPIs. It is important to note that these findings are not meant to compare the successes of each AAPI subgroups against each other, but instead provide support for investing in research on each diverse AAPI subgroup to generate accurate knowledge about their distinct experiences and successes. Furthermore, as future research continues to disaggregate data, it is important to

examine other markers of success beyond degree attainment, such as exploring dispositions and/or experiences that may be attributable to student success.

Over the past decade, some higher education scholars have conducted research, both quantitative and qualitative, to center each diverse and unique AAPI subgroup, thereby revealing many challenges that AAPI college students endure. These challenges include but are not limited to campus climate, learning experiences within the classroom, comfortability with accessing and utilizing on-campus services, and academic preparedness. For example, a recent report on the racialized experiences of college students illuminated that AAPI (71.0%) students reported hearing negative stereotypes and/or views about their racial/ethnic group at similar levels to their Black (72.7%) and Latino (66.4%) peers (Nguyen, Nguyen, Chan, & Teranishi, 2016). This report further revealed similarities between AAPI students and their Black and Latino peers in regard to their sense of belonging and satisfaction of their academic experiences. While these findings suggest that AAPI students experience racialized experiences that are similar to other Students of Color, Nguyen and colleagues (2016) further disaggregated racial/ethnic data specifically for AAPI students to better understand these experiences for these students. What emerged from their examination across multiple climate-related measures such as social experiences and sense of belonging were poignant differences in these experiences between Southeast Asian students and their AAPI peers (Nguyen et al., 2016). In another study, Kim (2009) examined the effects of cultural values and family on Korean students' difficulties in utilizing counseling services. From this study, Kim (2009) suggests that AAPI students are often misrepresented as having similar cultural values, but the findings of this study illuminate that cultural values do indeed differ across AAPI subgroups. As a final example, Suyemoto and colleagues (2009) illuminated that AAPI students, due to baseless assumptions, had negative

experiences with advising, difficult interactions with faculty, social isolation, and racial segregation, thereby countering the "model minority" myth that AAPI students do not need to be prioritized in research and support. Taken together, scholarship that used disaggregated racial/ethnic AAPI data suggests that these highly diverse and unique subgroups experience differing challenges, and their responses to these challenges are informed by distinct cultural backgrounds.

AAPI Data Aggregation in STEM

The prior section broadly illuminated educational attainment of various subgroups within the US AAPI population, yet this level of racial/ethnic disaggregation for STEM degree attainment is currently not well documented. Although the National Center for Education Statistics (NCES) (de Brey et al., 2019) reports that 33% of all bachelor's degrees conferred to Asian students were from STEM, it is unclear as to what proportion of these STEM degrees were conferred to Southeast Asian students. While it may seem that AAPI students are well represented in STEM, current aggregated data obscures which AAPI subgroups are actually represented in STEM and which subgroups have essentially been erased by this uniform aggregation. As such, herein lies the problem with AAPI diversity within postsecondary STEM education. Although it is difficult to ascertain specificity for AAPI subgroups' STEM enrollment or degree attainment through federal data (such as IPEDS), Teranishi (2010) reported broadly through Census data, that among Southeast Asians in the US, Hmong Americans (14.7%), Cambodian Americans (14.1%), Laotian Americans (12.1%), and Vietnamese Americans (24.8%) held bachelor's degrees, respectively. This is drastically different when comparing degree attainment to other Asian subgroups who had much higher proportions of bachelor's degree holders, such as 51.5% of all Chinese Americans and 52.7% of all Korean

Americans holding a bachelor's degree. As illustrated here, the aggregation of AAPI in success outcomes such as degree attainment is misleading, overlooking the actual experiences of Asian subgroups (such as Southeast Asians) who are often misrepresented due to the pervasive view of the AAPI population as one rigid group.

Moving beyond national statistics and into research studies, it is fairly common to find scholarship that continues to either group Asian students with White students or fails to disaggregate Asian students into their unique subgroups. While studies suggest that Asian students who declare a STEM major are more likely to complete a STEM degree when compared to other racial groups (e.g., Eagan, Hurtado, & Chang, 2010; Green & Sanderson, 2018), it is still unknown if these findings are consistent for each Asian subgroup. Furthermore, while scholars have begun to move the needle toward unpacking factors that may be attributed to AAPI student success broadly (e.g., Kim, 2009; Libarios Jr., Arriba, Lucas, Goto, & Labrador, 2018; Museus, 2011), much still remains unknown about what factors are associated with STEM success.

In sum, common practices of aggregating data have led to inaccurate assumptions about AAPI students, especially through the "model minority" myth. However, some recent research has both examined experiences of AAPI students beyond degree attainment and has centered ethnic subgroups within the broader AAPI racial categories has begun to unravel common misconceptions and illuminated the importance for researching and supporting AAPI college students. As highlighted in the prior paragraph, although scholars have illuminated bachelor's degree attainment by AAPI ethnic subgroups, there is limited reporting on degree attainment rates within STEM by AAPI ethnic subgroup. As I move into our review of the literature on students' early experiences within STEM, I similarly found that although empirical evidence has been generated for the salience of early experiences within STEM, more research is needed to

understand how these findings operate for AAPI college students and, more specifically, Southeast Asian students.

Early Experiences Within College STEM

Southeast Asian students enter college with a unique set of background characteristics, dispositions, and experiences, yet few studies have examined these factors and how they may be related to early experiences and transitions into college. For example, studies that have examined Southeast Asian high school students suggest that socioeconomic status, family support, college readiness, and educational aspirations are important characteristics for these students as they enter college (Her, 2014; Kim, Rendon, & Valadez, 1998). Furthermore, these characteristics differ when compared to other AAPI subgroups, providing further evidence of the uniqueness of Southeast Asian students. Understanding how these unique factors contribute to the development of Southeast Asian STEM college students during their first college year may provide implications for the development of their sense of science self-efficacy and science identity. First-year experiences stress the importance of both in-classroom and out-of-classroom engagement that contribute to developing student trajectories toward success. Although scholars have extensively produced general knowledge about early college experiences that contribute to a variety of student success outcomes, there is limited understanding on if these findings hold true for Southeast Asian students. Thus, it is important that my dissertation study focuses on the early experiences of STEM Southeast Asian college students to 1) illuminate the early strengths they bring with them to college and 2) provide tangible implications for practice that improves their persistence through the STEM pipeline. To accomplish these aims, this section reviews literature on first-year experiences which, subsequently, will partially inform variable selection to test if these findings hold true for Southeast Asian students.

As students enter college, they have access to a wide range of experiences that may have positive (or negative) effects on their early experiences and success outcomes. Research suggests that the first year is an important time in a college student's career to intervene and enhance development and improve retention and persistence (Reason, Terenzini, & Domingo, 2006; Kim, 2009; Stebleton, Soria, & Albecker, 2012; Strayhorn, 2009; van der Meer, Wass, Scott, & Kokaua, 2017; Padgett, Keup, & Pascarella, 2013; Sax & Weintraub, 2016). For example, academic and social integration are key factors in a students' first-year satisfaction (Strayhorn, 2009). Furthermore, positive peer interactions tend to improve persistence beyond the first year (Kim, 2009). In addition, when students are aware of the strengths they possess early in their college career, they may be better positioned to make decisions related to their academic and career choices (Stebleton et al., 2012). Lastly, Reynolds and Weigand (2010) suggest that active participation in class, interaction with professors, and participation in on-campus social organizations all contribute to a student's ability to cope with academic and personal challenges of college and, in turn, are important in first-semester GPA. Taken together, there is expansive empirical evidence suggesting that diverse experiences and interactions during the first year of college are critical for student adaptation and success.

Scholars have also examined first-year college experiences specifically within STEM, illuminating similar and unique findings in predispositions and experiences that contribute to varying STEM success outcomes. For example, similar to academic and social integration highlighted in Strayhorn's (2019) study, various scholars have found that learning communities and access to peer mentoring are critical in first-year STEM success outcomes related to STEM aspirations, STEM persistence, and the development of STEM-related psychosocial factors (Dagley, Georgiopoulos, Reece, & Young, 2016; Johnson, Sprowles, Goldenberg, Margell, &

Castellino, 2020; Schneider, Bickel, & Morrison-Shetlar, 2015). Further, Johnson and colleagues (2020) suggest that participation in learning communities is especially salient for underrepresented minority students and first-generation students within STEM. Additionally, extracurricular experiences such as participation in research or STEM-specific enrichment programs have positive effects on STEM students' development and, subsequent persistence within STEM (Findley-Van Nostrand & Pollenz, 2017; Schneider et al., 2020). Lastly, other academic and background characteristics such as math preparation, first-semester GPA, early course performance, race/ethnicity, and gender are important in early STEM college success (Dika, Siarzynski-Ferrer, Galloway, & D'Amico, 2019; Johnson et al., 2020; Lytle & Shin, 2020; Paschal & Taggart, 2019). As illustrated in this section, the first college year is critical for STEM students' development and success. Further, this literature guides variable selection in the present study which focuses on predictors of science self-efficacy and science identity among Southeast Asian college STEM students.

Prior Research on Science Self-Efficacy and Science Identity Within College STEM

In tackling the intersecting problem of disaggregating Southeast Asian experiences and examining their diversity within STEM, I focus on the salience of early college experiences of Southeast Asian STEM students, particularly looking at two psychosocial factors, science identity and science self-efficacy, which extensive prior research has found to be important factors in STEM success (e.g., Eagan, Hurtado, Chang, Garcia, Herrera, & Garibay, 2013; Findley-Van Nostrand & Pollenz, 2017; Luzzo et al., 1999; Lytle & Shin, 2020; Reason et al., 2006). In particular, research suggests that science self-efficacy (e.g., Luzzo et al., 1999; Rittmayer & Beier, 2009) and science identity (e.g., Eagan et al., 2013; Merolla & Serpe, 2013) are critical in both early persistence and long-term commitment within STEM. Bandura (1977)

describes self-efficacy as an individual-level belief that a person can complete a specific task and is further enhanced by "personal accomplishments, vicarious learning, verbal persuasion, and emotional arousal." Put another way, self-efficacy is influenced by individual experiences and social influences. A key part of self-efficacy is the centering of a "specific task" and, as such, research has unpacked specific types of self-efficacy across different fields such as science self-efficacy (e.g., Luzzo et al., 1999). On the other hand, science identity focuses on how individuals see themselves within the field of science and is primarily concerned with how individuals make meaning of their experiences within science, in addition to the social contexts that inform those meanings (Carlone & Johnson, 2007). Taken together, scholars have given attention to science self-efficacy and science identity as salient factors for STEM success.

Given the importance of science self-efficacy and science identity within STEM, scholars have built upon each other's work to operationalize and validate these two constructs (e.g., Estrada et al., 2011; Estrada, Hernandez, & Schultz, 2018). For example, Estrada and colleagues (2018) conducted a study that only included URM students, defined by students identifying as African-American, Hispanic, Latino/Latina, American Indian/Native American, and Alaskan Native. For these students, the authors validated a six-item factor for science self-efficacy and a five-item factor for science identity. While their science self-efficacy factor included measures that were rated on a scale of confidence, their science identity factor included measures that were rated on agreeing with certain statements. Subsequently, these two factors were found to be salient predictors and mediators for a number of STEM-related outcomes such as community integration, persistence, and STEM career choice for URM students (Estrada et al., 2011, 2018; Estrada, et al., 2019). Yet, while scholars have illuminated the importance of these two constructs for URM students, there is still a gap in understanding on how science self-efficacy

and science identity develop and operate for Southeast Asian students.

While there is expansive literature on science self-efficacy and science identity, there is scant empirical evidence on the salience of these two psychosocial constructs for Southeast Asian students. Given that research suggests that science self-efficacy and science identity are tied to positive student outcomes and heightened interests in science-related careers (e.g., Eagan et al., 2013; Estrada et al., 2018; Luzzo et al., 1999), in addition to the need to unpack this understanding for Southeast Asian students, my dissertation aims to examine the predispositions and college experiences that are most salient in the development of science self-efficacy and science identity for Southeast Asian students and how the role of these predictors compare to other AAPI subgroups.

Science Self-Efficacy

Research on science self-efficacy has generated important knowledge in understanding how to improve student development practices and related success outcomes for STEM college students. For example, scholars suggest that science self-efficacy are important in science-related outcomes such as developing aspirations in pursuing science-related careers after completing college (e.g., Carpi, Ronan, Falconer, & Lents, 2017; Luzzo et al., 1999; Estrada et al., 2011). Specifically, science self-efficacy measures an individual's self-confidence in completing a science-related task and is influenced by various experiences and environments. For example, undergraduate research stimulates the development of science self-efficacy and subsequently, students with higher levels of science self-efficacy are more likely to aspire to graduate school and pursue science-related careers (Carpi et al., 2017). Furthermore, Carpi and colleagues (2017) illuminated that "doing science" is just as important as "learning science" toward developing science self-efficacy, which provides support for investing in various college experiences beyond

the classroom. “Doing science” is defined as applying knowledge learned from the classroom, such as conducting undergraduate research (Carpi et al., 2017). In addition, Larson, Pesch, Surapaneni, Bonitz, Wi, and Werbel (2014) found that science self-efficacy is salient in early academic achievement for STEM majors and, in turn, predicts if students will earn a bachelor’s degree.

In addition to examining how science self-efficacy develops, scholars have uncovered the importance of science self-efficacy for various success outcomes for college students, ranging from success markers within early persistence to post-college STEM aspirations. For example, science self-efficacy has been positively linked to improved grades, commitment to science careers, early college transition, improved science identity, and graduation (Ballen et al., 2017; Chemers et al., 2011; DiBenedetto & Bembenutty. 2012; Estrada et al., 2019; Larose, Ratelle, Guay, Senecal, & Harvey, 2006; Larson et al., 2014; Robnett, Chemers, & Zurbiggen, 2015; Luzzo et al., 1999). Although these studies on the effectiveness of science self-efficacy as a predictor have contributed important knowledge on the salience of science self-efficacy, many did not include race or ethnicity in their statistical models. Of the ones that did include race and, more specifically underrepresented minority (URM) students in their analysis, AAPI college students were grouped together with non-URM students (Ballen et al., 2017, Chemers et al., 2011; Estrada et al., 2011). Thus, this dissertation study builds upon the findings of these specific studies on science self-efficacy and unpack the salience of this psychosocial construct for Southeast Asian students and how they differ from other AAPI subgroups.

Science Identity

Much like science self-efficacy, science identity is a psychosocial construct that has been found to be a salient identity attributed to varying success outcomes within college STEM,

especially for URM students (Chemers et al., 2011; Estrada et al., 2011; Hazari, et al., 2013; Lu, 2015). Extensive research has been conducted to better understand the development of science identity, in addition to the positive effects of science identity (e.g., Chemers et al., 2012; Estrada et al., 2018). For example, scholars suggest that science identity is salient in STEM career aspirations, STEM persistence, and graduate school matriculation (Chemers et al., 2012; Estrada et al., 2018; Merolla et al., 2013; Stets, Brenner, Burke, & Serpe, 2017; Williams & George-Jackson, 2014). Importantly, scholars have also illuminated that science identity mediates important relationships that influence integration into scientific communities and persistence within science (Estrada et al., 2011; Estrada et al., 2019).

In addition to examining science identity as a predictor for varying success markers within STEM, scholars have also explored how various experiences are attributed to the development of science identity. While these scholars have contributed powerful knowledge about science identity, there is a lack of knowledge of how science identity functions across varying racial/ethnic groups, particularly for Southeast Asian student. The studies that operationalize URM to better understand science identity are limited by a lack of disaggregation of racial/ethnic data and by the aggregation of AAPI students as non-URM (e.g., Estrada et al., 2010). As such, this dissertation hopes to advance the conversation on science identity by focusing on AAPI students by subgroup.

The Social, Political, and Historical Contexts of Asian American and Pacific Islanders

Whereas the prior three sections of this literature review examined prior literature related to the broader and narrower context for studying science identity and science self-efficacy for Southeast Asian college students, the final two sections discuss prior scholarly work on Southeast Asian students in higher education and briefly explore their social, political, and

historical contexts. The primary purpose of these two sections is to better understand salient factors in Southeast Asian college student development and success and extract important historical and generational influences that inform the conceptualization of this study's framework, in addition to bolster the methodological decisions made to answer this study's research questions.

As this study focuses on the development of science self-efficacy and science identity among Southeast Asian college STEM students in the U.S., it is important to understand the general history of Southeast Asians in this country. AAPIs immigrated to the U.S. for reasons that were influenced by social, political, and economic factors (Daniels, 1997; Teranishi, 2010; Takaki, 1989). Furthermore, AAPIs experience differing, yet racialized experiences that also influence their educational endeavors that are typically minimized due to the resounding misconception that they successful (Nguyen et al., 2016). As mentioned earlier in this literature review, although AAPIs comprise a large proportion of the current U.S. population, this group made up less than one percent of the American populous in 1955. Southeast Asians share a unique immigration history in that a large proportion came to the U.S. (during the mid to late 1970s) as refugees with low educational and economic backgrounds (Ngo & Lee, 2007; Teranishi, 2010), yet this history is often obscured by their grouping with all other AAPIs.

Broadly, Southeast Asians came to the U.S. as refugees which is a stark contrast to the immigration of other AAPI subgroups (Takaki, 1989; Ngo & Lee, 2007). Specifically, Southeast Asians entered the U.S. in three major waves (Takaki, 1989; Ngo & Lee, 2007). The first wave included educated professionals and elites. The second wave included family members of first-wave refugees and were, mostly, of high socioeconomic status. The third wave of Southeast Asian refugees were comprised of those who had lived in concentration camps for several years

before moving to America. What Southeast Asian subgroups have in common in addition to their historical entrance into the U.S. are 1) the multitude of psychological effects that linger from surviving their respective wars and 2) an adjustment to a new home that was vastly different than the one they were forced to leave (Takaki, 1989; Ngo & Lee, 2007).

Taken together with the diversity and differences of culture and values of each AAPI subgroup and the violent displacement that led Southeast Asians to the U.S., it is important to examine different factors that may contribute to the college experiences and development of Southeast Asian students (Takaki, 1989; Ngo & Lee, 2007). In particular, the immigration history for Southeast Asians may explain why they experiences high levels of poverty and lower levels of education attainment (Takaki, 1989; Ngo & Lee, 2007; Teranishi, 2010). With a better understanding of how and when Southeast Asians found their home in America, the final part of this literature review examines important studies that illuminate important factors that are important in Southeast Asian college student experiences.

Current Research on Southeast Asian Students

As of 2009, research on AAPI students in higher education made up only *one percent* of all publications that could be found in the five of the most widely read peer-reviewed higher education journals (Museus & Kiang, 2009). Relatedly, research on Southeast Asian college students is just as scant and is often nested within research on minority Students of Color (Ngo & Lee, 2007). In 2007, Ngo and Lee (2007) conducted a comprehensive literature review of research conducted on Southeast Asian students, highlighting key similarities and differences across culture and history amongst Vietnamese, Hmong, Cambodian, and Laotian students. Ngo and Lee (2007) note that much of the research on Southeast Asian students group them with other ethnic groups, therefore failing to account for the differences in culture and immigration

that may influence current and future generational experiences of these students. Most of the research that does exist on Southeast Asian students is on Vietnamese and Hmong students, with research on Cambodian and Laos students being especially scarce. Yet, even with little disaggregated empirical evidence, due to the pervasive "model minority" myth and the aggregation of data, Southeast Asians are viewed in a paradox, being grouped with other Asians as hardworking and successful, yet also portrayed as high school dropouts, welfare dependents, and gangsters (Ngo, 2006; Ngo & Lee, 2007). While Ngo and Lee (2007) discern distinct differences across these four Southeast Asian subgroups, they also found similarities in gender, culture, family, and immigration history. Moreover, new research over the past two decades has begun to advance knowledge about salient on-campus cultural experiences of Southeast Asian students, the influences of faculty and staff on these students, and the importance of family in their college choice process and college experiences.

In recent years, new research on Southeast Asian college students has illuminated the importance of culture (e.g., cultural knowledge, cultural expression), social influences, and external forces (such as family) toward influencing positive experiences for these students (e.g., Maramba & Palmer, 2014; Museus, 2013; Museus & Mueller 2018; Museus, Shiroma, & Dizon, 2016; Palmer & Maramba, 2015). Scholars have illuminated the relevance of cultural knowledge, cultural familiarity, cultural expression, and cultural advocacy on Southeast Asian college student experiences (Maramba & Palmer, 2014). These cultural factors are related to the opportunities to learn more about Southeast Asian cultural backgrounds, the accessibility to shared cultural backgrounds, the platform to express cultural identities, and the time to give back to Southeast Asian communities (Maramba & Palmer, 2014). These opportunities are especially important considering that Southeast Asian college students feel a lower sense of belonging

when compared to other AAPI groups, attributed to feelings of ethnic misrepresentation and underrepresentation (Nguyen et al., 2016). Further, Southeast Asian college students display a higher level of dissatisfaction with their academic and social experiences when compared with their AAPI peer (Nguyen et al., 2016). Additionally, Museus, Palmer, Kang, and Yull (2018) suggest that institutional agents (such as staff and faculty) help to strengthen Southeast Asian students' experiences through shared cultural background and values. Further extending the salience of culture in Southeast Asian college student experiences, Museus and colleagues (2016) stressed the importance of physical, epistemological, and transformative cultural connections, where Southeast Asian had a physical space to connect and learn more about their cultural background and, subsequently, give back to their communities. Scholars have also illuminated the importance of tailoring resources, such as counseling and interactions with staff and faculty, which consider the differing cultures and histories students from varying AAPI ethnic subgroups come from (Buenavista, Jayakumar, & Misa-Escalante, 2009; Kim, 2009; Museus & Truong, 2009; Suyemoto et al., 2009).

Scholars have also investigated the types of interactions that Southeast Asian students have with staff and faculty. These types of interactions are especially important since research suggests that teachers and counselors are critical in the college choice process of Southeast Asian students (Maramba et al., 2018). As such, these students may seek to develop these types of relationships during college. Furthermore, these student-faculty interactions are strengthened for Southeast Asian students when they feel that faculty provide a comforting space and express to them that they can succeed in college (Vang, 2018; Xiong & Wood, 2020). For example, Xiong, Lor, and Lorchueya (2021) conducted a study that examined the perceptions that Southeast Asian students had about their faculty. While these students mostly perceived that faculty provided

academic support, fewer students felt that faculty understood their personal needs. Stressors related to the personal needs of Southeast Asians include transportation issues, housing insecurities, health issues, employment issues, and to a lesser degree stressors related to food insecurities (Xiong, 2021). Taken together, the literature suggests that faculty who create spaces where Southeast Asian students could express their personal issues could alleviate potential stressors that impede academic progress.

Beyond campus experiences, research suggests that family, especially parents, are important in the college choice process and ongoing experiences of Southeast Asian students (Blair & Qian, 1998; Maramba et al., 2018; Museus, 2013). Research has illuminated that parents of Southeast Asian students, reflecting upon their own histories, see college as a means toward a better life for their children (Maramba et al., 2018). Additionally, Southeast Asian students may look to older siblings or cousins for college guidance (Surla & Poon, 2015). Furthermore, scholars suggest that there is a reciprocal relationship between Southeast Asian students and their families where these students may decide to stay at home during college to stay connected and work additional hours to provide support to their families (Surla & Poon, 2015; Yeh, 2004). Taken together, research on Southeast Asian college students emphasize the importance of cultural learning, sharing, and application in strengthening their development and success, which this study incorporates into its conceptual and methodological decisions.

To summarize, prior literature suggests that science self-efficacy and science identity are important psychosocial factors that are important in STEM student success. Additionally, extant literature suggests that the first college year is a critical time for students to develop a wide range of psychosocial factors that, subsequently, are associated with various STEM-related success outcomes. Taken together with the history of Southeast Asian students within the US, this study

provides a unique opportunity to further examine these findings within this AAPI subgroup. The next section of this chapter takes what was learned from prior literature and draw from theories and models to inform the development of the conceptual framework for this study that aims to center Southeast Asian students.

Conceptual Framework for Centering and Understanding the Development of Science Self-Efficacy and Science Identity of Southeast Asian STEM College Students

The first part of this chapter reviewed the prior work of higher education scholars, providing the context for examining the early development of science identity and science self-efficacy of Southeast Asian college students. Subsequently, this section draws from and synthesizes three primary theoretical perspectives and models to suggest a conceptual framework that serves as a nexus for this study's methodological decisions and the discussion of this study's findings. Firstly, Lent, Brown, and Hackett's (1994, 2000, 2002) social cognitive career theory (SCCT) lays the foundation for this study's conceptual framework, which suggests that student dispositions and college learning experiences are critical in self-efficacy and outcomes. Importantly, SCCT centers science self-efficacy, one of the two dependent outcomes for this study. Secondly, to assist in the operationalization of science identity, the second primary perspective for this study, I incorporate Carlone & Johnson's (2007) model of science identity, the second dependent outcome for this study, specifically into SCCT. The final primary theoretical perspective integrates Yosso's (2005) community cultural wealth (CCW) within SCCT, emphasizing the importance of various forms of capital that may be relevant to Southeast Asian college student experiences and development.

To better understand how CCW may operate for Southeast Asian students, I draw from Maramba and Palmer's (2014) qualitative research on Southeast Asian college student

experiences that extracted the importance of cultural knowledge, cultural familiarity, cultural expression, and cultural advocacy and integrate these four themes within Yosso's (2005) cultural capital construct. Lastly, the operationalization of CCW for a quantitative study is guided by Sablan's (2019) recommendations and utilization of measurement theory. Taken together, this conceptual framework guides the methodological decisions and discussion of results by centering Southeast Asian college students.

Social Cognitive Career Theory and Science Self-Efficacy

Over the past few decades, scholars across various disciplines conducting research about college students have predominantly guided their work by utilizing college impact models that suggests how students develop and which background factors, experiences, or relationships are most salient in explaining student development (Foubert & Urbanski, 2006; Kim, 2009; Stebleton, et al., 2012; Strayhorn, 2009; Zhao & Kuh, 2004). In its most basic form, these college impact models suggest that spatial and temporal relationships are critical in students' initial (or pre-college) characteristics and skills, experiences during college, and the talents, values, and aspirations that are developed during or after college (Astin & antonio, 2012). These spatial and temporal relationships are important in disentangling relationships among student background characteristics and how differing college experiences may predict student outcomes.

Although these college-specific impact models may provide sufficient support to explore the impact of first-year experiences on student development and outcomes, Lent, Brown, and Hackett's (1994, 2000, 2002) social cognitive career theory (SCCT) provides a relevant and robust model that centers self-efficacy, a primary interest in this study, and outcomes expectations, and how these two tenets inform interests, goals, and actions that predict vocational or educational tracks beyond college. Scholars have employed SCCT in their research to

examine the salience of background factors and learning experiences on persistence and career aspirations within college STEM (e.g., Cardoso, Dutta, Chiu, Johnson, Kundu, & Chan, 2013; Carpi et al., 2017; Fouad & Santana, 2016; Moakler & Kim, 2013). Similar to college impact models, SCCT provides spatial and temporal theoretical analysis that disentangles the relationships amongst variables of interest.

SCCT describes the varying levels of educational and occupational success by examining how students develop interests and make choices (Lent et al., 1994, 2000, 2002). This understanding is centered on the two primary tenets of SCCT—self-efficacy expectations and outcome expectations—which are preceded by person inputs, background, and learning experiences constructs, and together influence the interests, goals, and action constructs that inform career choices. This theoretical perspective depicts how person inputs and background characteristics inform learning experiences. Student inputs include innate traits such as predispositions (behaviors), gender, race/ethnicity, and values that students bring to college. Background and contextual affordances include pre-college environmental variables such as a SES, career-relevant role models (such as parent occupation), and the support or discouragement a student receives from academic or extracurricular activities. Learning experiences include in-class opportunities and out-of-class experiences and can extend to experiences that are external to the college environment. Although the entire SCCT model accounts for pathways leading to the potential career outcomes of students, this study is primarily interested in the development of science self-efficacy and science identity, and, therefore, focuses on the first half of this model which centers self-efficacy and outcome expectations.

Within SCCT, self-efficacy is central in personal agency in one's career development (Lent et al., 1994, Bandura, 1989). Further, self-efficacy informs an individual's choices to take

part in specific activities and environments, the amount of effort they put into those choices, and the emotional reactions to obstacles within those experiences.

The use of SCCT is further supported by studies that have explored the development of science self-efficacy and its impact on post-college interest, goals, and decisions (Luzzo, et al., 1999; Larson, et al., 2015; Carpi et al., 2017). For example, Carpi and colleagues (2017) utilized SCCT to describe the development of science self-efficacy through learning experiences. They then explored interests and goals such as pursuing graduate school of students. Thus, I utilize Lent and colleagues' (1994, 2000, 2002) SCCT, which is rooted in Bandura's (1977) concept of self-efficacy and Bandura's (1989) social cognitive theory, to identify which college experiences are salient in predicting science self-efficacy.

Although self-efficacy is an individual-level belief, it is a dynamic trait that interacts complexly with other people, behaviors, and environments. It is for this reason that this study hopes to learn more about the relationship between varying students' predispositions and various college experiences and self-efficacy for STEM majors, specifically by focusing on science self-efficacy. Furthermore, I argue that if this model suggests that self-efficacy expectations is one of the main tenets that predicts interests, goals, and actions on academic and career choices, then closely exploring how self-efficacy expectations develop within the first-year of college for STEM students may provide important findings that inform early higher education development practices that will have lasting effects throughout and beyond college, especially for Southeast Asian students.

Science Identity

Whereas SCCT provides an explanation for self-efficacy, it does not offer an explanation for science identity. To strengthen the foundation for this study's conceptual framework and to

fully operationalize science identity within this study, I draw from Carlone and Johnson's (2007) model for science identity. This model provides an analytical lens that suggests the intrapersonal and interpersonal engagement between science students and their learning environments. Specifically, science identity is influenced by a students' knowledge, skills, and beliefs that help them navigate through their marginalized experiences in science learning due to the current heteronormative and dominant norms of being a science major. Ultimately, this model strives to improve equity in the sciences.

Importantly, science identity describes the interplay between interrelated constructs of performance, recognition, and competence. These three constructs, together, interact with student identities such as race/ethnicity and gender. Performance is defined by the utilization of science-based tools and communications in making social connections. Recognition emphasizes the acknowledgement of oneself within the field and science in addition to the acknowledgement from others. Lastly, competence focuses specifically on a student's content knowledge within the sciences. What is important to note about these any given student continually uniquely develops each of these constructs and, therefore they may exhibit great strength in one construct, but not another. While this is in no way a deficit, it is important, through an analytical lens to recognize these differences in strengths and developments amongst the three constructs since each are important in forming the science identity of a student. Taken together, science identity is operationalized as an outcome expectation within SCCT and the discussion of the results about science identity is informed heavily by Carlone and Johnson's (2007) model.

Community Cultural Wealth

While SCCT and science identity provides a solid foundation for examining the outcomes for this study, it is missing the unique predispositions and experiences that Southeast Asian

college students bring with them into college and how these factors may influence their development. While theoretical perspectives that center Southeast Asian students are limited, scholars have illuminated the importance of family in the college choice process and the college experiences of Southeast Asian students (e.g., Maramba et al., 2018; Blair & Qian, 1998; Yeh, 2004). Thus, the final primary component that is integrated into this study's conceptual framework is Yosso's (2005) community cultural wealth (CCW). Although CCW tends to lend itself to qualitative methodologies, Sablan (2019) argues that research paradigms and methodological decisions are typically intrinsically tied together yet can and should be distinct. As such, Sablan (2019) suggests that CCW may also lend itself to quantitative methodologies, primarily through measurement theories that provide a deeper understanding of each CCW construct. By critiquing and challenging the dominant hierarchical narrative of (cultural, social, and economic) capital through a critical race theory (CRT) and interdisciplinary lens that counters deficit framing by empowering the unique experiences of communities of Color, Yosso (2005) proposes CCW as model that describes the unique strengths that are acquired by communities of Color. These strengths are obtained through a various forms of a capital, each unique to each community of Color. The interrelated forms of capital outlined by CCW are aspirational, linguistic, familial, social, navigational, resistant, and cultural capital. The important piece of CCW for the conceptualization of this study lies within the uniqueness that communities of Color (within racial and ethnic categories) experience, and the strengths that are developed through these experiences, specifically through various types of capital.

Aspirational capital is described as the future dreams and hopes that are developed and maintained even through the face of adversities and barriers. Linguistic capital highlights the multiple languages that students bring with them into their educational experiences that provide

them with various tools of communications for learning. These tools for communication range from traditional classroom learning such as memorization and critical thinking to expression through art such as music or poetry. Familial capital emphasizes the importance of family, which extends beyond the nuclear definition of family and includes extended family and communities. Through this kinship, valuable capital that centers on belonging is fostered. Similarly, social capital includes the network of family and community resources that strengthen a student's ability to navigate professionally and emotionally though social institutions. Navigational capital is the ability for students to navigate societal institutions whose systems were not developed with communities of Colors in mind. Lastly, resistance capital is concerned with the knowledge and skills to counter inequalities and inequities within established societal institutions. Taken together, these forms of capitals within CCW are not siloed but continually inform and strengthen each other.

Cultural Validation

Within CCW, cultural capital is unique to each racial group or ethnic subgroup being studied (Yosso, 2005), therefore I draw from a prior study (Maramba & Palmer, 2014) to help define cultural capital for Southeast Asian students for this study. As described in the first chapter and earlier in this chapter within the review of the literature, Southeast Asian college students bring with them a unique cultural background that differs from other AAPI subgroups. Because of this uniqueness, it was important for this conceptual framework to define cultural capital more specifically for Southeast Asian students. To do this, I draw from a qualitative research study by Maramba and Palmer (2014) that extracted key cultural themes that were salient in the college experiences of Southeast Asian college students. These four cultural themes are specifically integrated in CCW's cultural capital construct.

Maramba and Palmer (2014) describe four culturally validating themes in their qualitative paper. *Cultural knowledge* describes available opportunities within a student's institution to gain more knowledge about Southeast Asian student cultures and histories. *Cultural familiarity* describes social connections to others with similar cultural backgrounds within a student's institution. *Cultural expression* focuses on opportunities and/or platforms in which Southeast Asian college students are able to express and share their cultural backgrounds and histories. Lastly, *cultural advocacy* describes opportunities for Southeast Asian students to give back to their communities beyond their college campuses.

Although these four themes of cultural validation are primarily integrated into the cultural capital tenet of CCW, they undeniably emanate throughout the entire conceptual framework given that all the tenets within CCW are interrelated.

Summary of the Conceptual Framework

The goal of this study's conceptual framework, as shown in Figure 2.1 below, is to understand what is most salient in the development of science self-efficacy and science identity among Southeast Asian STEM college students. The role of SCCT and science identity within this framework provides a broader understanding of what background factors, environmental influences, and learning experiences may be related to science self-efficacy and science identity development. Importantly, SCCT and science identity were not developed specifically for Southeast Asian students, therefore I integrate CCW and cultural validation which suggests background factors, environmental influences, and learning experiences specific to Southeast Asian college student development. Taken together, this conceptual framework aims to inform variable selection and analytical decisions that center Southeast Asian students.

Summary of the Literature and Conceptual Framework

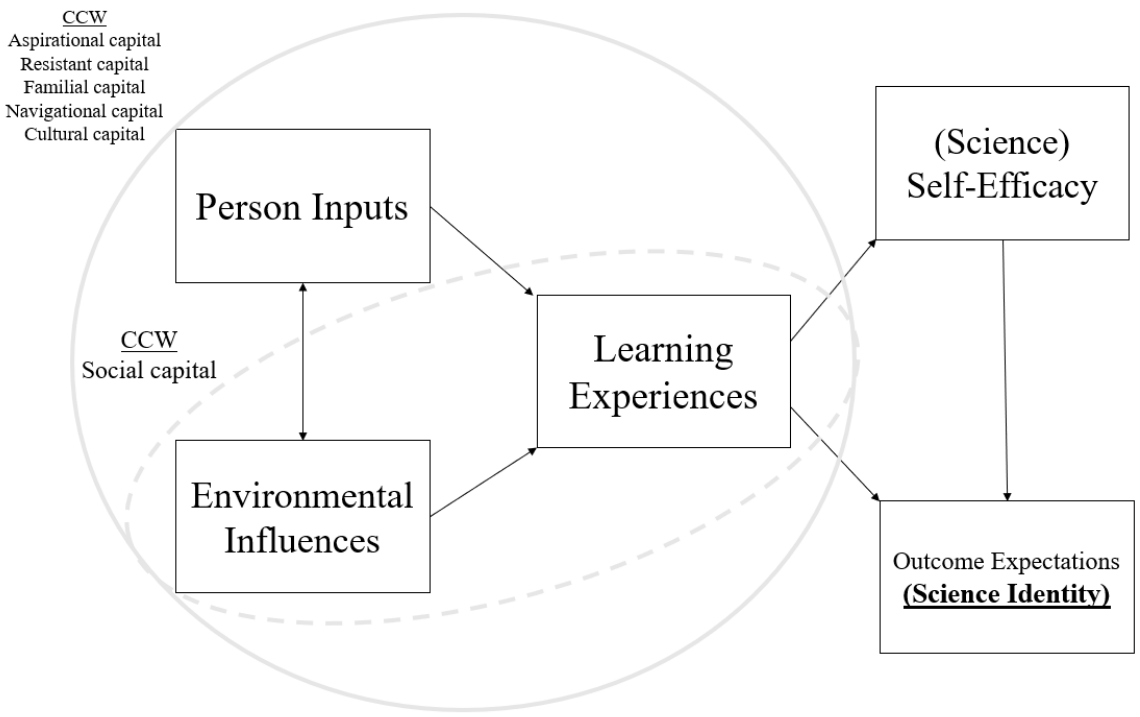

Figure 2.1. Conceptual Framework: Social Cognitive Career Theory (Lent et al., 1994, 2000, 2002) (*denoted by black rectangular boxes)*, Science Identity (Carlone & Johnson, 2007) (*denoted by bolded and underlined text*), and Community Cultural Wealth (Yosso, 2005) (*denoted by grey circle and dotted oval*)
Note. SCCT model reproduced from Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest choice, and performance. *Journal of Vocational Behavior*, *45*, 79-122.

The review of the literature in this chapter acknowledges the scholarship generated about the salience of science identity and science self-efficacy, suggesting that these psychosocial markers may contribute to STEM students' success, yet not much is known about how these psychosocial constructs operate for Southeast Asian STEM students. When we also consider the duality of low STEM degree attainment and low bachelor's degree attainment for Southeast Asian students, it is important that this study closely examines how Southeast Asian college STEM students develop science identity and science self-efficacy during college. To examine this problem, this study draws from three primary theoretical perspectives and models including

Lent and colleagues (1994, 2000, 2002) social cognitive career theory, Carlone and Johnson's (2007) science identity model, and Yosso's (2005) community cultural wealth. These theoretical perspective and models form this study's conceptual framework that guides the methodological decisions for study which aims to center the experiences of Southeast Asian STEM college students.

Guided by prior literature and the aforementioned conceptual framework, Chapter 3 will discuss methodological approaches that are best suited to answer this study's research questions. These methodological approaches include this study's data source and sample, variable selection, analytic decisions, and limitations.

CHAPTER THREE: METHODOLOGY

This study aimed to examine the development of science self-efficacy and science identity of first-time first-year Southeast Asian STEM college students by exploring changes in these science-related psychosocial factors over the first college year, unpacking characteristics and experiences that were predictive of these underlying constructs, and illuminating if and how these relationships differed between Southeast Asian students and their AAPI peers. Guided by the conceptual framework described in chapter two, I utilized a combination of descriptive statistics and inferential analyses using University of California Los Angeles (UCLA) Higher Education Research Institute's (HERI) CIRP Freshman Survey (TFS) and Your First College Year (YFCY) Survey to answer the following research questions:

1. What are the academic, background, and psychosocial (e.g., science self-efficacy, science identity) characteristics of first-time, first-year Southeast Asian STEM college students? Do these characteristics differ when compared to other AAPI subgroups?

2. How does science self-efficacy change during the first year of college for Southeast Asian STEM students? Does change in science self-efficacy differ across AAPI subgroups?

3. How does science identity change during the first year of college for Southeast Asian STEM students? Does change in science identity differ across AAPI subgroups?

4. Among first-time, first-year Southeast Asian STEM students, what personal inputs (e.g., gender, race/ethnicity), environments, assets in the form of various types of capital, and learning experiences predict changes in science self-efficacy at the end of their first college year? Do the predictors of science self-efficacy vary in direction and/or salience between Southeast Asian students and all AAPI students?

5. Among first-time, first-year Southeast Asian STEM students, what personal inputs

(e.g., gender, race/ethnicity), environments, assets in the form of various types of capital, and learning experiences predict changes in science identity at the end of their first college year? Do the predictors of science identity vary in direction and/or salience between Southeast Asian students and all AAPI students?

As described in the previous chapter, the methodological decisions for this quantitative dissertation study were primarily guided by empirical evidence from prior literature and from the study's conceptual framework to center the narrative on Southeast Asian STEM college students. These methodological decisions included 1) the statistical methods that were utilized to run analyses (e.g., ANOVA, regression), 2) the selection of potentially salient independent variables, 3) the missing values analyses that allowed for the most robust sampling, 4) and the temporal and spatial blocking of variables within regression analyses. These four methodological decisions aimed to center the experiences of Southeast Asian students by reducing as much statistical and conceptual bias as possible through quantitative approaches to answer the research questions.

Data Source

This study was conducted using four years of longitudinal data from TFS and YFCY surveys from 2016-2017, 2017-2018, 2018-2019, and 2019-2020. TFS is administered annually at participating colleges and universities to first-year students at the start of their first college year whereas YFCY is administered at the end of their first college year. These two surveys aim to capture the characteristics and experiences of students prior to entering and during their first college year. Participating institutions may opt to administer one or both of these surveys. Given the longitudinal nature of this study, only institutions that administered both surveys to their students in each respective year between 2016-2020 were included in the sample. Importantly,

the cohort of students (from 2016-2020) in this sample were given the opportunity to respond to the demographic race/ethnicity question on the TFS and YFCY surveys with a wider selection of identities than in administrations of the surveys prior to 2015. Specifically, whereas survey administrations prior to 2015 only included two AAPI racial/ethnic identity options, TFS and YFCY surveys administered after 2015 allowed respondents to select from a more disaggregated list of six AAPI categories. These categories included: East Asian (e.g., Chinese, Japanese, Korean, Taiwanese), South Asian (e.g., Indian, Pakistani, Nepalese, Sri Lankan), Southeast Asian (e.g., Cambodian, Vietnamese, Hmong), Filipina/o/x, Native Hawaiian/Pacific Islander, and other Asian. As such, these surveys allowed for analytical comparisons to be made between Southeast Asian students and other AAPI subgroups. Across the combined administrations of TFS and YFCY from 2016 to 2020, 4,910 students who self-identified as belonging to one or more AAPI racial/ethnic group completed both surveys.

In addition to disaggregated racial/ethnic data, these surveys also provided a robust range of questions that were critical for addressing this study's research questions. These two nationwide, multi-institutional surveys collected sociodemographic, academic, psychological, and sociological characteristics and experiences of first-time first-year college students, respectively at the start and end of their first college year. These surveys also captured information on student involvement, engagement, and interactions across a variety of academic, non-academic, cultural, and extracurricular student experiences, both internal and external to their institutions. The extensive selection of data available across these two surveys allowed this study to employ a rich, robust, and critical selection of variables guided by this study's conceptual framework and prior literature.

Participants

To perform longitudinal analyses with survey data collected at the start and end of the first college year, I restricted the sample to students who completed both the TFS and YFCY surveys, therefore students who only completed only one of the two surveys were excluded. Utilizing this matched sample of students who completed both surveys allowed for inferential analyses, thereby providing an opportunity to examine salient predictors through regression analyses. Additionally, as this study was interested in comparing Southeast Asian STEM students with their AAPI STEM peers, I limited the sample to students who declared a STEM major either at the start or end of their first year *and* self-identified as AAPI by selecting at least one of the six AAPI categories on the surveys. Table 3.1 describes the demographic profile of first-year AAPI STEM college students in the sample. Of the 4,910 students AAPI students who completed both surveys between 2016 and 2020, 1,286 students identified as a STEM major at the start and/or end of their first college year. Furthermore, the majority of survey takers identified as women (60.2%). Additionally, Southeast Asian students made up 15.2% of the overall sample with East Asian students being the most represented AAPI subgroup, accounting for 53.0% of the sample. Further, 75.5% of the study sample were comprised of U.S. Citizens with 18.3% identifying as international students.

Table 3.1
Demographic and Academic Profile of First-Time First-Year AAPI STEM College Student Survey Takers at the Start of College

Characteristic	**Percent of Students**
Gender (n=1,270)	
Woman	60.2
Man	38.5
Non-binary/Other	1.4
Race/ethnicity (n=1,286)	
East Asian only (e.g., Chinese, Japanese, Korean, Taiwanese)	53.0
South Asian only (e.g., Indian, Pakistani, Sri Lankan)	15.9
Southeast Asian any (e.g., Cambodian, Vietnamese, Hmong)	15.2
Filipina/o/x only	9.7

Non-SEA Multi-ethnic	3.0
Other Asian only	2.3
Native Hawaiian/Pacific Islander only	1.0
Citizenship (n=1,277)	
U.S. Citizen	75.5
International student (i.e., F-1 or M-1 visa)	18.3
Permanent resident (green card)	5.5
None of the above	0.9
Major Entering College (n=1,244)	
Biological sciences	38.9
Engineering	24.3
Mathematics or computer science	18.9
Health professions	7.0
Non-STEM[a]	6.5
Physical science	4.4
High School GPA (n=1,274)	
A or A+	52.0
A-	34.8
B+	7.9
B	4.5
B-, C+ or C	0.8
First-Generation Status (n=1,125)	
No	85.7
Yes	14.3
Concern with ability to finance college education (n=1,270)	
None (I am confident that I will have sufficient funds)	29.5
Some (but I probably will have enough funds)	59.3
Major (not sure I will have enough funds to complete college)	11.2
Pell grant recipient (n=1,246)	
No	73.3
Yes	26.7
Need-based grants or scholarships recipient (n=1,246)	
No	61.6
Yes	38.4

[a] These students were included in the sample since at some point during their first year, they decided to become a STEM major

In terms of major, AAPI students predominantly entered college as either a biological sciences or engineering major, with students majoring in the physical sciences being the least represented in this study's sample. Lastly, the majority of the sample for this study was

comprised of students who were continuing generation students and of those who did not receive need-based grants or scholarships to fund their college education.

It is important to note that students had the opportunity to select their major when they took the TFS and when they completed the YFCY. Since this study focused on the development of Southeast Asian STEM college students, any survey taker identifying as a STEM major at the start or at the end of their first college year was included in the sample.

In terms of the institutional profile for this study's sample, Table 3.2 shows that Southeast Asian students predominantly attended public institutions (74.5%) in the West (76.5%). Additionally, Southeast Asian students were mostly represented at public universities (72.4%) with the lowest representation at public four-year colleges (2.0%).

Table 3.2
Institutional Profile of First-Time First-Year AAPI STEM College Student Survey Takers (n=1,286)

	Percent among	
	Southeast Asian Students	All AAPI Students
Region		
West	76.5	58.9
East	11.2	23.9
Midwest	9.7	12.6
South	2.6	4.6
Institutional Type		
University	86.2	81.9
Four-year college	13.8	18.1
Institutional Control		
Public	74.5	56.5
Private	25.5	43.5
Institutional Type x Control		
Public university	72.4	52.6
Public four-year college	2.0	3.9
Private university	13.7	29.3
Private four-year college	11.7	14.2

Measures

The TFS and YFCY surveys included a wide selection of variables that allowed for statistically and theoretically driven testing as informed by the conceptual framework described in chapter two. These data sources also allowed this study to control for variation among student backgrounds, pre-college characteristics, and college experiences to produce a salient model for predicting science self-efficacy and science identity for first-year Southeast Asian students, in addition to allowing for the comparison of these outcomes across AAPI subgroups.

Dependent Variables: Science Self-Efficacy and Science Identity

The dependent variables (DV) for this study were two latent constructs for science self-efficacy and science identity, which respectively represent the self-efficacy and outcome expectations tenets from SCCT. Latent constructs are underlying concepts that are not observable and therefore cannot be ascertained through individual questions asked on the survey. For example, there was no single questions that could be asked on the TFS or YFCY that could capture students' science self-efficacy or science identity. Instead, several items from each respective survey were combined through factor analysis to produce factors that represented these two science-specific psychosocial dependent outcomes.

Through item response theory, HERI validated these latent constructs by using 10 self-rated science self-efficacy-based questions and four self-rated science association questions from the TFS/YFCY surveys as outlined in Table 3.3 below (HERI Technical Report, 2016-2017). Additionally, these 14 measures were available across all administrations of TFS and YFCY that this study is using. Although these two measures were validated across all students who completed the TFS and YFCY surveys, I conducted a confirmatory factor analyses for the restricted sample for this study. Table 3.6 shows that the model for science self-efficacy and science identity factors held together for this sample of AAPI students.

Table 3.3
Single-Item Measures for Science Self-Efficacy and Science Identity

Measure
Science self-efficacy
Using technical science skills
Generating research questions
Determining how to collect appropriate data
Explaining the results of a study
Using scientific literature to guide research
Integrating results from multiple studies
Asking relevant questions
Identifying what is known and not know about a problem
Understanding scientific concepts
Seeing connections between different areas of science and mathematics
Science identity
Sense of belonging among community of scientist
Personal satisfaction from working with a team of researchers
I think of myself as a scientist
I feel like I belong in the field of science

Each of these 14 questions had answer choices ranging from responses including, "strongly disagree," "disagree somewhat," "neutral," "agree somewhat," and "strongly agree."

Independent Variables

The selection of independent variables was guided by the conceptual framework of this study and include student inputs (e.g., gender, race/ethnicity), environmental influences (e.g., socioeconomic status), learning experiences (e.g., in-classroom, out-of-classroom), community cultural wealth (e.g., family support), and cultural validation (e.g., participation in ethnic organizations) (Carlone & Johnson, 2007; Lent et al., 1994, 2000, 2000; Maramba & Palmer, 2014; Sablan, 2019; Yosso, 2005) . Table 3.4 shows the full list of variables and their respective scales. Importantly, this study utilized secondary data and although the TFS and YFCY surveys offer a robust selection of

Table 3.4
Variable Definitions and Coding Schemes

Framework	**Variable/Construct**	**Definition/Coding**

SCCT: Self-Efficacy (Dependent Variable)	*Science self-efficacy*	Ten-item factor scale (Table 3.6)
SCCT: Outcome Expectations (Dependent Variable)	*Science identity*	Four-item factor scale (Table 3.6)
SCCT: Inputs & Environmental Influences	*Race/ethnicity*	Students were able to select from six distinct Asian American and Pacific Islander subgroups which include: Southeast Asian East Asian Filipina/o/x South Asian Native Hawaiian/Pacific Islander Other Asian
	Gender[a]	1 = Man; 2 = Woman; 3 = Genderqueer, gender non-conforming, other identity
	Citizenship status	1 = None of the above; 2 = International student (i.e., F-1 or M-1 visa); 3 = Permanent resident (green card); 4 = U.S. Citizen
	High school GPA	1 = D; 2 = C; 3 = C+; 4 = B-; 5 = B; 6 = B+; 7 = A-; 8 = A or A+
	Years studying mathematics	1 = None; 2 = Less than one; 3 = One; 4 = Two; 5 = Three, 6 = Four; 7 = Five or more
	Years studying physical science	1 = None; 2 = Less than one; 3 = One; 4 = Two; 5 = Three, 6 = Four; 7 = Five or more
	Years studying biological science	1 = None; 2 = Less than one; 3 = One; 4 = Two; 5 = Three, 6 = Four; 7 = Five or more
	Years studying computer science	1 = None; 2 = Less than one; 3 = One; 4 = Two; 5 = Three, 6 = Four; 7 = Five or more

	Do you have any concern about your ability to finance your college education?	1 = None (I am confident that I will have sufficient funds); 2 = Some (but I probably will have enough funds); 3 = Major (not sure I will have enough funds to complete college)
	First-generation status	1 = No; 2 = Yes
	Pell grant recipient	1 = No; 2 = Yes
	Need-based grant/scholarship recipient	1 = No; 2 = Yes
SCCT: Learning Experiences	*Taken a course or first-year seminar designed to help students adjust to college*	1 = No; 2 = Yes
	Learning experiences factor	Three-item factor scale (Table 3.6)
	Contributed to class discussions	1 = Not at All; 2 = Occasionally; 3 = Frequently
	Worked with classmates on group projects	1 = Not at All; 2 = Occasionally; 3 = Frequently
CCW: Aspirational Capital	*Will you pursue a science-related research career?*	1 = Definitely No; 2 = Probably No; 3 = Uncertain; 4 = Probably Yes; 5 = Definitely Yes
	Aspirational capital: leadership goals	Three-item factor scale (Table 3.6)
	Aspirational capital: social goals	Four-item factor scale (Table 3.6)
CCW: Resistant Capital	*There is a lot of racial tension on this campus*	1 = Strongly Disagree; 2 = Disagree; 3 = Agree; 4 = Strongly Agree
	Resistant capital: navigating systems	Three-item factor scale (Table 3.6)

CCW: Navigational Capital	*Navigational capital factor: accessing service-based resources*	Six-item factor scale (Table 3.6)
CCW: Familial Capital	*Felt that your family supported you to succeed*	1 = Not at All; 2 = Occasionally; 3 = Frequently
	Felt that your family responsibilities interfered with your schoolwork	1 = Not at All; 2 = Occasionally; 3 = Frequently
	Family capital factor: family interactions	Two-item factor scale (Table 3.6)
CCW: Social Capital	*Social capital factor: external faculty and staff interactions*	Three-item factor scale (Table 3.6)
	Social capital factor: Faculty and staff general support	Two-item factor scale (Table 3.6)
	Develop close friendships with other students	1 = Very Difficult; 2 = Somewhat Difficult; 3 = Somewhat Easy; 4 = Very Easy
CCW: Cultural Capital	*Participated in: An ethnic/racial student organization*	1 = No; 2 = Yes
	Cultural capital factor: ethnic identity threat	Two-item factor scale (Table 3.6)

[a] Gender is a socially constructed concept and is not interchangeable with sex. The 2016-2017 administration asked students to self-select their sex whereas the subsequent administrations between 2017-2020 asked students to self-select their gender identity

variables, they were not created or administered with consideration for the theoretical perspectives that guided this study. Thus, the process of selecting independent variables for this study was based on how each construct within each theoretical perspective was defined. It is also important to note that the independent variables described were available across all administrations of TFS and YFCY that this study is using.

Person inputs describes characteristics, predispositions, and experiences that students bring with them to college such as their gender and racial/ethnic identities. Importantly, given the differing sociopolitical histories between domestic and international AAPI students, a variable for citizenship status was included in this study. Furthermore, students who identified as a STEM major were categorized as biological/life science, engineering, computer science or math, or physical sciences under the aggregated major variable. Additionally, the pre-test variables for science identity and science self-efficacy were also included in the person input block since it was important to understand the level of science self-efficacy and science identity that students entered college with.

Environmental influences included the contextual backgrounds that students are coming from when entering college. These variables included socioeconomic status proxies such as receiving Pell grants and/or need-based grants/scholarships.

Within the context of college, *learning experiences* included in-class and out-of-class experiences that 1) describe how students gained new knowledge and 2) how that new knowledge may have developed. According to SCCT, learning experiences are a critical mediator in self-efficacy development and, as such, the inclusion of measures that captured learning opportunities (such as participation in undergraduate research) and pedagogical approaches (such as group work within the classroom) were important to include in this study.

The next blocks of variables selected for this study were guided by CCW (Yosso, 2005) and cultural validation (Maramba & Palmer, 2014). Furthermore, several factors were created to represent forms of capital from CCW (Sablan, 2019). This section describes how well the variables available on TFS/YFCY mapped onto CCW and cultural validation.

Aspirational capital describes the goals that students hold as they navigate college. The

variables selected reflect students' aspirations and goals related to self (e.g., becoming an authority in my field), career goals (e.g., it is important for me to pursue a science-related career), and community (e.g., becoming a community leader).

Resistant capital explains the perseverance students use to push through systemic challenges and barriers. To best capture this resistant capital in this study, measures related to academic and discriminatory challenges were selected. Unfortunately, there were no variables on the TFS or YFCY that directly measured a student's perseverance in pushing through systemic challenges and barriers. At best, variables available on these surveys either captured student skills (e.g., adjust to the academic demands of college) related to perseverance or student experiences with systemic and discriminatory challenges (e.g., There is a lot of racial tension on campus).

Navigational capital stresses the importance of finding and utilizing resources. As such, it was important for this study to include variables that illuminated if students were accessing resources such as advising or writing centers within their institutions. The variables selected for this construct focused on resources beyond the classroom that students utilized (e.g., writing center, student psychological services).

Familial capital describes the importance of (immediate and extended) family in a student's college journey. Therefore, I selected measures that accounted for family interactions (e.g., parents/guardians, siblings, or extended family) during the first college year. While these variable were able to capture if students interacted with their immediate family, it does not include friends who are considered family, which is an important piece of familial capital. Furthermore, while these variables measured if students were interacting with their family, it did not provide details about what type of interactions were occurring, which are also important

within CCW.

Social capital helps guide students through institutional systems by tapping into key players that can help students navigate through the challenges of colleges. To capture this construct, variables measuring student interaction with faculty and staff and how they feel about those interactions were included in this study. The variables selected for this block included the frequency of interaction with key institutional players in addition to students' perception of these key players.

Lastly *cultural capital and cultural validation* explains the desire for students to learn about their culture and share what they have learned. Ultimately, students hope to take what they have learned about their culture and give back to their communities. The measures available on TFS and YFCY that captured this final block were fairly limited and the variables that did exist worked best as proxy variables. For example, one of the selected measures highlighted if they participated in an ethnic/racial organization, but the assumption cannot be made that this experience was related to Southeast Asian culture since they could have joined another ethnic organization that was different than their own racial/ethnic identity. Furthermore, there were two measures that captured students' ethnic experiences related to feeling threatened because of one's race/ethnicity and feeling ignored or invisible because of one's race/ethnicity which may somewhat account for cultural knowledge, familiarity, and expression, yet there were no variables that captured cultural advocacy. In the overall regression models, the cultural capital and cultural validation blocks were extremely limited.

Table 3.5
Descriptive Statistics for Predictors of Science Self-Efficacy and Science Identity (n=1,286)

Variable/Construct	Mean	SD	Min, Max	% Missing
Science self-efficacy (pre-test)	50.89	9.43	17.22, 72.43	3.2
Science self-efficacy	49.81	9.71	14.21, 73.25	15.6
Science identity (pre-test)	56.77	7.13	33.36, 71.24	6.5

Science identity	55.56	7.54	33.36, 72.87	15.2
Race/ethnicity	--	--	1, 7	0.0
Gender	--	--	1, 3	1.2
High school GPA	7.32	.876	2, 8	0.9
Years studying mathematics	5.82	.786	1, 7	0.8
Years studying physical science	4.10	1.488	1, 7	1.6
Years studying biological sciences	3.98	1.105	1, 7	12.7
Years studying computer science	1.97	1.345	1, 7	12.8
Do you have any concern about your ability to finance your college education?	1.82	.611	1, 3	1.2
Pell grant recipient	1.27	.443	1, 2	3.1
First-generation status	1.14	.350	1, 2	12.5
Need-based grant/scholarship recipient	1.38	.487	1, 2	3.1
Taken a course or first-year seminar designed to help students adjust to college	1.36	.479	1, 2	26.2
Learning experiences factor				
Contributed to class discussions	2.20	.565	1, 3	17.1
Worked with classmates on group projects	2.07	.568	1, 3	20.5
Will you pursue a science-related research career?	3.79	1.048	1, 5	5.0
Aspirational capital: leadership goals	3.92	1.15	1.49, 5.95	7.0
Aspirational capital: social goals	6.64	1.79	2.60, 10.40	7.6
There is a lot of racial tension on this campus	1.99	.638	1, 4	11.51
Resistant capital: navigating systems	6.15	1.74	2.43, 9.72	8.6
Navigational capital factor: accessing service-based resources	4.53	1.12	3.08, 9.24	18.4
Felt that your family supported you to succeed	2.37	.690	1, 3	5.8
Felt that your family responsibilities interfered with your schoolwork	1.47	.638	1, 3	13.0
Family capital factor: family interactions	6.52	2.06	1.57, 9.42	11.4
Social capital factor: external faculty and staff interactions	4.98	1.90	2.09, 12.52	4.5

Social capital factor: faculty and staff general support	4.77	1.46	1.77, 7.06	12.1
Develop close friendships with other students	2.69	.951	1, 4	8.5
Participated in: An ethnic/racial student organization	1.22	.415	1, 2	15.9
Cultural capital factor: ethnic identity threat	3.12	1.80	1.77, 8.83	14.9

Data Analysis

The prior section focused on the data source, sample, and measures that were vital in addressing this study's research questions. The next section of this chapter provides a description of and justification for the analytic procedures that were used to answer the research questions. Importantly, the analytic decisions for this study were guided by integrating appropriate statistical tests and this study's conceptual framing. As such, the decisions described in the subsequent subsections weaved in quantitative approaches to minimize as much statistical and conceptual bias as possible in addition to ensuring that I centered Southeast Asian students in my analyses. The alpha level was set at 0.05 for all statistical tests in this study.

Variable Coding

Dummy coding was utilized for all categorical independent variables in this study. These categorical variables included gender, Pell grant recipient, need-based grants/scholarships recipient, citizenship status, completion of a first-year seminar course, and participation in an ethnic organization. For gender, the reference group was set as male. For all other categorical variables with a yes/no responses, the reference group was set as no.

AAPI ethnic subgroups were coded into the following seven groups: any students self-identifying as Southeast Asian (including if they identified multi-ethnic), students identifying only as East Asian, students identifying only as Filipina/o/x, students identifying only as South

Asian, students identifying only as Other Asian, students identifying only as Native Hawaiian and/or Pacific Islander, and students identifying as non-Southeast Asian and multi-ethnic. The decision to group students who identified only as Southeast Asian and identified as multi-ethnic Southeast Asian was to conceptually capture all Southeast Asian experiences in this sample and to statistically have a large enough sample to run a separate regression model for Southeast Asian students since this group is the focus of this study. Among the students in this study who identified as Southeast Asian, 74.9% identified only as Southeast Asian, 21.1% also identified as East Asian, 2.0% also identified as Filipina/o/x, 1.0% also identified as South Asian, and also 1.0% identified as other Asian.

Factor Analyses

Following dummy coding of the variables as described in the prior section, confirmatory factor analyses was completed 1) to validate science self-efficacy and science identity for this study's sample and 2) to create salient constructs for tenets described in this study's conceptual framework (e.g., cultural capital, social capital). Importantly, the operationalization and validation of CCW's forms of capital were guided by Sablan's (2019) recommendation of utilizing measurement theory, such as factor analysis, to examine CCW through quantitative inquiries. Confirmatory factor analysis is a quantitative method of dimension reduction that creates a factor or several factors from various measures. Specifically, confirmatory factor analysis takes an a priori approach, drawing from theories and models to guide the production of a factor. Model estimations were used to test if a factor held together statistically. In this case, factor loadings and Cronbach's alpha were used to determine the salience of each dependent factor for this study.

As mentioned in a prior section, a factor for science self-efficacy was created by HERI

using ten measures that encompassed observable traits that represented this underlying construct. Similarly, science identity was also created by HERI using four measures. Once again, HERI validated these two factors using item response theory (HERI Technical Report, 2012), but since these factors were not validated for just AAPI students, I confirmed these factors before running descriptive and inferential analyses. Additionally, given the relatively small sample of Southeast Asian students in this study and the breadth of single measures that captured the tenets described by this study's conceptual framework, factors were also created for aspirational capital, learning experiences, familial capital, resistant capital, social capital, navigational capital, and cultural capital (Sablan, 2019). These factors can be found in Table 3.6 with their respective factor loadings and Cronbach alphas.

Table 3.6
Factor Loadings and Reliability Statistics for Composite Measures

Measures	**Factor Loadings**
Aspirational Capital (Leadership Goals) (n=1,196; Cronbach's alpha = 0.712)	
Goal: becoming an authority in my field	0.744
Goal: obtaining recognition from my colleagues for contributions in my special field	0.744
Aspirational Capital (Social Goals) (n=1,188; Cronbach's alpha = 0.750)	
Goal: becoming a community leader	0.721
Goal: helping others who are in difficulty	0.675
Goal: helping to promote racial understanding	0.664
Goal: influencing social values	0.560
Cultural Capital (Ethnic Identity Threat) (n=1,095; Cronbach's alpha = 0.874)	
Ethnic experience: felt insulted or threatened because of your race/ethnicity	0.883
Ethnic experience: felt ignored or invisible because of your race/ethnicity	0.883
Familial Capital (Family Interactions) (n=1,154; Cronbach's alpha = 0.758)	
Interact: your parents/guardians	0.785
Interact: your siblings or extended family	0.785
Learning Experiences (Classroom Faculty Support) (n=1,208; Cronbach's alpha = 0.797)	
Felt: that my contributions were valued in class	0.807
Felt: that faculty encouraged me to ask questions and participate in discussions	0.729

Felt: that faculty provided me with feedback that helped me assess my progress in class	0.723
Navigational Capital (Service-Based Resources) (n=1,050; Cronbach's alpha = 0.681)	
Services: study skills advising	0.600
Services: academic advising	0.555
Services: career services	0.552
Services: writing center	0.506
Services: financial aid advising	0.441
Services: student health services	0.427
Resistant Capital (Academic Adjustment) (n=1,175; Cronbach's alpha = 0.851)	
Ease: adjust to the academic demands of college	0.845
Ease: develop effective study skills	0.828
Ease: manage your time effectively	0.758
Science Identity (Pre-test) (n=1,208; Cronbach's alpha = 0.849)	
Associations: I have a strong sense of belonging to a community of scientists	0.850
Associations: I derive great personal satisfaction from working on a team that is doing important research	0.789
Associations: I think of myself as a scientist	0.784
Associations: I feel like I belong in the field of science	0.632
Science Identity (n=993; Cronbach's alpha = 0.867)	
Associations: I have a strong sense of belonging to a community of scientists	0.874
Associations: I derive great personal satisfaction from working on a team that is doing important research	0.808
Associations: I think of myself as a scientist	0.759
Associations: I feel like I belong in the field of science	0.709
Science Self-Efficacy (Pre-test) (n=1,231; Cronbach's alpha = 0.910)	
Skills: use technical science skills (use of tools, instruments, and/or techniques)	0.790
Skills: generate an answerable research question	0.776
Skills: determine how to collect appropriate data	0.772
Skills: explain the results of a study	0.748
Skills: use scientific literature to guide research	0.729
Skills: integrate results from multiple studies	0.711
Skills: ask relevant questions	0.670
Skills: identify what is known and not known about a problem	0.662
Skills: understand scientific concepts	0.643
Skills: see connections between different areas of science and mathematics	0.602
Science Self-Efficacy (n=972; Cronbach's alpha = 0.955)	
Skills: use technical science skills (use of tools, instruments, and/or techniques)	0.877

Skills: generate an answerable research question	0.876
Skills: determine how to collect appropriate data	0.870
Skills: explain the results of a study	0.846
Skills: use scientific literature to guide research	0.841
Skills: integrate results from multiple studies	0.837
Skills: ask relevant questions	0.821
Skills: identify what is known and not known about a problem	0.814
Skills: understand scientific concepts	0.748
Skills: see connections between different areas of science and mathematics	0.723
Social Capital (External Faculty and Staff Interaction) (n=1,228; Cronbach's alpha = 0.731)	
Interact: faculty outside of class or office hours	0.753
Interact: faculty during office hours	0.714
Interact: academic advisors/counselors	0.620
Social Capital (Faculty and Staff General Support) (n=1,130; Cronbach's alpha = 0.876)	
Opinion: at least one staff member has taken an interest in my development	0.883
Opinion: at least one faculty member has taken an interest in my development	0.883

Descriptive Analyses

Descriptive analyses were used to answer the first three research questions for this study. Specifically, a combination of frequencies, crosstabulations with chi-square statistical testing and Bonferroni corrections, and ANOVAs with Dunnett's test revealed the characteristics of Southeast Asian STEM students and their AAPI peers in this study and how science self-efficacy and science identity changed over their first college year for these students.

The first research question aimed to understand the pre-college academic, background, and science-related psychosocial characteristics of students in this study. In addition to unpacking the proportional representation of AAPI subgroups within this study, it was also important to examine the academic (e.g., high school experiences), background (e.g., SES), and psychosocial traits (e.g., science self-efficacy, science identity) of each AAPI subgroup when they started college. As mentioned in the first chapter of this dissertation, this study aimed to

address the problem of data aggregation to illuminate the differences in experiences and stories of each AAPI subgroup, with a specific focus on Southeast Asian students. As such, simple frequencies were performed to obtain a basic picture of the numerical and proportional representation of AAPI subgroups in this dataset. Subsequently, two-way crosstabulations and one-way ANOVAs were run to uncover the academic, background, and psychosocial characteristics of each AAPI subgroup. Additionally, post-hoc tests were conducted to reveal differences between Southeast Asian STEM college students and their AAPI peers across these measures.

Research question two and three focused on how science self-efficacy and science identity change from the start of the first college year to the end of the first college year for AAPI STEM college students. Since science self-efficacy and science identity were measured as a continuous variable, a combination of independent samples t-tests, ANOVAs, and general linear modeling were used to answer these research questions. Specifically, t-test were used to reveal significant changes in science self-efficacy and science identity for each AAPI subgroup. The specific goal of these questions was to see if there was a growth, decline, or no change in science self-efficacy and science identity during the first college year. Subsequently, I then tested for differences in these changes between Southeast Asian students and their AAPI peers utilizing a combination of ANOVA and general linear modeling. As literature has provided empirical evidence on the salience of the first college year and given that science self-efficacy and science identity are the two primary (dependent) variables of interests for this study, it was important to understand the nature of the change for these constructs before addressing the final two research questions.

Missing Values Analyses

Given the relatively small sample sizes utilized in this study, it was important to conduct an analysis of missing values that could provide the most robust estimation possible to retain as much as the sample as possible for regression analyses. Scholars have touted multiple imputation (MI) as a best practice for dealing with missing data (Myers, 2011). The decision to employ MI was further supported by three major considerations which included 1) staying as true as possible to the responses provided by the students, 2) utilizing a statistical technique that provided the most accurate representation of students who may have not answered questions on the surveys, and 3) statistically reducing the bias in the estimation of missing values. To start, Little's Missing Completely at Random (MCAR) analysis was conducted on all variables in the regression models, which identified patterns of missing data across cases, variables, and values. Next, with the exception of gender, race/ethnicity, and the dependent variables, missing values for independent variables in the models were imputed with 50 iterations which were then pooled for regression analyses. Further, each variable in the regression models were utilized as predictors for imputing missing values. Ultimately, the aim of employing multiple imputation for dealing with missing data was to optimize the data available in the final sample of this study so that the examination of the research questions yielded statistical power while retaining the truest story possible for Southeast Asian STEM college students.

Regression Analyses

After running descriptive analyses for science self-efficacy and science identity of Southeast Asian STEM students as compared to their AAPI counterparts and imputing a pooled dataset, research questions four and five aimed to unveil some explanatory power of science self-efficacy and science identity through ordinary least squares regression.

Ordinary least squares regression was utilized in order to examine the relationship

between key independent variables, such as gender and college experiences, and the dependent variables, science self-efficacy and science identity, while controlling for person inputs, background/contextual characteristics. Within this analysis, the conceptual framing of this study guided the regression analyses for these final two research questions. SCCT guided the temporal and spatial placement of each independent variable into blocks whereas science identity, community cultural wealth, and cultural validation provided direction on selecting potential predictors that would be important in the overall regression model, which was important to highlight in the results section, and how each of these findings are explained in the discussion section. Nine blocks (as described in table 3.3 in the prior section) were created for each of the regression models for this study. To optimize the temporal relationship between the independent variables and dependent variables for this study, person-inputs entered the regression model first followed by environmental influences. The third block to enter the regression models was aspirational capital since most of the aspirational variables were measured during the TFS administration at the start of the college year. The order of the final six blocks entered in the following order: learning experiences, familial capital, resistant capital, social capital, navigational capital, and cultural capital. The order of the final six blocks was less concerned with the temporal placement in the model since this study's longitudinal dataset only offers two time-points and it was not possible to distinguish what experiences students had first. Instead, the blocking of the final six constructs placed more emphasis on the spatial placement of these experiences as described by SCCT and CCW.

Two regression models were executed for each of the final two research questions for this this study, one for all AAPI students in the sample (East Asian, Filipina/o/x, South Asian, Southeast Asian, Native Hawaiian/Pacific Islander, Other Asian) and one that only included

Southeast Asian students. Each model included the same independent variables. The purpose of running two regression models for each of the final two research questions was to allow for comparison of salient predictors between Southeast Asian students and all AAPI students in the aggregate. As mentioned in the prior two chapters, research often aggregates AAPI students, therefore this study provides evidence for the importance of disaggregating these groups. While this study uniquely examined Southeast Asian students, this approach also presented limitations which are discussed in the section below. The purpose of this dissertation was to unpack differences between Southeast Asian students all AAPI student subgroups together to illuminate stories that are truer and specific to each subgroup, and to counter the narrative that all AAPI students share similar backgrounds and successes.

Limitations

The purpose of this study was to quantitatively examine science self-efficacy and science identity development of Southeast Asian STEM college students during their first college year, as compared to other AAPI subgroups. It is important to note that, generally, a quantitative study will not provide the depth of stories that can be extracted and told through qualitative methodologies. Still, through the integration of prior research, theory, and statistical methodologies, this study aimed to center the narrative on Southeast Asian students as much as possible. Yet, there are some limitations that are discussed in this section related to the data source, study sample, methodological decisions, and the generalizability of the study's findings.

The first limitation for this study is concerned with the data sources utilized in this study. While it was previously discussed that TFS and YFCY provided a robust selection of variables that were vital in the selection of independent variables for this study, there were limited options that were available to examine the cultural influences that prior literature on Southeast Asian

college students have found to be salient in their success. As such, the discussion section draws heavily from the cultural sphere of the conceptual framing for this study to explain the results and provide implications for future studies.

Another limitation related to the study's sample is concerned with the oversampling of specific students and institutions within this dataset. At the institutional level, data was primarily collected from four-year colleges and universities. Additionally, prior research suggest that Southeast Asian students largely attend community colleges (CARE, 2010; Maramba, 2011). As such, the findings of this study were not representative of all Southeast Asian or other AAPI STEM students within the U.S. higher education system which consists of a robust network of institutional types, including community colleges. At the student level, the data skewed slightly toward responses from female students, students from high socioeconomic status, and continuing generation students, and, therefore, is not generalizable to all first-year AAPI STEM college students.

The decision to produce two regression models, one that included only Southeast Asian students and the second which included Southeast Asian students with all other AAPI subgroups offered this study the opportunity to compare the experiences of Southeast Asian students as their own unique group versus when they are aggregated with all other AAPI students. While this approach enhanced the opportunity to center Southeast Asian students for this study, a limitation of this decision is that I aggregated all other AAPI subgroups together, which is an approach that, generally, should be avoided since data aggregation often cloaks the nuances and uniqueness of each group. Ultimately, while it is important to give equal consideration to each unique AAPI subgroup, deciding to proceed with this two-model approach best centered Southeast Asian students in this study.

Related to the aggregation of AAPI students, although this study advanced knowledge by disaggregating AAPI students into seven distinct ethnic categories and centered the narrative of Southeast Asian students, I acknowledge that Southeast Asian students (and other AAPI subgroups) comprise of even more unique diasporas. For example, Southeast Asian students are further comprised of unique subgroups such as Burmese, Cambodian, Hmong, Thai, and Vietnamese students, among others. Given that race is a politically and socially constructed and racial/ethnic groupings are evolving to be more considerate and inclusive of the diverse histories of ethnic subgroups, this study was only able to go as far as examining AAPI students in seven disaggregated categories.

The final limitation for this study was that utilizing pre-existing secondary data did not fully capture the complexities of this study's conceptual framework, especially community cultural wealth. As mentioned earlier, the operationalization of CCW factors were guided by Sablan's (2019) study that suggested a method for quantitively investigating CCW. Whereas Sablan's (2019) study created a survey that captured the forms of capital presented by CCW, this study was conducted using surveys that had already been administered and not specifically guided by CCW. Furthermore, although there was rich and robust data offered with this dataset, this study was unable to explain the depth that may come from a qualitative study on the science identity and science self-efficacy development of first-time first-year Southeast Asian college STEM students. Yet, Southeast Asian college STEM students are severely understudied and this quantitative approach in examining this problem provides future research directions.

Positionality

I enter my dissertation study with an extensive background that has intersected with my identity as a Cambodian man. This extensive background includes my experiences as an

undergraduate STEM student, a student affairs professional working toward STEM student success, and as a higher education researcher that has spent the majority of his pre-dissertation training examining the early psychosocial development of college STEM students. As a first-generation college student from a low-SES upbringing with limited resources and capital, I thought the most important tool toward success was studying independently and using performance on examinations of reinforce my success in STEM. Unfortunately, I did not perform well as a STEM major, barely graduating with a B.S. and almost immediately leaving STEM after graduation when I could not acquire employment in a STEM field. As I took a role in student affairs for a STEM department poised to improve student success for STEM students, I began to understand the importance of success markers such as growth mindset, academic grit, sense of belonging, and other psychosocial factors that have been found to be salient in improving student persistence in STEM. Upon leaving my position as a student affairs professional and entering the higher education arena as a research scholar, I began to examine early development psychosocial factors such as science self-efficacy for STEM students, specifically focusing on URM students. With this extensive background, I approach my dissertation study with two goals specific to my positionality which include 1) unpacking college experiences for Southeast Asian students and 2) emphasizing the importance of success markers that go beyond the traditional markers of test scores. The aim of this approach hopes to 1) challenge research to acknowledge AAPI subgroups who have been historically excluded from research and practice and 2) provide higher education institutions with evidence to leverage tailored resources for students from varying racial/ethnic backgrounds, especially within STEM. Thus, the methodological decisions and discussion of results is not only be informed by this study's conceptual framework but will incorporate my background and experiences.

Summary

Chapter three described the methodological design employed to examine the early development of science identity and science self-efficacy of first-time first-year Southeast Asian STEM college students during their first college year to better understand what predictors are most salient in the development of these psychosocial constructs. Utilizing matched samples from five cohorts of the TFS and YFCY survey administrations, through ordinary least squares regression, and guided by social cognitive career theory, science identity, community cultural wealth, and cultural validation, this study examines a wide range of predictors that may be salient in the development of science identity and science self-efficacy for Southeast Asian STEM college students during their first college year. Further, this study aims to compare how these psychosocial developments for Southeast Asian students compare to other students from other AAPI ethnic subgroups by applying a regression model that includes all AAPI students in the sample in addition to a regression model that only includes Southeast Asian students. These methodological decisions aim to center the development of Southeast Asian college students, who, in prior studies, have often been grouped in the AAPI aggregate.

CHAPTER FOUR: RESULTS

This study explored the development of science self-efficacy and science identity among Southeast Asian STEM students during their first year of college, with a focus on how these outcomes related to these students' unique backgrounds and academic experiences prior to and during the first college year. First, I utilized descriptive statistics to build a foundation for understanding the differences between Southeast Asian STEM college students and their AAPI STEM peers in terms of their pre-college characteristics, experiences, science self-efficacy, and science identity. I then examined how science self-efficacy and science identity changed over the first college year for Southeast Asian students to see if there were notable differences in these changes when compared to other AAPI subgroups. Through regression analyses, I concluded my investigation by testing for salient predictors of science self-efficacy and science identity development during the first college year for Southeast Asian students and compared the significance of these predictors against AAPI students in the aggregate. This chapter describes the findings organized around each of my research questions.

Research Question One: Comparison of Pre-College Background Characteristics, Academic Experiences, Science Self-Efficacy, and Science Identity Between Southeast Asian Students and Their AAPI Peers at the Start of College

Before examining how science self-efficacy and science identity developed during the first college year for Southeast Asian students, it was important to first understand their background characteristics and academic experiences prior to entering college. Further, potential differences for these factors were assessed between Southeast Asian students and other AAPI subgroups. These subgroups included East Asian, Filipina/o/x, South Asian, Native Hawaiian/Pacific Islander, other Asian, and non-Southeast Asian multi-ethnic subgroups. As

such, the first research question descriptively examined these characteristics and experiences in addition to the self-rated science self-efficacy and science identity of these students at the start of college. To test for differences, I utilized a series of crosstabulations with a Bonferroni correction and ANOVAs with a Dunnett's test to compare these characteristics and experiences for Southeast Asian students and their AAPI peers. It is important to note that other Asian, Native Hawaiian/Pacific Islander, and non-Southeast Asian multi-ethnic subgroups did not meet cell size thresholds of n=5 (due to overall smaller sample sizes for each of these groups) for a handful of crosstabulations, which are noted in the Table 4.1. However, I acknowledge the importance of keeping the analytical results of Native Hawaiian/Pacific Islander, other Asian, and non-Southeast Asian multiethnic students when possible because their stories are equally important and, thus, their results are shared when statistically possible.

Background Characteristics of Southeast Asian STEM College Students

Southeast Asian students differed significantly when compared to their AAPI peers on a number of background characteristics. Table 4.1 shows these statistically significance differences between Southeast Asian students and other AAPI subgroups as demarcated by a bolded uppercase letter. To start, among each AAPI subgroup except for non-Southeast Asian multiethnic students, women made up a majority of the students in this sample. Additionally, no statistically significant differences emerged between Southeast Asian students and their AAPI peers in gender representation.

In terms of generational status, 26.7% of Southeast Asian STEM students in the aggregate identified as first-generation college students, compared to 14.3% among all AAPI students. In particular, the proportion of Southeast Asian students who were first-generation was significantly higher than their AAPI peers with only 15.3% of East Asian students, 1.8% of

Table 4.1

Proportional Differences of Academic and Background Characteristics Between First-Time First-Year Southeast Asian STEM College Students and their AAPI peers[a,b,c]

	Percent Among AAPI Ethnic Subgroup							
	Southeast Asian (n=196) A	East Asian only (n=681) B	Filipina/o/x only (n=125) C	South Asian only (n=204) D	Other Asian only (n=29) E	NHPI only (n=13) F	Non-SEA multi-ethnic (n=38) G	All AAPI[d] (n=1,286)
Gender								
Woman	67.6	60.8	61.8	55.9	64.0	54.5	50.0	60.9
Man	31.9	38.9	38.2	43.6	36.0	45.5	50.0	38.7
Non-binary/other	0.5[e]	0.3[e]	0.0[e]	0.6[e]	0.0[e]	0.0[e]	0.0[e]	0.3[e]
χ^2=8.714, p>.05								
First generation								
Yes	26.7 **BCDG**	15.3	1.8	7.5	21.7	9.1[e]	2.9[e]	14.3
No	73.3 **BCDG**	84.7	98.2	92.5	78.3	90.9	97.1	85.7
χ^2=48.423, p<.001								
Received Pell grant								
Yes	43.2 **BCD**	24.7	25.8	18.6	32.1	33.3[e]	16.7	26.7
No	56.8 **BCD**	75.3	74.2	81.4	67.9	66.7	83.3	73.3
χ^2=37.355, p<.001								
Received need-based grants/scholarships								
Yes	57.0 **BCDG**	35.6	36.1	33.2	46.4	41.7	21.6	38.4
No	43.0 **BCDG**	64.4	63.9	66.8	53.6	58.3	78.4	61.6
χ^2=38.218, p<.001								
High school GPA								
A or A+	51.0	53.7	55.2	49.0	41.4	53.8	50.0	51.6
A-	38.8	34.9	28.0	32.8	34.5	30.8[e]	34.2	34.4

B+ or below χ^2=25.738, p>.05	9.2	11.7	16.8	17.6	17.2	15.4[e]	15.8	13.1

[a] Capitalized superscripts denote differences between Southeast Asian students (A) and other AAPI subgroups (BCDEFG) for each variable listed

[b] Statistical significance set at $p<0.05$

[c] Sample sizes for each group may be slightly smaller across the variables listed in this paper due to missing values

[d] AAPI column totals are included as a reference for numerical and proportional comparison for AAPI subgroups, but were not included in statistical significance testing

[e] Cell sizes fell below the cell size threshold of n=5 for statistical significance testing

Filipina/o/x students, 7.5% of South Asian students, and 2.9% of non-Southeast Asian multi-ethnic students identifying as first-generation college students. These findings underscore the importance of closely examining ethnic subgroups to accurately represent the unique characteristics of these groups that have historically been hidden behind aggregated racial data. In this case, Southeast Asian STEM students entered college as first-generation in higher proportions than other AAPI subgroups.

In addition to the differing patterns in generational status between Southeast Asian and other AAPI students, descriptive statistics revealed that a higher proportion of Southeast Asian students funded their college education through Pell grants and/or need-based grants, typically markers of low socioeconomic status since these awards are based on family income. Notably, 43.2% of all Southeast Asian students received Pell grants, which was significantly higher than their East Asian (24.7%), Filipina/o/xx (25.8%), and South Asian (18.6%) peers. Similar trends emerged when examining the proportion of each AAPI subgroup receiving need-based grants with a little over half of Southeast Asian students (57.0%) receiving these scholarships, whereas only a little over a third of East Asian (35.6%), Filipina/o/x (36.1%), and South Asian (33.2%) students received these grants. As seen with prior findings discussed so far, by analyzing Southeast Asian students separately from the AAPI aggregate, a more accurate representation of Southeast Asian students' background factors was revealed.

Lastly, AAPI students differed significantly in their concern with being able to finance their college education. Specifically, as shown in Table 4.2, Southeast Asian students expressed having more concern about financing their college education when compared to East Asian and South Asian students. This finding is somewhat unsurprising given the differences in Southeast Asian students' college generational status and their qualification for Pell and need-based grants.

With a better understanding of the background characteristics that Southeast Asian STEM students entered college with, I now describe their pre-college academic characteristics.

Academic Characteristics of Southeast Asian STEM College Students

In examining high school GPA for AAPI STEM students, no statistically significant differences emerged across the AAPI subgroups in this study as shown in Table 4.1. Among all AAPI students, 51.6% had a high school GPA of an A or A+ average, 34.4% entered college with an A- average high school GPA, and 13.1% finished high school with a B+ average GPA or less, noting that Southeast Asian students are entering college with exceptional high school GPA averages that are comparable to their AAPI peers. Still, some differences in other pre-college factors emerged for Southeast Asian students, which are discussed next.

In addition to considering high school GPA as a pre-college factor for students, it was also important to consider other high school experiences that were relevant to the pre-college development of STEM students, such as STEM preparation. Table 4.2 describes the average number of years that Southeast Asian students and their AAPI peers spent studying specific disciplines within STEM during high school including math, physical sciences, biological sciences, and computer sciences. Statistically significant mean differences between Southeast Asian students and other AAPI student subgroups are denoted by a bolded uppercase letter. In terms of the number of years completed in relevant STEM courses, the mean scores for these measures were calculated based on the following scale: 1 = No year completed; 2 = Less than one year completed; 3 = One year completed; 4 = Two years completed; 5 = Three years completed, 6 = Four years completed; 7 = Five or more years completed. There were no notable differences for AAPI students in the number of years that these students completed for math, physical sciences, and biological sciences. Overall, AAPI students entering college STEM had

Table 4.2

Means Differences of Academic, Background, and Science-Related Psychosocial Characteristics of First-Time First-Year Southeast Asian STEM College Students and Their AAPI Peers[a,b]

	Southeast Asian (n=196) A	East Asian only (n=681) B	Filipina/o/x only (n=125) C	South Asian only (n=204) D	Other Asian only (n=29) E	NHPI only (n=13) F	Non-SEA multi-ethnic (n=38) G	All AAPI[c] (n=1,286) *reference*
Concern with ability to finance your college education								
Mean	1.95 **BD**	1.78	2.01	1.67	1.70	1.85	1.97	1.82
Standard deviation	0.60	0.61	0.58	0.61	0.61	0.69	0.59	0.61
Years of HS math completed								
Mean	5.87	5.82	5.83	5.79	5.82	5.38	5.89	5.82
Standard deviation	0.59	0.77	0.85	0.96	0.91	0.96	0.61	0.79
Years of HS physical sciences completed								
Mean	4.05	4.17	3.75	4.22	4.04	3.38	3.84	4.10
Standard deviation	1.37	1.44	1.37	1.70	1.95	1.50	1.57	1.49
Years of HS biological sciences completed								
Mean	4.00	3.97	3.76	4.17	3.92	3.64	3.81	3.98
Standard deviation	1.12	1.07	0.91	1.21	1.69	1.43	0.93	1.11
Years of HS computer sciences completed								
Mean	1.58 **BD**	2.12	1.64	2.11	2.00	2.09	1.56	1.97

Standard deviation	1.05	1.38	1.12	1.50	1.67	1.14	1.08	1.35
Pre-college science self-efficacy								
Mean	48.94 [D]	50.72	48.93	54.23	53.19	53.04	50.32	50.89
Standard deviation	9.44	8.90	9.83	9.90	10.35	5.96	10.47	9.43
Pre-college science identity								
Mean	57.33	56.63	55.83	57.59	56.32	52.70	56.55	56.77
Standard deviation	7.08	6.78	6.98	8.27	7.49	6.86	6.89	7.14

[a] Capitalized superscripts denote differences between Southeast Asian students (A) and other AAPI subgroups (BCDEFG) for each variable listed

[b] Statistical significance set at $p<0.05$

[c] AAPI column totals are included as a reference for numerical and proportional comparison for AAPI subgroups, but were not included in statistical significance testing

the most preparation in math, followed by fairly equal levels of course completion in the physical and biological sciences, yet we see a significant gap in computer science course-taking. In addition to AAPI students mostly completing only one or fewer years of computer science during high school, differences emerged between AAPI subgroups, with Southeast Asian (Mean=1.58, SD=1.051) students taking fewer computer science courses when compared to East Asian (Mean=2.12, SD=1.384) and South Asian (Mean=2.11, SD=1.502) students. Taken together, examining high school preparation of AAPI students in the aggregate potentially painted Southeast Asian STEM students as well-prepared for pursuing their STEM majors in college, which held true for math, physical sciences, and biological sciences. Yet when looking more closely at the number of years of computer sciences completed by Southeast Asian students, it appears that these students finished fewer years than their East Asian and South Asian peers. This is especially important when considering the specific STEM disciplines that Southeast Asian students may pursue upon entering college and the implications pre-college coursework completion may have if they decide to major in computing fields.

Pre-College Science Self-Efficacy

The final part of the first research question aimed to understand how Southeast Asian STEM students rated their science abilities and identities through two underlying construct called science self-efficacy and science identity.

Table 4.2 shows the results of the ANOVAs for science self-efficacy and science identity of AAPI students. At the start of their first college year, Southeast Asian STEM college students rated their science self-efficacy (Mean=48.935, SD=9.435) slightly lower than AAPI students in the aggregate (Mean=50.887, SD=9.431). Additionally, Southeast Asian students' science self-efficacy was significantly lower than their South Asian peers. Taken together, Southeast Asian

STEM students entered college with a self-rated confidence in their science skills that was similar to most of their AAPI peers.

Pre-College Science Identity

Lastly, Table 4.2 reports the self-rated science identity of AAPI STEM college students. Similar to science self-efficacy, Southeast Asian students' self-rated science identity (Mean=54.373, SD=8.111) was slightly lower than AAPI students' score in the aggregate (Mean=55.559, SD=7.544). Furthermore, Southeast Asian students' science identity was not significantly different than any other AAPI subgroup. Taken together, Southeast Asian STEM students and their AAPI peers all entered college with similar levels of science identity.

Ultimately, the first research question revealed that Southeast Asian students held unique socioeconomic background characteristics that were different from their AAPI peers when they entered college. Yet, in terms of academic preparation during high school, Southeast Asian students entered college with comparable levels of STEM training to those of their AAPI peers, with the exception of preparation in computer science. Lastly, Southeast Asian students entered college with comparable levels of science self-efficacy and science identity when compared to other AAPI STEM students, with the exception of having significantly lower levels of science self-efficacy when compared to South Asian students.

Research Question Two: Change in Science Self-Efficacy of Southeast Asian Students and Their AAPI Peers Over the First College Year

Having established an understanding of the background and academic characteristics and experiences that Southeast Asian STEM students entered college with, in addition to understanding their pre-college science self-efficacy and science identity, the next research question investigated how science self-efficacy changed during the first college year for

Southeast Asian STEM students and other AAPI subgroups. Further, I investigated potential differences in these changes of science self-efficacy between Southeast Asian students and their AAPI.

Changes in Science Self-Efficacy of Southeast Asian STEM College Students Over the First College Year

As shown in Table 4.3, although there was a statistically significant decrease in science self-efficacy when examining AAPI students in the aggregate, Southeast Asian students did not experience a statistically significant change in science self-efficacy during their first year of college. The only AAPI group that exhibited a notable change in science self-efficacy during the first year of college were East Asian students. Furthermore, no statistically significant differences emerged when comparing the mean changes in science self-efficacy during the first college year between Southeast Asian students and their AAPI peers. These findings illuminated that science self-efficacy of Southeast Asian students did not change significantly over the first year of college. Further, the lack of an increase in these mean scores is jarring considering that these students are not becoming more confident in their science skills during their first year in college STEM.

Research Question Three: Change in Science Identity of Southeast Asian Students and Their AAPI Peers Over the First College Year

Findings from the first research question revealed that Southeast Asian STEM students and all other AAPI subgroups entered college with similar levels of science identity. The third research question took this examination one step further by investigating how science identity changed during the first year of college for Southeast Asian STEM students and assessed if these changes in science identity differed between these students and their peers.

Table 4.3

Changes in Science Self-Efficacy and Science Identity of AAPI STEM Students (Utilizing Paired Sample T-Tests) and Differences in these Changes Between Southeast Asian Students and their AAPI Peers (Utilizing ANOVAs)[a,b,c]

	Science Self-efficacy (SSE) (n=1,056)						Science Identity (SI) (n=1,032)					
AAPI Subgroup	Pre-test		Post-test		Mean Δ		Pre-test		Post-test		Mean Δ	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Southeast Asian (A)	48.71	9.47	47.67	10.56	-1.04	9.66	57.39	6.90	54.35	8.19	**-3.04*B**	7.87
East Asian (B)	51.04	8.76	49.62	9.27	**-1.42***	9.76	56.77	6.69	55.91	7.09	**-0.86***	7.45
Filipina/o/x (C)	49.38	10.00	48.88	9.56	-0.50	12.36	55.43	7.24	53.17	9.08	**-2.26***	9.46
South Asian (D)	53.83	10.04	52.95	9.88	-0.88	10.79	57.43	8.42	56.89	7.78	-0.53	8.30
Other Asian (E)	52.92	11.29	50.56	8.94	-2.35	11.56	56.30	7.84	56.76	7.16	-0.46	8.21
Native Hawaiian/Pacific Islander (F)	53.65	5.84	53.23	8.77	-0.41	6.28	52.57	7.18	55.41	2.98	-2.84	7.84
Multiethnic (G)	48.32	9.90	47.19	9.94	-1.13	12.28	55.80	6.95	53.64	7.38	-2.16	8.58
All AAPI	50.94	9.39	49.75	9.74	**-1.19***	10.24	56.77	7.12	55.51	7.62	**-1.26***	7.95

[a] Capitalized superscripts denote significant differences between Southeast Asian students and other AAPI subgroups for science self-efficacy and science identity

[b] Statistical significance for changes in science self-efficacy and science identity are marked with an (*)

[c] AAPI row means are included as a reference for AAPI subgroups

Changes in Science Identity of Southeast Asian STEM College Students Over the First College Year

At the end of their first college year, science identity decreased by some degree for Southeast Asian, East Asian, and Filipina/o/x students. Specifically, Southeast Asian students' mean scores for science identity decreased by 3.04 points at the end of their first college year. Furthermore, whereas there were no statistically significant differences in science identity across any AAPI subgroups at the start of college, statistically significant differences in the change of science identity emerged between Southeast Asian ($m\Delta$=-3.04) and East Asian ($m\Delta$=-0.86) students in science identity at the end of the first college year. Much like science self-efficacy, prior literature revealed the importance of science identity on STEM success. Yet, the findings from this research question not only illuminated that Southeast Asian students' identity within the sciences weakens during the first year of college, but this decrease was greater in magnitude than their AAPI peers. Further, these findings suggest that Southeast Asian STEM students are completing their first year of college without strengthening their identity within the sciences.

Having established that science self-efficacy and science identity is not improving during the first year of college for Southeast Asian students and that science identity, indeed, decreases significantly, the final two research questions of this study identified predictors for science self-efficacy and science identity development and how these predictors were similar or different for Southeast Asian STEM college students when compared to AAPI students in the aggregate.

Research Question Four: Predicting Science Self-Efficacy Development of Southeast Asian STEM College Students

Thus far, I have described the unique background and pre-college characteristics and experiences of Southeast Asian STEM students. Paired with the examination of how Southeast

Asian students rated their science self-efficacy and science identity at the end of their first college year, the first three research questions provided a foundation for understanding the development of these science-related psychosocial constructs for Southeast Asian students that have been found to be salient for STEM student success in prior studies. The final part of this chapter dives into the fourth and fifth research questions which focused on exploring salient predictors of science self-efficacy and science identity. As described in the second and third chapters of this dissertation, the regression models for the next two research questions were guided by a conceptual framework that centered the experiences of Southeast Asian STEM college students. Importantly, two models were constructed for each of the final two research questions. As shown in Table 4.4 and 4.5, the first model included only Southeast Asian students and the second model included all AAPI students (including Southeast Asian students).

Predictors of Science Self-Efficacy Development of Southeast Asian STEM College Students Over the First College Year

I begin with the results of the fourth research question, which explored what predictors were most salient for science self-efficacy development during the first college year for first-time, first-year Southeast Asian STEM students and how these predictors of science self-efficacy varied in direction and/or salience between Southeast Asian students and all AAPI students. Given the difference in sample sizes between the two regression models, it is possible that non-significant predictors that emerged from the model that only included Southeast Asian students may have been significant if fewer variables were included or if the sample had been larger.

As shown in Table 4.4, five predictors were salient for science self-efficacy in Model 1 (R^2=0.430, p<0.001) which only included Southeast Asian students. Pre-test science self-efficacy emerged as a significant predictor for this model (β =0.480, p<0.001). No statistically significant

Table 4.4

Summary of Ordinary Least Squares Regression of Science Self-Efficacy for First-Time First-Year Southeast Asian STEM College Students (Model 1) and all AAPI STEM College Students (Model 2)[a]

	Southeast Asian students (n=168)		All AAPI students (n=1,024)	
Block/Variable	β	Sig.[b]	β	Sig.[b]
Pre-test				
Science self-efficacy self-rating	0.480	0.000***	0.332	0.000***
Person Inputs & Environmental Influences				
Gender: Woman *(Ref group: Man)*	-0.073	0.315	-0.039	0.172
High school GPA	0.011	0.890	0.007	0.802
Greater concern about financing college	0.014	0.852	-0.038	0.205
Pell grant recipient (*Ref group: No*)	0.043	0.569	0.013	0.681
Need-based grant recipient (*Ref group: No*)	-0.087	0.288	-0.007	0.818
International student (*Ref group: US Citizen*)	-0.056	0.543	-0.025	0.358
Permanent resident (*Ref group: US Citizen*)	0.108	0.259	0.031	0.312
Aspirational Capital				
Aspire to a science-related career	-0.021	0.783	0.035	0.203
Aspirational capital: leadership goals	-0.079	0.269	-0.042	0.160
Aspirational capital: social goals	-0.023	0.783	0.079	0.012*
Learning Experiences				
Completed a first-year seminar course (*Ref group: No*)	-0.042	0.576	-0.003	0.908
Learning experiences: classroom faculty support	0.229	0.010**	0.077	0.026*
Contributed to class discussions	-0.003	0.966	0.026	0.391
Worked with classmates on group projects	0.167	0.019*	0.079	0.006**
Familial Capital				
Felt that family support to succeed	-0.197	0.005**	-0.034	0.231
Felt that your family responsibilities interfered with your schoolwork	0.045	0.512	-0.026	0.374
Familial capital: family interactions	0.039	0.588	0.037	0.186

Resistant Capital				
Opinion: there is a lot of racial tension on this campus	-0.119	0.179	-0.071	0.024*
Resistant capital: academic adjustment	0.281	0.001***	0.161	0.000***
Social Capital				
Social capital: external faculty and staff interactions	0.161	0.073	0.052	0.122
Social capital: faculty and staff general support	-0.016	0.855	0.033	0.314
Developed close friendships with other students	-0.001	0.944	0.074	0.013*
Navigational Capital				
Navigational capital: service-based resources	-0.054	0.536	0.006	0.849
Cultural Capital				
Participated in an ethnic organization (*Ref group: No*)	0.047	0.508	0.049	0.089
Cultural capital: ethnic identity threat	0.154	0.057	0.043	0.191
Final Model R^2	**0.430**		**0.281**	

[a] Multiple imputation utilized for missing data (m=50)
[b] Statistical significance set at the following: *p<.05, **p<.01, ***p<.001

predictors emerged within the person inputs, environmental influences, or aspirational capital blocks for this model. Although no measures emerged as significant within the person inputs block, it is important to note that identifying as an international student or permanent resident was not predictive of science self-efficacy development for Southeast Asian students or AAPI students in the aggregate.

Among the *learning experiences* block, when Southeast Asian students felt that faculty supported them in the classroom (β =0.229, $p<0.01$) and when they were given opportunities to work with classmates on group projects (β =0.167, $p<0.05$), their science self-efficacy was expected to improve during their first year of college. Similarly, these two predictors were also salient in the second model which aggregated all AAPI students, including Southeast Asian students. Among the *familial capital* block, Southeast Asian students who felt that their family supported their endeavors to succeed (β =-0.197, $p<0.01$) were expected to decline in their science self-efficacy. This counterintuitive finding, which was not salient for the aggregated AAPI model, was surprising given that the expected outcome of feeling supported by family should result in an increase in science self-efficacy[1]. Next, within the *resistant capital* block, Southeast Asian students who had the means to adjust to the academic demands of college (β =0.246, $p<0.001$) were expected to improve their science self-efficacy during their first year. Lastly, the predictors within the social capital, navigational capital, and cultural capital blocks

[1] To further investigate this counterintuitive finding, Beta changes for the family support variable were assessed as variables entered the regression model. The simple correlation for this family support measure with science self-efficacy was r(166)= -0.057 with a p-value of 0.466. This investigation showed that the negative correlation for the family support variable became significantly stronger (and statistically significant) when the classroom faculty support factor entered the regression model. It is possible that this counterintuitive finding may be related to a suppressor effect resulting from multicollinearity (Astin & antonio, 2012). These findings will be discussed further in Chapter 5.

were not statistically significant in the expected development of science self-efficacy for Southeast Asian students.

When Southeast Asian students were aggregated with all other AAPI students as shown in Model 2 (R^2=0.281, p<0.001), some unique predictors emerged. Whereas there were no salient predictors within the *aspirational capital* block for Southeast Asian students, having aspirational capital related to social goals emerged as significant for AAPI students in the aggregate. Further, within the *resistant capital* block, in the aggregate, AAPI students who felt that there was a lot of racial tension on campus were expected to worsen in their science self-efficacy. Lastly, within the *social capital* block, AAPI students in the aggregate were expected to improve in their science self-efficacy if they developed close friendships with other students.

Based on the findings from this research question, building community within classrooms where Southeast Asian students felt that they were supported by faculty and where they had an opportunity to work with other students on class projects were important in their science self-efficacy development. Further, developing independent skills to adjust to the academic demands of college were also salient in the expected improvement of science self-efficacy during the first college year. Lastly, although garnering family support was a negative predictor for science self-efficacy, this finding underscored the importance of family in Southeast Asian students' college experience. Taken together, the key predictors for science self-efficacy of Southeast Asian students stresses the importance of both intrapersonal and interpersonal community-building and connections, internal and external to the classroom and institution. While these findings, although important, were not generalizable to all Southeast Asian students (given the diversity of subgroups within Southeast Asian diasporas and the robustness of the U.S. higher education system), it does support the need to examine the unique experiences of subgroups within AAPI

students as opposed to this diverse group in the aggregate, when possible.

Research Question Five: Predicting Science Identity Development of Southeast Asian STEM College Students

The final research question for this study examined salient predictors for science identity development for first-time, first-year Southeast Asian STEM students and if these predictors of science identity varied in direction and/or salience between Southeast Asian students and all AAPI students. Based on this study's conceptual model, science identity was operationalized as an outcome expectation, an outcome-based construct defined by SCCT. Of note, because SCCT theorizes self-efficacy as a predictor of outcome expectations, science self-efficacy was included as an independent variable in the model predicting science identity (whereas science identity was not included in the model predicting science self-efficacy). Furthermore, given that SCCT (1994, 2000, 2002) suggests that self-efficacy is directly and indirectly influenced by person inputs, environmental contexts, and learning experiences, post-test science self-efficacy was utilized instead of pre-test science self-efficacy. Lastly, similar to the examination of research question four, it is possible that non-significant predictors that emerged from the regression model for science identity that only included Southeast Asian students may have been significant if the analysis included fewer variables or a larger sample.

Predictors of Science Identity Development of Southeast Asian STEM College Students Over the First College Year

Table 4.5 presents the findings for the two models utilized to examine predictors for the development of science identity for Southeast Asian STEM college students. Similar to the models for research question four, Model 1 included Southeast Asian students whereas Model 2 included Southeast Asian students and their AAPI peers. Although 48.1% of the variance was

Table 4.5

Summary of Ordinary Least Squares Regression of Science Identity for First-Time First-Year Southeast Asian STEM College Students (Model 1) and all AAPI STEM College Students (Model 2)[a]

	Southeast Asian students (n=167)		All AAPI students (n=1,032)	
Variable	β	Sig.[b]	β	Sig.[b]
Pre-Test				
Science identity self-rating	0.273	0.001***	0.264	0.000***
Person Inputs & Environmental Influences				
Gender: Woman *(Ref group: Man)*	-0.065	0.356	0.041	0.114
High school GPA	0.008	0.914	0.022	0.403
Greater concern about financing college	0.157	0.029*	0.032	0.242
Pell Grant recipient (*Ref group: No*)	0.009	0.903	-0.033	0.246
Need-based grant recipient (*Ref group: No*)	0.117	0.135	0.058	0.054
International student (*Ref group: US Citizen*)	0.073	0.403	-0.012	0.625
Permanent resident (*Ref group: US Citizen*)	0.039	0.677	-0.031	0.280
Aspirational Capital				
Aspire to a science-related career	0.091	0.252	0.055	0.056
Aspirational capital: leadership goals	-0.126	0.070	0.012	0.667
Aspirational capital: social goals	0.030	0.695	-0.047	0.109
Learning Experiences				
Completed a first-year seminar course (Ref group: No)	-0.113	0.114	-0.009	0.728
Learning experiences: classroom faculty support	0.106	0.231	0.072	0.028*
Contributed to class discussions	0.034	0.654	-0.006	0.826
Worked with classmates on group projects	-0.074	0.291	0.014	0.611
Familial Capital				
Felt that family support to succeed	0.022	0.759	-0.017	0.532
Felt that your family responsibilities interfered with your schoolwork	0.039	0.556	-0.024	0.378
Familial capital: family interactions	-0.063	0.363	-0.020	0.446

Resistant Capital				
Opinion: There is a lot of racial tension on this campus	-0.011	0.901	0.017	0.562
Resistant capital: academic adjustment	0.066	0.439	0.078	0.008**
Social Capital				
Social capital: external faculty and staff interactions	-0.108	0.223	0.064	0.044*
Social capital: faculty and staff general support	0.125	0.148	0.047	0.134
Develop close friendships with other students	0.026	0.748	0.010	0.726
Navigational Capital				
Navigational capital: Service-based resources	0.009	0.915	-0.015	0.644
Cultural Capital & Science Self-Efficacy				
Participated in an ethnic organization (Ref group: No)	0.129	0.061	0.081	0.003**
Cultural capital: ethnic identity threat	0.041	0.600	-0.013	0.672
Science self-efficacy	0.433	0.000***	0.387	0.000***
Final Model R^2	**0.465**		**0.381**	

[a] Multiple imputation utilized for missing data (m=50)

[b] Statistical significance set at the following: *p<.05, **p<.01, ***p<.001

described by the variables in Model 1, only three salient predictors emerged including the pre-test for science identity ($\beta=0.273$, $p<0.001$), confidence in financing college ($\beta=0.157$, $p<0.05$), and science self-efficacy ($\beta=0.465$, $p<0.001$). Additionally, as also found for science self-efficacy, citizenship status was not a significant predictor for the expected change in science identity during the first college year for Southeast Asian students or AAPI students in the aggregate.

Whereas no predictors emerged as salient for science self-efficacy within the person inputs and environmental influences block, the predictive power of being confident in financing college was a key factor in the expected development of science identity. Additionally, science self-efficacy emerged as a positive predictor of science identity for both Southeast Asian and AAPI student models, which falls in line with what SCCT theorizes.

When examining AAPI students in the aggregate, six predictors emerged as significant in the expected development of science identity which include variables from the *learning experiences, resistant capital, social capital, and cultural capital* blocks. Specifically, AAPI students that felt they were supported by faculty in their learning experiences, possessed the capital to adjust to the demands of college, built community with staff and faculty outside the classroom, and participated in an ethnic organization were expected to positively improve in their science identity at the end of their first college year.

The findings for this research question similarly stresses the importance of disaggregating racial/ethnic data to better understand the experiences of Southeast Asian STEM college students with unique characteristics and experiences lending to the predictive power of science identity development. More so, this research question also illuminated characteristics and experiences that may not be as salient for Southeast Asian students even though they are seemingly

significant for AAPI students in the aggregate.

In closing this chapter, these findings highlighted the importance of examining unique subgroups within often-used racial/ethnic aggregations to better understand what is salient in student development and experiences. In the case of this study, Southeast Asian STEM students' confidence and identity development within the sciences differs from their AAPI peers and, additionally, the predictors for those changes are also unique to this historically and socio-politically distinct subgroup of AAPI STEM students.

Summary

This chapter described the findings for this study which utilized a combination of descriptive and inferential models to 1) test for differences between first-time first-year Southeast Asian STEM college students and their AAPI peers on various pre-college characteristics and experiences, 2) test for changes in science self-efficacy and science identity of Southeast Asian STEM college students and if these changes differed across AAPI subgroups, and 3) unpacking salient predictors for science self-efficacy and science identity of Southeast Asian STEM college students. Overall, the findings illustrated that Southeast Asian STEM college students, while sharing similar characteristics and experiences with their AAPI peers also possess a multitude of unique qualities such as differences in high school STEM preparation and relatively lower science self-efficacy at the start and end of their first college year when compared to other AAPI STEM students. Furthermore, regression analyses highlighted that, within the first year of college, there were unique salient factors specific to Southeast Asian STEM students for science self-efficacy and science identity development. In summary, these important distinctions in pre-college characteristics and experiences, in addition to experiences during college, for Southeast Asian STEM students provide novel findings that have implications

for future research, practice, and policy.

CHAPTER FIVE: DISCUSSION AND IMPLICATIONS

Utilizing a combination of descriptive and inferential quantitative tools, this study revealed key factors that support the development of science self-efficacy and science identity of Southeast Asian STEM students during their first year of college. Furthermore, by focusing on AAPI students, this study illuminated important differences on a range of characteristics and experiences between Southeast Asian students and their AAPI peers, thereby underscoring the necessity of disaggregating racial and ethnic data. Following a brief summary of the study and the theoretical perspectives that guided the methodological decisions for investigating the research questions at hand, the closing chapter of this dissertation summarizes and discusses the key findings that emerged from chapter four. The results from this study align with prior research findings while also producing novel discoveries that are specific to Southeast Asian STEM college students. This chapter also provides implications for advancing theoretical perspectives and frameworks that center Southeast Asian students, recommendations of practices that enhances the psychosocial development of these students, and suggestions for policies surrounding data aggregation and URM categorizations. This chapter concludes with guidance for future research that addresses the limitations of this study and advances scholarship that aims to understand how to improve equitable experiences and development of Southeast Asian students in postsecondary STEM.

Overview of the Study

To address the continued shortage of STEM professionals within the US (with only 18% of all bachelor's degrees conferred coming from STEM fields (NCES, 2019)), researchers have produced scholarship delineating factors that contribute to students' success within these fields. In particular, evidence supporting the salience of science self-efficacy and science identity for

STEM success has prompted scholars to explore these psychosocial constructs further for URM student (e.g., Ballen et al., 2017; Chemers, 2011). Indeed, extensive literature suggest that confidence in performing science skills and identifying as a scientist are key factors on a range of STEM outcomes for URM students (e.g., Estrada et al., 2011; Estrada et al., 2018), yet Southeast Asian students continue to be excluded from URM categorization in this line of research. This misrepresentation has mostly been driven by enrollment and degree attainment data which depicts AAPI students as "overrepresented" in higher education relative to their representation in the broader U.S. population. Yet, these educational statistics aggregate nearly 48 ethnic subgroups and obfuscate salient differences among AAPI students that mask disparities (Museus & Truong, 2009; Teranishi, 2012). In reality, Southeast Asian students have a much lower bachelor's degree attainment rate when compared to their AAPI counterparts (NCES, 2017; Teranishi, 2010). Furthermore, data disaggregation is so rare that rates of STEM degree attainment specifically for Southeast Asians are difficult to ascertain.

Given the lack of disaggregated findings on Southeast Asian students in general and in STEM, it was important for this study to unpack the unique dispositions and experiences that are associated with positive outcomes for Southeast Asian students. Considering science self-efficacy and science identity's role in forming students' interests in science-related careers (e.g., Eagan et al., 2013; Estrada, 2018; Luzzo et al., 1999) as well as the need to understand whether and how these constructs operate for Southeast Asian students, this study examined how these students compare to other AAPI subgroups on a variety of characteristics and environments, and what factors influence the development of these important constructs among AAPI students by quantitatively examining the following questions:

1. What are the academic, background, and psychosocial (e.g., science self-efficacy, science identity) characteristics of first-time, first-year Southeast Asian STEM college students? Do these characteristics differ when compared to other AAPI subgroups?

2. How does science self-efficacy change during the first year of college for Southeast Asian STEM students? Does change in science self-efficacy differ across AAPI subgroups?

3. How does science identity change during the first year of college for Southeast Asian STEM students? Does change in science identity differ across AAPI subgroups?

4. Among first-time, first-year Southeast Asian STEM students, what personal inputs (e.g., gender, race/ethnicity), environments, assets in the form of various types of capital, and learning experiences predict changes in science self-efficacy at the end of their first college year? Do the predictors of science self-efficacy vary in direction and/or salience between Southeast Asian students and all AAPI students?

5. Among first-time, first-year Southeast Asian STEM students, what personal inputs (e.g., gender, race/ethnicity), environments, assets in the form of various types of capital, and learning experiences predict changes in science identity at the end of their first college year? Do the predictors of science identity vary in direction and/or salience between Southeast Asian students and all AAPI students?

To address these research questions, this study's conceptual framework synthesized three primary theoretical perspectives that centered and guided the examination of Southeast Asian STEM college students. These three theoretical perspectives included SCCT (Lent et al., 1994, 2000, 2002), science identity (Carlone & Johnson, 2007), and CCW (Yosso, 2005). Additionally, cultural validation (Maramba & Palmer, 2014) and measurement theory (Sablan, 2019) assisted in the quantitative operationalization of CCW's forms of capital. While SCCT and science

identity were critical in the spatial and temporal placement of student experiences in addition to operationalizing the outcomes for this study, CCW and cultural validation guided the selection of unique background characteristics and experiences specific to Southeast Asian students.

Utilizing four years of longitudinal data from HERI's TFS and YFCY surveys, this study employed descriptive statistics and inferential analyses to explore differences between Southeast Asian students and their AAPI peers on a number of characteristics, experiences, and environments that were salient in science self-efficacy and science identity development. The following sections discuss the findings that emerged from this investigation.

Pre-College Characteristics and Experiences of Southeast Asian Students

In recent decades, scholars have illuminated important socioeconomic and academic differences between extremely diverse AAPI subgroups that have, for far too long, been aggregated together in national statistics and research studies (Nguyen et al., 2016; NCES, 2017, 2019; Teranishi, 2010). These diverse backgrounds and experiences of AAPI students have been influenced by a wide range of sociopolitical histories that have and continue to influence the trajectories into and experiences during college (Ngo & Lee, 2007; Takaki, 1989). Although the literature on Southeast Asian college students is still limited, higher education scholars have shed light on the true experiences of this unique ethnic group suggesting that these students enter college with vastly diverse backgrounds and pre-college experiences than those of their AAPI peers (e.g., Her, 2014; Ngo & Lee, 2007; Nguyen, 2016). In alignment with these prior findings, the results from this study illuminate how socioeconomic status, generational status, and academic STEM preparation of Southeast Asian STEM college students significantly differ from their AAPI peers.

Socioeconomic Status

This study operationalized SES through measures where students reported receiving Pell grant and/or need-based grants and scholarships. “Grants” and “scholarships” are used interchangeably in this section. Given that qualifying for these funding sources are set by federal and state guidelines, these measures offered a relatively accurate marker of SES. The results from this study showed that Southeast Asian students differed significantly from their AAPI peers in being recipients of these types of grants. More specifically, the majority of Southeast Asian students in this study reported receiving these scholarships whereas the majority of other AAPI students reported not receiving these funds. Based on prior reports and scholarly work revealing that Southeast Asians in the U.S. earn well below the average household income (among all Asians and among all Americans) (Budiman, 2021; Teranishi, 2010), these findings, although unsurprising, provide current insight on the SES of Southeast Asian STEM students attending four-year colleges and universities. It is important to emphasize that these findings are only reflective of four-year college and university students, since Southeast Asian students who tend to enroll within community college systems were not included in this study (CARE, 2010; Maramba, 2011; Xiong, 2021). Paired with the results showing that Southeast Asian STEM students expressed significantly more concern with financing their college education when compared to their East Asian and South Asian peers, these finding also suggest that Southeast Asian students may experience heightened financial stressors (Xiong, 2021) during their first year of college. For example, Yeh (2004) explains that Southeast Asian college students tend to work during college given that financial aid, such as Pell grants and need-based scholarships, may not be sufficient for covering the total cost of college. Additionally, Yeh (2004) suggests that Southeast Asian students are likely to work during college to provide financial support for their families. Taken together, Southeast Asian students’ socioeconomic status may contribute to

a range of additional stressors and responsibilities within and external to their college journey, which in turn may have direct and/or indirect effects on their experiences during college. For this reason, it is important to consider how SES may differentially affect Southeast Asian students considering that their unique cultural values (Blair & Qian, 1998) emphasize the importance of supporting their family while pursuing a college career.

Generational Status

Approximately three-quarters of Southeast Asian students in this study identified as continuing generation college students. At first glance, this finding is somewhat unexpected since scholars suggest that Southeast Asian students are typically the first in their family to attend college (Maramba et al., 2018; Yeh, 2004). Furthermore, a majority of Southeast Asians entered the U.S. during the mid-to-late 1970s as refugees with low levels of educational attainment (Takaki, 1989: Yeh, 2004). Additionally, national statistics reported for 2016 suggest that these levels of educational attainment for Southeast Asians continue to remain disproportionately lower than their AAPI peers (NCES, 2017). Taken together, I expected a higher proportion of Southeast Asian students in this study to identify as first-generation college students. Yet consideration must be given to the fact that this study focused on students who attended four-year colleges or universities. Given that Southeast Asian students tend to enroll within community college systems (CARE, 2010; Maramba, 2011; Xiong, 2021), generational status may look different for Southeast Asian college students attending other institutional types. Furthermore, it is a plausible that within the past four decades, since attending college has become an important cultural value for the Southeast Asian diasporas (Blair & Qian, 1998; Maramba et al., 2018), we may yet see an upward trend of continuing generation Southeast Asian students attending college. Furthermore, given that response bias exists in survey-taking

(Sax, Gilmartin, Lee, & Hagedorn, 2010), it is also possible that continuing generation students may have been oversampled within these survey administrations due to self-selection bias (i.e., the greater likelihood of continuing generation students to respond to a survey about college). Still, within the scope of this study, consideration must be given to the fact that the proportion of Southeast Asian STEM students who were first-generation was significantly higher than among East Asian, Filipina/o/x, and South Asian students. Thus, the differences in generational status between Southeast Asian students and their AAPI peers suggests a need to provide tailored resources that enhances Southeast Asian students' ability to access resources that support their adjustment to college.

Access to Computing Courses During High School

The results of this study show that Southeast Asian students completed an equivalent numbers of years in high school math, biological sciences, and physical sciences to that of their AAPI peers. Yet, Southeast Asian students are completing fewer years of computer science upon entering college when compared to their East Asian and South Asian peers. While this study is unable to speak to whether this completion rate is related to an issue of access (e.g., high school course offering, knowledge about the availability of these courses), it is important to note that this may have implications for Southeast Asian students who wish to pursue majors or careers in computing fields.

Early Predictors of Science Self-Efficacy among Southeast Asian Students

With an understanding of the characteristics and experiences that Southeast Asian students entered college with, a research design was implemented to examine if science self-efficacy changed during the first year of college for these students and if these changes differed from their AAPI peers. This research design also allowed for the extraction of a salient set of

predictors for science self-efficacy of Southeast Asian students and, further, showed that a distinct set of predictors emerged when Southeast Asian students were aggregated with their AAPI peers. Thus, these findings provide evidence that are unique to Southeast Asian students which, in turn, may be utilized to leverage resources for and be applied to practices for this group of students.

Changes in Science Self-Efficacy During the First Year of College

While the results presented in this study suggest that AAPI students' science self-efficacy significantly decreased during the first year of college, the disaggregated findings illuminated that Southeast Asian students actually sustained their confidence in their ability to perform science-related tasks. While one might suspect that science self-efficacy would grow during the first year of college for STEM students, sustaining one's confidence may be just as important as improving it for developing and/or maintaining integration into scientific communities (Estrada et al., 2011), especially if STEM students are already entering college with a relatively high level of science self-efficacy and the intent to pursue a science-related career (Estrada et al., 2019). Generally, this finding speaks to the consequence of examining AAPI students as unique subgroups with diverse experiences that differentially influences their development during college. Specifically, this finding underscores the importance of utilizing research tools to unpack descriptive results and, in this case, to better understand how Southeast Asian students are sustaining their confidence in science which is discussed next.

Fostering Science Self-Efficacy During the First Year of College

In examining what factors were salient in developing science self-efficacy of Southeast Asian STEM students during the first year of college, findings point to a range of traditional experiences and environments (as suggested by SCCT) and assets and community support (as

suggested by CCW) that are critical in sustaining science self-efficacy. Importantly, pre-college science self-efficacy emerged as the strongest predictor of students' science self-efficacy at the end of their first year of college. While there is expansive literature that describes the positive relationships between science self-efficacy and a variety of STEM-related outcomes (e.g., intent to pursue a science career, grades) (e.g., Ballen et al., 2017; Chemers et al., 2011; Estrada et al., 2018), there are few studies examining how science self-efficacy develops during the first college year, which extensive scholarship explains as being an important year for student development (e.g., Reason et al., 2006; Kim, 2009; Stebleton, Soria, & Albecker, 2012). As such, this finding advances knowledge in this area of research by suggesting that fostering students' initial science self-efficacy and supporting the sustainment of this confidence, especially during the first year of college, has important implications for Southeast Asian STEM students.

Building Community with Faculty and Peers Within the Classroom

In unpacking the types of *learning experiences* that illicit science self-efficacy development within the classroom, faculty and peers emerged as important players for Southeast Asian students. Specifically, faculty who created environments where students felt that their contributions mattered, felt that they were encouraged to ask questions and participate in discussions, felt that they were provided with feedback that helped them assess their progress in class, and felt that they were given opportunities to work with classmates on group projects provided Southeast Asian students with a space to foster their confidence in science. While these findings speak to the learning experiences that influence self-efficacy development as suggested by SCCT, CCW and prior scholarship may help to explain why these environments are important for these students. Past studies have illuminated that it is rare that parents of Southeast Asian

students are able to provide educational guidance (e.g., Blair & Quin, 1998; Maramba et al., 2018; Yeh, 2004) so Southeast Asian students build communities with and receive guidance from teachers and counselors (Maramba et al., 2018). Furthermore, research suggests that Southeast Asian students are more likely to interact with faculty when they perceive that faculty provide supportive environments within the classroom (Vang, 2018; Xiong, 2021; Xiong et al., 2021). Taken together, implementing pedagogical practices that provide opportunities to enhance connection and community building with faculty and peers are important in growing Southeast Asian students' confidence within the sciences.

Including Family Within the College Experiences of Southeast Asian Students

Scholarship that exists on Southeast Asian students provides empirical evidence on the importance of family, especially parents, in the college choice process (e.g., Maramba et al., 2018; Ngo and Lee, 2007). With these prior findings, it was unsurprising to find that garnering support from family for their success would be salient in their development. What was rather counterintuitive was that students who felt that their families supported their success had a negative relationship with the expected development of science self-efficacy. Put another way, when Southeast Asian students felt that their family supported them to succeed, they were expected to decrease in their confidence to perform science-related tasks. While this finding may seem counterintuitive, it is important to emphasize that this finding may be due to a suppressor effect with classroom faculty support as indicated in Chapter 4. Still, given that the simple correlation between family support and science self-efficacy was negative, I will offer some possible explanations for interpreting this result. First, prior scholarship suggests that family are important in the lives of Southeast Asian students. For example, Southeast Asian parents provide educational support for their children by fostering a college-going culture (e.g., Blair and Qian,

1998). Additionally, Southeast Asian students may seek guidance from other family members such as older siblings or cousins for guidance about college (Maramba et al., 2018). With all of these considerations, it is important to think about from who this family support predominantly comes from (e.g., parents, siblings) and in what ways this support may manifest. For example, the type of support that Southeast Asian students receive from family may inadvertently lead to more pressure to succeed in fear of disappointing their family and, therefore, mediate a decline in science self-efficacy. Another possible explanation for this inverse effect between family support and science self-efficacy could be that Southeast Asian students may explore other career options beyond STEM during their first year of college. Within this exploration, less time and space may be given to developing their science-related skills and, therefore, may lead to a decline in their science self-efficacy. Furthermore, it is possible that Southeast Asian STEM students who are more confident in their science skills may seek additional support from their family to bolster their success. In any case, there are important implications that stem from this finding that are discussed later in this chapter.

Tapping into Resistant Capital to Navigate College

The final salient predictor for science self-efficacy development of Southeast Asian students emerging from this study was a form of resistant capital whereby students utilize their assets to overcome obstacles. Specifically, the results show that students entering college with assets to adjust to the academic demands of college were expected to improve their science self-efficacy. This form of resistant capital is formed prior to entering college and are uniquely influenced by the communities that Southeast Asian students grew up in (Yosso, 2005). Synthesizing CCW and prior literature on Southeast Asian students, it is possible that Southeast Asian students developed this form of capital through the support of their family. Prior literature

suggests that Southeast Asian parents place college in high regard, hoping that their children will not have to endure the challenges they faced (Blair & Quin, 1998; Maramba et al., 2018). As such, this motivation manifests in the form of resistant capital whereby Southeast Asian students persevere through obstacles and barriers presented by college environments, especially those of traditional systems.

Early Predictors of Science Identity Among Southeast Asian Students

Similar to the investigation conducted for science self-efficacy in this study, a research design was implemented to examine if science identity changed during the first year of college for these students and if these changes differed from their AAPI peers. While science identity was not included as a possible predictor of science self-efficacy development, science self-efficacy was included as a potential predictor for science identity (as explained by the conceptual framework of this study). Other than this difference, the models utilized for examining science identity included the variables that were found in the science self-efficacy models. Much like the models for science self-efficacy, two unique sets of predictors emerged for the models implemented for science identity.

Changes in Science Identity During the First College Year

The results presented in this study show that AAPI students' science identity significantly decreases during the first year of college. When findings were disaggregated for each AAPI subgroup, these decreases held for Southeast Asian, East Asian, and Filipina/o/x students. Importantly, Southeast Asian students experienced a statistically significant larger decrease when compared to their East Asian peers. Much like science self-efficacy, one might suspect that science identity would grow during the first year of college for STEM students. Yet, it is important to consider that Carlone and Johnson (2007) propose that the interplay amongst

performance, recognition, and competence are critical in developing and maintaining science identity. Translated, science identity is informed by the utilization of science-based tools to form social connections, giving oneself and receiving acknowledgement within the field of science, and building content knowledge within the sciences. Thus, it is expected that changes in science identity are potentially influenced by a separate set of factors than those for science self-efficacy.

Similar to prior scholarship on science self-efficacy, scholars have extensively studied the importance of science identity for a number of success outcomes within STEM. Yet, the literature is scant on how this psychosocial construct operates for Southeast Asian students and further have yet to identity key background characteristics, experiences, and assets that are associated with the development of science identity for these students. The emergent findings from this study illuminate unique factors that are important in the development of science identity for Southeast Asian students. Specifically, findings revealed that pre-college science identity, confidence in financing college, and science self-efficacy were all related to growth in science identity.

The Importance of Science Self-Efficacy and Community in the Development of Science Identity

The results showing science self-efficacy as a positive predictor of science identity aligns with the conceptual framework of this study which suggests that science self-efficacy has a direct relationship with science identity (as an outcome expectation) and also aligns with prior research that frequently pairs science self-efficacy and science identity together to examine various STEM outcomes (Estrada et al., 2011; Estrada et al., 2018; Merolla & Serpe, 2013). Specifically, research shows that science self-efficacy is both correlated to and predictive of science identity, especially for URM students (Estrada et al., 2011; Estrada et al., 2018; Merolla & Serpe, 2013). Yet, it is important to understand how this operates for Southeast Asian students. For example,

science self-efficacy may directly interact with students' performance and competence (as described by the model for science identity) (Carlone & Johnson, 2007) to improve science identity. An important part of building performance is utilizing science-based tools to build social connections. Furthermore, prior research and findings from this study suggest the importance of community building (especially within the classroom) for Southeast Asian student development. Given the circumstances, it can be speculated that science self-efficacy may prompt Southeast Asian students to utilize their science-based tool to build community and, thereby, enhancing their science identity. Furthermore, fostering confidence in science may lead to heightened competence (or desire to improve content knowledge within the sciences), which in turn also enhances science identity. What is additionally interesting is that science self-efficacy was a stronger predictor than pre-college science identity when Southeast Asian students were examined separately and in the aggregate which warrants future research to investigate why this type of relationship occurs between these two constructs.

The Relationship Between Financial Stressors and Domain-Specific Identities

The other positive predictor of science identity was Southeast Asian students' concern with financing college. Although this predictor was positive, it is important to note that this finding translates as Southeast Asian students who felt greater concern in financing college were expected to improve in their science identity. As has been extensively discussed in this study, Southeast Asians tend to come from families whose income is below the national average (Teranishi, 2010). Furthermore, a majority of Southeast Asian STEM students enter college and receive Pell grants and/or need-based grants and scholarships. Prior literature on Southeast Asian college students illuminate that their experiences are influenced by financial stress (Xiong, 2021) and responsibility to financially assist their families (Yeh, 2004). Taken together, it is possible

that Southeast Asian students may discover STEM careers as financially lucrative opportunities that would better support their families and, thus, may see an increase in their science identity as they begin to see themselves within these fields. It is also possible that taking on additional responsibilities beyond their college experiences provides these students with less time to engage with their science communities leading to a decrease in their sense of membership within the sciences. As such, it is important to acknowledge the unique contexts of Southeast Asian STEM students to better support their identities within the sciences.

Noteworthy Non-Significant Results

Across science self-efficacy and science identity, it is important to discuss two predictors that were not significant in predicting changes in science self-efficacy or science identity. First, citizenship status was not salient in explaining changes in either of these factors. This is important to consider given the differing sociopolitical histories that inform the pre-college experiences of domestic and international Southeast Asian students. Although research suggests that citizenship status is important in the differing experiences and outcomes of college students (Shalka, 2016; Soria & Johnson, 2017; Zhao, Kuh, & Carini, 2005), the results from the present study show that it was not associated with the development of science self-efficacy or science identity.

Additionally, given that prior research suggests that Southeast Asian students' racialized experiences during college are heightened by negative racial/ethnic stereotyping (Nguyen et al., 2016), it was surprising to find that perceptions of racial tension on campus were not significant among Southeast Asian students for either of these outcomes. This is even more surprising given that racial tension negatively predicted science self-efficacy for AAPI students in the aggregate. Future research will hopefully aim to unpack this phenomenon, though it is possible that the non-

significance of racial tension for Southeast Asian students may be due to small sample size.

Summary of Key Findings

In summary, scholars have thoroughly examined science self-efficacy and science identity as an important factor for a wide range of STEM success markers such as STEM persistence and heightened interest in pursuing a science-related career (e.g., Estrada et al., 2018; Larose et al., 2006). While scholars have advanced knowledge about the importance of these two science-related psychosocial constructs for underrepresented minority students within STEM, Southeast Asian students have continued to be understudied in this area (e.g., Estrada, 2018; Merolla & Serpe, 2013). Furthermore, while there is expansive literature on science self-efficacy and science identity as a predictor and/or mediator for various STEM success markers, few studies have examined factors that contribute to the development of these two factors. To ameliorate these two deficiencies within this area of research, the findings that emerged from this study provide insight on science self-efficacy and science identity for Southeast Asian STEM students and what background factors, experiences, and assets are salient for the development of science self-efficacy for these students. Particularly, pre-college science self-efficacy, feeling supported by faculty within the classroom, working with classmates on group projects, and having resistant capital to adjust to the academic demands of college were all related science self-efficacy development. Surprisingly, results suggest that feeling supported by family to succeed is associated with a decline in science self-efficacy. Lastly, pre-college science identity, concerns with financing college, and science self-efficacy were predictive of science identity development.

Implications for Theoretical Perspectives and Frameworks that Center Southeast Asian Students

Although Southeast Asian students have been severely understudied in higher education, the scholarship that does exist reveals valuable information about the unique characteristics and experiences of this group of students. This advancement in the literature on Southeast Asian students has illuminated that family members are influential in their educational trajectory into and through college (e.g., Blair & Qian, 1998; Maramba et al., 2018). This emphasis on family, and the cultural expectations and strengths that come from these connections, bears many resemblances to the forms of cultural assets (e.g., aspirational capital, aspirational capital) described by Yosso's (2005) CCW. Thus, given the need to incorporate theoretical perspectives that best center the experiences of Southeast Asian college students, this study synthesized a conceptual framework that incorporated traditional perspectives (to account for the traditional college-going nature of the students in this study's sample) and lenses which emphasized distinct factors that would potentially be salient for Southeast Asian student development. Together, this study's framework and the associated findings provide important implications for how SCCT (Lent et al., 1994, 2000, 2002), science identity (Carlone & Johnson, 2007), and CCW (Yosso, 2005) may advance future investigations of Southeast Asian students.

First, SCCT and science identity provided broad perspectives on key characteristics, environmental influences, and learning experiences that were potentially salient for science self-efficacy and science identity development, and additionally guided the operationalization of these two outcomes. While SCCT has been utilized extensively in quantitative research (e.g., Cardoso et al., 2013; Carpi et al., 2017; Fouad & Santana, 2016; Moakler & Kim, 2013), its application on this study's sample of Southeast Asian students provides important insights about this group. Specifically, the results from this study suggest that Southeast Asian students' confidence in their science skills are enhanced by learning experiences within classrooms where

faculty provide support and opportunities for working with peers. Taken together, while there are various types of learning experiences that students may take part in during college, the findings from this study point to the importance of learning experiences that are bolstered by the facilitation of supportive and collaborative classroom environments for Southeast Asian students.

Further, this study also integrated CCW to guide the inclusion of non-dominant forms of capital (Sablan, 2019; Yosso, 2005) that were potentially salient for Southeast Asian students' college development. Given that CCW has primarily been used to frame qualitative inquiries, this study utilized factor analysis to operationalize the various forms of capital as described by CCW (Sablan, 2019). Although this study was unable to fully implement Sablan's (2019) validated factors for CCW due to the secondary nature of the data, familial capital and resistant capital emerged as salient predictors of science self-efficacy for Southeast Asian students. Additionally, the non-significance of aspirational capital, navigational capital, social capital may suggest that these factors are less salient for first-year Southeast Asian students attending four-year colleges and universities.

Of note, regression analysis showed that familial capital was negatively associated with change in science self-efficacy. While this finding should not detract from the important assets that Southeast Asian students gain from family members (as prior literature has illuminated), it does complicate frameworks that seek to quantify counternarratives such as CCW. In the case of this study, familial capital was operationalized through three measures related to interactions with and feeling supported by family whereas Sablan's (2019) operationalization of familial capital included eight measures. While this study revealed a negative relationship between familial capital and science self-efficacy, it is possible that a different relationship may have emerged if familial capital was operationalized differently. Taken together, given the scantiness

of quantitative research that utilizes CCW, it is important that future quantitative inquiries guided by CCW strives to 1) assess the capacity of an instrument's ability to validate CCW, 2) ensure that the operationalization of CCW is tailored to the specific group that is being studied and 3) utilize the appropriate quantitative tools to apply CCW frameworks.

Lastly, upon interpreting the results from this study, a unique and dynamic relationship emerged amongst science self-efficacy, science identity, and community cultural wealth. In particular, the salience of science self-efficacy for science identity development could be explained by linking the concept of confidence to the performance and competence constructs of science identity (Carlone & Johnson, 2007). Put another way, the framework in this study would describe that having confidence in science would be associated with the utilization of science-based tools and improving content knowledge within the sciences. What is additionally interesting are the community-based components described within the performance and recognition constructs of science identity emphasizes the importance of making social connections and feeling recognized by others. Given that CCW describes the importance of building community and utilizing these community assets to champion systemic barriers, it is important to consider that this conceptual framework may have implications for advancing quantitative research designs that aim to investigate why certain phenomena occurs within STEM, especially for Southeast Asian students.

Implications for Student Affairs Practice

Postsecondary institutions are an excellent training ground for fostering and developing STEM professionals, especially when environments and experiences are tailored to the unique needs of diverse students. Specifically, strengthening science self-efficacy and science identity of students, especially for those who are underrepresented within STEM, have been found to

mediate and directly influence a wide range of outcomes such as intent on pursuing a science-related career (Estrada et al., 2018). Specifically, the results from this study suggest that Southeast Asian STEM students enter college feeling confident that they can complete science-related tasks. Furthermore, these students also enter college with a heightened sense of science identity. The findings from this study highlight the importance of peers, faculty, institutional support, and family in sustaining confidence and identity within the sciences for Southeast Asian students and, thus, this section provides recommendations for practice within these areas.

Support Within the Classroom

In terms of peer support, Southeast Asian students benefit greatly from participating in learning experiences where they have the opportunity to work with classmates on group projects. This may speak to the keen sense of community that Southeast Asian students establish prior to entering college and, thus, excel when these communities are fostered within the classroom. Considering that these findings are specific to the first year of college and the experiences examined within this study may have taken place during introductory courses, implementing pedagogical practices that exemplifies group work within these introductory STEM courses may strengthen science self-efficacy. To enhance this form of peer support, STEM departments may consider paired-teaching opportunities where more advanced students who have completed these introductory-level courses can assist in the development and implementation of group-based assignments and projects. The incorporation of advanced students within these introductory course during the formative year of college could offer unique insight since these students would be closer in year to new students and may be able to connect with them on a different level. In line with this recommendation, Micari and Pazos (2021) conducted a study that examined the effects of peer-led group learning that enhances collaborative learning environments within

STEM. Their findings suggest that these types of learning environments, indeed, improve course self-efficacy. Furthermore, Drane, Micari, and Light (2014) conducted a study that implemented small-group peer-led sessions (outside of the classroom) to solve problems related to STEM course material. The findings from this study suggest that students who participate in these group experiences performed better in their STEM courses when compared to students who did not participate in this program. While these two studies did not examine the relationship between peer support and science self-efficacy and science identity development, it does underscore the importance of peer relationships within STEM for other outcomes such as course grades.

In terms of faculty support, Southeast Asian students' confidence in completing science-related tasks are strengthened when they feel that faculty provide validation by valuing their contributions, creating spaces where questions and discussions are welcomed, and providing feedback to enhance learning. Workshops that provide tools for creating inclusive learning spaces, especially for introductory course faculty, could assist in the facilitation of these environments for students (O'Leary, Shapiro, Toma, Sayson, Levis-Fitzgerald, Johnson, & Sork, 2020). Specifically, it would be valuable to offer workshops to introductory course-level faculty where they can learn how to implement pedagogical best practices that incorporate group learning. For example, STEM faculty that participate in culturally responsive teaching workshops are likely to become more aware of the differing and unique social identities of their students and acknowledge barriers to learning (O'Leary et al., 2020). In turn, faculty would then be able to translate these skills into creating equitable environments for their diverse students (O'Leary et al., 2020).

Support Beyond the Classroom

When Southeast Asian students feel that they can adjust to the academic demands of

college, develop effective study skills, and manage their time effectively, they are more likely to sustain or improve their science self-efficacy. Given that the transition to postsecondary education may bring many new challenges, it is important for institutions to provide their students with continual guidance and direction about resources and spaces that can enhance their ability to navigate college. For example, Palmer and Maramba (2015) suggest that Southeast Asian college students tend to seek institutional agents (e.g., counselors, peers), organizations, and student services that provide them with guidance to adapt to and navigate through college environments. As such, these resources can be shared and encouraged during pre-existing programs such as student orientation, first-year seminars, during classes, during advising meetings, and through department-wide emails. Implementation of this practice may be enhanced when students are continually reminded that these resources are available. Furthermore, these resources are especially important to consider for Southeast Asian students given that they may have responsibilities outside of school to address (Yeh, 2004), therefore, incorporating skill building and time management within several environments (such as in the classroom and during advising meetings) may enhance their ability to navigate their first year of college.

Including Family in Students' Educational Journey

The literature that exists on Southeast Asian students point to the significant role of family, especially parents, in the college experience of Southeast Asian students. For example, students seek to maintain communications with their parents, especially during the first year of college (Sax & Weintraub, 2016). Chang, Heckhausen, Greenberger, and Chen (2010) describe college students as having some form of shared agency, defined by parents acting as co-managers within their educational journey. Specifically, Southeast Asian students tend to agree

that their parents take on an accommodating role where students take greater responsibility in the choices they make about their educational decisions (Chang et al., 2010). Furthermore, Harper, Zhu, and Kiyama (2020) suggest that parents of first-generation college students feel comfortable with leveraging their students' independence when institutions provide resources such as campus tours, orientations, and offices such as a Parent Relations Office to alleviate concerns that parents have about their students' transition into college. Scholarship also suggests that among first-generation students, parents hope to maintain communications with their student while they are away at college (Chang et al., 2010; Roksa, Silver, Deutschlander, Whitley, 2020). The support that Southeast Asian students receive from their parents is vital to their success, yet there are opportunities to include parents to ensure that the support does not develop into an unintentional stressor. For example, students may convert their parent's support for their success into an unmanageable form of pressure. To help bridge this understanding, institutions could incorporate opportunities for parents to attend events, such as orientation programs and/or parent-family weekends, where they learn more about their students' programs (Ward-Roof, Heaton, & Coburn, 2008). The information from these sessions could range from explaining time commitments of a college student to describing the potential careers that their students are able to pursue with their degrees with the goal to assist parents with their students' transition to college (Ward-Roof et al., 2008). It is important to note that these sessions are not meant to deter Southeast Asian students from giving up familial responsibilities (Yeh, 2004), but instead help parents to understand and support potential stressors and pressures that their students may experience while attending college. Lastly, it is important that these opportunities are offered throughout the tenure of their students' college career since consistent support would be beneficial to both parties.

Implications for Local, State, and Federal Policy

While the development of policy reform was not a major goal of this study, two major recommendations emerged from the synthesis of prior scholarly work which was then bolstered by the findings of this study. In terms of allocating resources for research and practice, specifically for Southeast Asian students whose position as URM students continue to float in obscurity, it is important for policymakers to revisit and re-assess current disaggregated enrollment and degree attainment data. Additionally, policymakers should utilize the findings from recent scholarship on Southeast Asian college students' to better understand the needs and experiences of these students. Utilizing these current forms of empirical evidence, policymakers can provide leverage to push for a federally updated definition of URM within STEM to include Southeast Asian students. This is especially important since there is currently no consensus on whether Southeast Asian students should be included in a universally accepted definition of URM. For example, some federal agencies that provide funding for research and practice aimed to improve representation and equity within STEM still exclude Southeast Asian students. Within research, scholars differentially include and exclude Southeast Asian students from their definition of URM. Taken together, consideration for updating the definition of URM to include Southeast Asian students across federal agencies that aim to diversify STEM could have a trickle-down effect which would be a major step in improving diversity for and advancing knowledge about this group of students.

As Southeast Asians students continue to be ambiguously included and excluded in diversity and equity efforts, these students may continue to be ineligible for postsecondary STEM programs, scholarships, and/or fellowships aimed to support underrepresented students. For example, NIH (2019) offers undergraduate research training grants focused on improving

representation within these fields. While NIH does not explicitly state that Southeast Asian students are an ethnic group that are underrepresented in health-related sciences, this agency does state that, "it is recognized that underrepresentation can vary from setting to setting; individuals from racial or ethnic groups that can be demonstrated convincingly to be underrepresented by the grantee institution should be encouraged to participate in NIH programs to enhance diversity" (NIH, 2019, Notice NOT-OD-20-031). Thus, while Southeast Asian students are not entirely excluded as an underrepresented racial/ethnic group for this specific grant, additional efforts must be taken to convince these agencies that these students are, indeed, underrepresented.

Furthermore, it is especially important for policymakers to prioritize the inclusion of Southeast Asian students as an underrepresented minority group to align with the efforts of Asian American and Native American Pacific Islander-serving institutions (AANAPISIs) (U.S. Department of Education, 2022). Although AANAPISIs are federally recognize and supported in their efforts to serve these unique population of students, the misalignment between AANAPISIs and other federal agency's definition of diversity and underrepresentation may impede the ability of AANAPISIs to apply for funding and secure support for reaching their goals.

The second recommendation is related to disaggregating racial/ethnic data for AAPI students. While many federal agencies have and continue to collect disaggregated data on a number of measures such as household income, educational enrollment, and educational attainment, there is still a need to understand these growing trends within STEM. Providing statistics on STEM enrollment and degree attainment, by ethnic subgroups, provides a more accurate representation of the STEM landscape and additionally provide leverage and direction for future research and practice that serves underrepresented students.

Future Research

The emergent findings from this study advanced scholarship on the early college experiences of Southeast Asian STEM college students and how these experiences, in combination with their pre-college characteristics and experiences, were associated with changes in their science self-efficacy and science identity. Yet, there were various limitations related to the data sources utilized, the quantitative operationalization of CCW, the sampling of students, the institutions included, and the aggregation of AAPI racial/ethnic data. These limitations and the associated recommendations for future research are described below.

Student Experience During the Covid-19 Pandemic

This study utilized secondary data from 2016-2020. As such, data collected from students between 2019 and 2020 were influenced by a global pandemic that disrupted student learning and transitions. Given that prior scholarship has illuminated the importance of first-year experiences on students' college transitions and subsequent successes, the experiences of students who transitioned into their first year of college or completed their first year of college during a global pandemic may have differed from the experiences of those who completed their first year of college in person (or prior to the start of the Covid-19 pandemic). Taken together, future research should consider the effects of a global pandemic on the development of Southeast Asian STEM students' science self-efficacy and science identity and how these developmental experiences may differ from the experiences of pre-pandemic college students.

Utilization of Data Sources that Exemplify the Quantification of CCW

As described in the study's conceptual framework, CCW is often utilized in qualitative research to allow for a deeper understanding of the systemic barriers that typically ignore the community assets that bolsters the development and experiences of Students of Color. The

decision to include CCW in this study's conceptual framework was prompted by its alignment with specific research findings about the salience of community for Southeast Asian college students. In regard to CCW, future research should examine the development of science self-efficacy and science identity utilizing qualitative methodologies to get at deeper stories that can explain systemic issues that arise for Southeast Asian students. When considering future quantitative research that builds upon the findings of this study, I recommend the development of a new instrument that is guided by Sablan's (2019) recommendations to utilize measurement theory to encapsulate each form of community capital suggested by CCW. Due to this study's use of secondary data that was not guided by CCW, the factors for CCW that were developed for this study did not provide as deep of an explanation as recommended by Sablan's (2019) measures. Furthermore, Sablan (2019) argues that there is space to advance research that synthesizes CCW, and quantitative methods and future research should build upon these recommendations.

Improving Sampling Methods and Investigating Non-Traditional Institutions

The study revealed some surprising findings in relation to the relatively low proportion of Southeast Asian students identifying as first-generation. One explanation was that this study focused exclusively on traditional college-going students meaning that the students in this study's sample entered a baccalaureate-granting institution immediately after completing high school, which may have been influenced by having family members who attended college before them. A few recommendations for future research may help to address this limitation. First, a replication of this study that includes community college students is important to consider since prior research suggests that Southeast Asian are more likely to attend a community college after high school when compared to their AAPI peers (CARE, 2010; Maramba, 2011). Given this

representation within community colleges, it is important to understand how science self-efficacy and science identity develops for this particular group of Southeast Asian students. Second, the secondary data utilized in this study came from four years of data to enhance sample sizes, yet the final sample was still relatively low. In combination with the other recommendations presented in this section, future research should push to collect data from larger samples and ensure that there is sufficient variability across background, environmental, and experiential measures that are collected. This bolsters the statistical power and potential generalizability of findings for these students.

The Further Disaggregation of Southeast Asian Students

As argued throughout this study, racial/ethnic data disaggregation is an important approach that should be considered and implemented to reveal the unique and distinct experiences and challenges of an ethnically and culturally diverse students. Although this study ameliorated this problem by disaggregating AAPI students into seven distinct subgroups, there are nearly 48 diverse ethnic groups that exists within the AAPI aggregate (Teranishi, 2012). As such, future research should investigate science self-efficacy and science identity further for each of the diasporas that are categorized under Southeast Asian. These groups include, but are not limited to Burmese, Cambodian, Hmong, Lao, Thai, and Vietnamese students. Although these ethnic groups may share similar sociopolitical histories in regard to their relocation into the U.S., they also experience diverse cultural backgrounds, norms, and challenges (Ngo & Lee, 2007). Much like a unique set of predictors emerging for Southeast Asian students when compared including this students in the aggregated AAPI category, my assumption is that each diaspora within the Southeast Asian subgroup have their own distinct set of factors that contribute to their science self-efficacy and science identity development. Further, these future investigations could

potentially lead to the formation of distinct theoretical perspectives and frameworks that may assist in explaining their experiences. Lastly, whereas this study utilized two regression models (since the purpose was to center Southeast Asian student experiences), one that included only Southeast Asian students and one that included all AAPI students, future research should include additional models for a more nuanced comparison amongst all AAPI subgroups.

Investigating the Relationship Between Family Support and Self-Efficacy

One of the most intriguing findings from this study was the negative relationship between families' support for their students' success and the development of students' confidence in completing science-specific skills. Yet, further investigation into this negative relationship suggests that a suppressor effect with classroom faculty support and/or multicollinearity may have occurred. Given that prior research has suggested that families and faculty are critical in the educational journey of Southeast Asian students, future research should investigate this relationship further. Given that this finding emerged from a quantitative research design, a qualitative approach would be ideal for unpacking the complexities of this relationship. Importantly, these future studies should aim to include families and students within their research design to allow for an optimal synthesis of stories that could be explain this relationship.

Advancing Knowledge on Science Self-Efficacy and Science Identity

To advance knowledge on science self-efficacy and science identity, there are four recommendations that can be offered based on the findings of this study and on existing scholarship. First, these two psychosocial constructs are typically examined as predictors for a wide range of STEM-related outcomes, yet the literature is scant on how these constructs develop for college students. The present study was able to elucidate how these two factors develop during the first college year, yet there is still much to unpack on how these constructs

develop during students' entire college career. As such, future research should investigate the changes in science self-efficacy and science identity over the course of college. Furthermore, as future research explores these changes, it is important to consider how these two constructs inform each other. While research exists that provides evidence that these two constructs are significantly related (e.g., Estrada, 2011; Merolla & Serpe, 2013), there is scant literature examining the magnitude that each of these constructs have on each other as evidenced by the findings of this study which suggest that science self-efficacy was stronger than pre-test science identity as a predictor for science identity.

The second recommendation for future research focuses on scoring science self-efficacy and science identity. While studies have utilized these two constructs as validated factors that are created from several measures, there is a dearth of research that analyzes "how much" science self-efficacy and science identity are salient for outcomes. Put another way, future studies may want to consider if there are cut points (e.g., low, average, high) for these two constructs and how they change over the course of time.

Third, future research should investigate the salience of science self-efficacy and science identity on STEM-related outcomes for Southeast Asian students. While this study focused on how science self-efficacy develops for Southeast Asian students, prior research suggests that science self-efficacy and science identity are crucial factors for a range of outcomes within the sciences (e.g., Estrada, 2011), yet these studies typically exclude Southeast Asian students. Furthermore, given the importance of community cultural wealth in the experiences of Southeast Asian students, it would be important not only to understand if science self-efficacy and science identity are salient predictors of STEM success of Southeast Asian students, but also how the significance of these two salient construct compare to the cultural assets that these students enter

college with or how these constructs and assets are related.

Finally, future research should unpack the relationship between science self-efficacy, science identity, and STEM persistence. While one may argue that science self-efficacy and science identity would improve during the first college year, the decreases in these psychosocial factors during the first year of college may potentially be related to students' departure from STEM. Specifically, it would be important to understand if science self-efficacy and science identity decreases because Southeast Asian students are leaving STEM or if leaving STEM is what leads to a decline in these psychosocial constructs. These future findings would contribute to a better understanding of how to better serve Southeast Asian STEM students.

Conclusion

This study aimed to contribute to the growing scholarly work on the postsecondary experiences of Southeast Asian students. More specifically, the findings from this dissertation advances knowledge on the development of science self-efficacy and science identity of Southeast Asian STEM college students during their first year of college. Furthermore, the present study provides a better understanding about the unique dispositions and experiences of Southeast Asian students and that these factors, indeed, differ from their AAPI peers. As such, this study adds to the growing evidence that racial/ethnic data on AAPI students should be disaggregated in data collection and analyses, when possible.

The results that emerged from the quantitative methods employed in this study also underscore the importance of community building and team-based learning as salient contexts for the positive development of Southeast Asian STEM students during their first year of college. In particular, building confidence in completing science-related tasks and identifying as a scientist were associated with classroom environments where faculty provided spaces for

engagement and collaboration. These types of learning experiences may function as an extension of the strong community that Southeast Asian students built with their families prior to entering college and fostering these community assets within the classroom seem to improve their development. Yet, it is important to emphasize that these findings are specific to Southeast Asian students who attended four-year colleges and universities at the start of their college career and are not wholly representative of the postsecondary educational experiences of all Southeast STEM college students.

As researchers and practitioners within the arena of higher education continue to investigate factors that contribute to the improvement of diversity and equity within STEM, it is important that future research and the application of prior scholarship complicates and challenges the methods in which information has been generated over the past few decades. In the case of this study, preparing Southeast Asian students to become future STEM professionals and leaders requires the acknowledgment of a distinct sociopolitical history that heavily influences how Southeast Asian students learn and make decisions about college, how their community cultural assets strengthen their adjustment to and experiences in college, and the types of environments that bolster their successes.

APPENDIX A

Additional tables.

Table A.1

ANOVA Results for Academic, Background, and Science-Related Psychosocial Characteristics of First-Time First-Year Southeast Asian STEM College Students and their AAPI Peers

Variable	**Sum of Squares**	***df***	**Mean Square**	***F***	***p*[a]**	**Welch[a]**	**Brown-Forsythe[a]**
Concern with ability to finance your college education x AAPI subgroup	14.419	6	2.403	6.600	***	***	***
Years of HS math completed x AAPI subgroup	3.340	6	0.557	0.901			
Years of HS physical sciences completed x AAPI subgroup	31.386	6	5.231	2.377	*	*	
Years of HS biological sciences completed x AAPI subgroup	14.139	6	2.357	1.941			
Years of HS computer sciences completed x AAPI subgroup	61.983	6	10.331	5.861	***	***	***
Pre-college science self-efficacy x AAPI subgroup	3630.735	6	605.123	7.000	***	***	***
Pre-college science identity x AAPI subgroup	1409.712	6	234.952	4.201			

[a] Significance: *p<0.05, **p<0.01, ***p<0.001

Table A.2

ANOVA Results for Changes in Science Self-Efficacy and Science Identity of First-Time First-Year Southeast Asian STEM College Students and their AAPI peers

Variable	**Sum of Squares**	***df***	**Mean Square**	***F***	***p*[a]**	**Welch[a]**	**Brown-Forsythe[a]**
Change in science self-efficacy	132.593	6	22.099	0.210			
Change in science identity	1070.346	6	178.391	2.852	**	*	*

[a] Significance: *p<0.05, **p<0.01, ***p<0.00

APPENDIX B

Surveys for 2016 TFS and 2017 YFCY are attached here (full surveys and codebooks for 2017, 2018, 2019 TFS and 2018, 2019, and 2020 YFCY can be found at: https://heri.ucla.edu/instruments/)

2016 CIRP Freshman Survey

PLEASE PRINT IN ALL CAPS YOUR NAME AND PERMANENT/HOME ADDRESS (one letter or number per box).

NAME: FIRST | MI | LAST

ADDRESS:

CITY: | STATE: | ZIP: | COUNTRY, if NOT USA:

STUDENT ID# *(as instructed)*: | EMAIL *(print letters carefully)*:

When were you born? Month (01-12) | Day (01-31) | Year

SERIAL #

MARKING DIRECTIONS
- Use a black or blue pen.
- Fill in your response completely. Mark out any answer you wish to change with an "X".

CORRECT MARK ● INCORRECT MARKS ✓ ⊗ ◒ ◒

Group Code A B

1. **Your sex:** ○ Male ○ Female

2. **Is English your primary language?**
○ Yes ○ No

3. **In what year did you graduate from high school?** (Mark one)
○ 2016 ○ 2015 ○ 2014 ○ 2013 or earlier ○ Did not graduate but passed G.E.D. test ○ Never completed high school

4. **Are you enrolled (or enrolling) as a:** (Mark one)
○ Full-time student ○ Part-time student

5. **How many miles is this college from your permanent home?** (Mark one)
○ 5 or less ○ 6-10 ○ 11-50 ○ 51-100 ○ 101-500 ○ Over 500

6. **What was your average grade in high school?** (Mark one)
○ A or A+ ○ A– ○ B+ ○ B ○ B– ○ C+ ○ C ○ D

7. **What were your scores on the SAT I and/or ACT?**
SAT Reading and Writing...
SAT Mathematics...
ACT Composite...

8. **Where do you plan to live during the fall term?** (Mark one)
○ With my family or other relatives
○ Other private home, apartment, or room
○ College residence hall
○ Fraternity or sorority house
○ Other campus student housing
○ Other

9. **From what high school did you graduate?**
Name of high school
City | State

10. **Are you:** (Mark all that apply)
○ White/Caucasian
○ African American/Black
○ American Indian/Alaska Native
○ East Asian (e.g., Chinese, Japanese, Korean, Taiwanese)
○ Filipino
○ Southeast Asian (e.g., Cambodian, Vietnamese, Hmong)
○ South Asian (e.g., Indian, Pakistani, Nepalese, Sri Lankan)
○ Other Asian
○ Native Hawaiian/Pacific Islander
○ Mexican American/Chicano
○ Puerto Rican
○ Other Latino
○ Other

11. **Prior to this term, have you ever taken courses for credit at this institution?**
○ Yes ○ No

12. **Since leaving high school, have you ever taken courses, whether for credit or not for credit, at any other institution (university, 4- or 2-year college, technical, vocational, or business school)?**
○ Yes ○ No

13. **To how many colleges other than this one did you apply for admission this year?**
○ None ○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6 ○ 7-8 ○ 9-10 ○ 11 or more

14. **Were you accepted by your first choice college?** ○ Yes ○ No

15. **Is this college your:** (Mark one)
○ First choice ○ Second choice ○ Third choice ○ Less than third choice

16. **Citizenship status:** (Mark one)
○ U.S. citizen
○ Permanent resident (green card)
○ International student (i.e., F-1, J-1, or M-1 visa)
○ None of the above

17. **Please mark which of the following courses you have completed:**
(Y) (N) Algebra II
(Y) (N) Pre-calculus/Trigonometry
(Y) (N) Probability & Statistics
(Y) (N) Calculus
(Y) (N) AP Probability & Statistics
(Y) (N) AP Calculus
(Y) (N) AP Computer Science A

18. **How many weeks this summer did you participate in a bridge program at this institution?**
○ 0 ○ 1-2 ○ 3-4 ○ 5-6 ○ 7+

19. **During high school (grades 9-12) how many years did you study each of the following subjects?** (Mark one for each item)

	None	1/2	1	2	3	4	5 or more
Mathematics	○	○	○	○	○	○	○
Foreign Language	○	○	○	○	○	○	○
Physical Science	○	○	○	○	○	○	○
Biological Science	○	○	○	○	○	○	○
History/Am. Gov't	○	○	○	○	○	○	○
Computer Science	○	○	○	○	○	○	○
Arts and/or Music	○	○	○	○	○	○	○

20. **How many Advanced Placement/International Baccalaureate courses did you take in high school?** (Mark one in each row)

	Not offered at my high school	None	1-4	5-9	10-14	15+
AP Courses	○	○	○	○	○	○
IB Courses	○	○	○	○	○	○

21. **Please refer to the same Parent/Guardian throughout this survey. Please mark the sex of your parent(s) or guardian(s).**

	Male	Female
Parent/Guardian 1	○	○
Parent/Guardian 2	○	○

22. **At any time since you turned 13, were you in foster care or were you a dependent of the court?**
○ Yes ○ No ○ I don't know

23. **Do you consider yourself:** (Mark Yes or No for each item)

	Yes	No
Pre-Med	○	○
Pre-Law	○	○

24. **Please indicate your intended major using the codes provided on the attached fold out.**

25. Please indicate your intended career as well as the careers of your parents/guardians, using the codes provided on the attached fold out. (Your intended career, Parent/Guardian 1 career, Parent/Guardian 2 career)

Your intended career ☐☐

Parent/Guardian 1 career ☐☐

Parent/Guardian 2 career ☐☐

26. Current employment status: (Mark one in each row)

	Employed	Seasonally Employed	Unemployed	Retired
Parent/Guardian 1	○	○	○	○
Parent/Guardian 2	○	○	○	○

27. How much of your first year's educational expenses (room, board, tuition, and fees) do you expect to cover from each of the sources listed below? (Mark one answer for each possible source)

	None	$1-$2,999	$3,000-$5,999	$6,000-$9,999	$10,000-$14,999	$15,000+
Family resources (parents, relatives, spouse, etc.)	○	○	○	○	○	○
My own resources (savings from work, work-study, other income)	○	○	○	○	○	○
Aid which need not be repaid (grants, scholarships, military funding, etc.)	○	○	○	○	○	○
Aid which must be repaid (loans, etc.)	○	○	○	○	○	○

28. Did you receive any of the following forms of financial aid? (Mark Yes or No for each item)

	Yes	No
Military grants	○	○
Work-study	○	○
Pell Grant	○	○
Need-based grants or scholarships	○	○
Merit-based grants or scholarships	○	○

29. What is your best estimate of your parents'/guardians' total income last year? Consider income from all sources before taxes. (Mark one)

- ○ Less than $15,000
- ○ $15,000-24,999
- ○ $25,000-29,999
- ○ $30,000-59,999
- ○ $60,000-74,999
- ○ $75,000-99,999
- ○ $100,000-124,999
- ○ $125,000-149,999
- ○ $150,000-199,999
- ○ $200,000-249,999
- ○ $250,000-499,999
- ○ $500,000 or higher

30. Please select how many individuals in your household (including yourself) are dependent on your parent(s)/guardian(s) for financial support. (Mark one)

- ○ I am not dependent on my parent(s)/guardian(s)
- ○ 1
- ○ 2
- ○ 3
- ○ 4
- ○ 5
- ○ 6 or more

31. Do you have any concern about your ability to finance your college education? (Mark one)

- ○ None (I am confident that I will have sufficient funds)
- ○ Some (but I probably will have enough funds)
- ○ Major (not sure I will have enough funds to complete college)

32. Current religious preference: (Mark one in each column)

	Yours	Parent/Guardian 1	Parent/Guardian 2
Agnostic	Y	1	2
Atheist	Y	1	2
Baptist	Y	1	2
Buddhist	Y	1	2
Church of Christ	Y	1	2
Eastern Orthodox	Y	1	2
Episcopalian	Y	1	2
Hindu	Y	1	2
Jewish	Y	1	2
LDS (Mormon)	Y	1	2
Lutheran	Y	1	2
Methodist	Y	1	2
Muslim	Y	1	2
Presbyterian	Y	1	2
Quaker	Y	1	2
Roman Catholic	Y	1	2
Seventh-day Adventist	Y	1	2
United Church of Christ/Congregational	Y	1	2
Other Christian	Y	1	2
Other Religion	Y	1	2
None	Y	1	2

33. What is the highest academic degree that you intend to obtain? (Mark one in each column)

	Highest Planned	Highest Planned at This College
None	○	○
Vocational certificate	○	○
Associate (A.A. or equivalent)	○	○
Bachelor's (B.A., B.S., B.D., etc.)	○	○
Master's (M.A., M.S., M.B.A., etc.)	○	○
J.D. (Law)	○	○
M.D., D.D.S., D.V.M., etc. (Medical)	○	○
Ph.D.	○	○
Professional Doctorate (Ed.D., Psy.D., etc.)	○	○
Other	○	○

34. In the past year, how often have you: (Mark one for each item)

	Frequently	Occasionally	Not at All
Attended a religious service	F	O	N
Been bored in class	F	O	N
Demonstrated for a cause (e.g., boycott, rally, protest)	F	O	N
Tutored another student	F	O	N
Studied with other students	F	O	N
Consumed beer	F	O	N
Consumed wine or liquor	F	O	N

34. Continued. In the past year, how often have you: (Mark one for each item)

	Frequently	Occasionally	Not at All
Felt overwhelmed by all I had to do	F	O	N
Felt depressed	F	O	N
Performed volunteer work	F	O	N
Asked a teacher for advice after class	F	O	N
Voted in a student election	F	O	N
Socialized with someone of another racial/ethnic group	F	O	N
Been late to class	F	O	N
Discussed religion	F	O	N
Discussed politics	F	O	N
Skipped school/class	F	O	N
Publicly communicated my opinion about a cause (e.g., blog, email, petition)	F	O	N
Helped raise money for a cause or campaign	F	O	N
Fallen asleep in class	F	O	N
Failed to complete homework on time	F	O	N
Felt anxious	F	O	N

35. How would you rate yourself in the following areas: (Mark one for each item)

	A Major Strength	Somewhat Strong	Average	Somewhat Weak	A Major Weakness
Ability to see the world from someone else's perspective	○	○	○	○	○
Tolerance of others with different beliefs	○	○	○	○	○
Openness to having my own views challenged	○	○	○	○	○
Ability to discuss and negotiate controversial issues	○	○	○	○	○
Ability to work cooperatively with diverse people	○	○	○	○	○
Critical thinking skills	○	○	○	○	○
Ability to manage your time effectively	○	○	○	○	○

36. What is the highest level of formal education obtained by your parents/guardians? (Mark one in each column)

	Parent/Guardian 1	Parent/Guardian 2
Junior high/Middle school or less	○	○
Some high school	○	○
High school graduate	○	○
Postsecondary school other than college	○	○
Some college	○	○
College degree	○	○
Some graduate school	○	○
Graduate degree	○	○

37. How often in the past year did you: (Mark one for each item)

	Frequently	Occasionally	Not at All
Ask questions in class	F	O	N
Support your opinions with a logical argument	F	O	N
Seek solutions to problems and explain them to others	F	O	N
Evaluate the quality or reliability of information you received	F	O	N
Take a risk because you feel you have more to gain	F	O	N
Seek alternative solutions to a problem	F	O	N
Look up scientific research articles and resources	F	O	N
Explore topics on your own, even though it was not required for a class	F	O	N
Accept mistakes as part of the learning process	F	O	N
Analyze multiple sources of information before coming to a conclusion	F	O	N
Take on a challenge that scares you	F	O	N

38. How confident are you that you can: (Mark one in each row)

	Absolutely	Very	Moderately	Somewhat	Not at All
Use technical science skills (use of tools, instruments, and/or techniques)	A	V	M	S	N
Generate a research question	A	V	M	S	N
Determine how to collect appropriate data	A	V	M	S	N
Explain the results of a study	A	V	M	S	N
Use scientific literature to guide research	A	V	M	S	N
Integrate results from multiple studies	A	V	M	S	N
Ask relevant questions	A	V	M	S	N
Identify what is known and not known about a problem	A	V	M	S	N
Understand scientific concepts	A	V	M	S	N
See connections between different areas of science and mathematics	A	V	M	S	N

39. How would you characterize your political views? (Mark one)

- Far left
- Liberal
- Middle-of-the-road
- Conservative
- Far right

40. In deciding to go to college, how important to you was each of the following reasons? (Mark one answer for each possible reason)

	Very Important	Somewhat Important	Not Important
To be able to get a better job	V	S	N
To gain a general education and appreciation of ideas	V	S	N
To make me a more cultured person	V	S	N
To be able to make more money	V	S	N
To learn more about things that interest me	V	S	N
To get training for a specific career	V	S	N
To prepare myself for graduate or professional school	V	S	N
To please my family	V	S	N

41. Rate yourself on each of the following traits as compared with the average person your age. We want the most accurate estimate of how you see yourself. (Mark one in each row)

	Highest 10%	Above Average	Average	Below Average	Lowest 10%
Academic ability					
Artistic ability					
Compassion					
Creativity					
Drive to achieve					
Emotional health					
Leadership ability					
Mathematical ability					
Physical health					
Public speaking ability					
Risk-taking					
Self-confidence (intellectual)					
Self-confidence (social)					
Spirituality					
Understanding of others					
Writing ability					

42. Mark one in each row:

1 Strongly Disagree
2 Disagree Somewhat
3 Agree Somewhat
4 Strongly Agree

	4	3	2	1
Wealthy people should pay a larger share of taxes than they do now	4	3	2	1
Addressing global climate change should be a federal priority	4	3	2	1
The federal government should have stricter gun control laws	4	3	2	1
Affirmative action in college admissions should be abolished	4	3	2	1
The federal government should raise taxes to reduce the deficit	4	3	2	1
Sexual activity that occurs without the presence of explicit, affirmative consent (i.e., "yes means yes") is considered sexual assault	4	3	2	1
There is little that a person can do to be better at math – you are either "good" or "bad" at math	4	3	2	1
Intelligence is something that can be improved by studying or working harder	4	3	2	1

43. Below are some reasons that might have influenced your decision to attend this particular college. How important was each reason in your decision to come here? (Mark one answer for each possible reason)

	Very Important	Somewhat Important	Not Important
My parents/relatives wanted me to come here	V	S	N
My teacher advised me	V	S	N
This college has a very good academic reputation	V	S	N
This college has a good reputation for its social and extracurricular activities	V	S	N
I was offered financial assistance	V	S	N
The cost of attending this college	V	S	N
High school counselor advised me	V	S	N
Private college counselor advised me	V	S	N
I wanted to live near home	V	S	N
Not offered aid by first choice	V	S	N
Could not afford first choice	V	S	N
This college's graduates gain admission to top graduate/professional schools	V	S	N
This college's graduates get good jobs	V	S	N
I was attracted by the religious affiliation/orientation of this college	V	S	N
I wanted to go to a school about the size of this college	V	S	N
Rankings in national magazines	V	S	N
I was admitted through an Early Action or Early Decision program	V	S	N
A visit to this campus	V	S	N
This college's graduates make a difference in the world	V	S	N

44. During your last year in high school, how much time did you spend during a typical week doing the following activities?

Hours per week:	None	Less than 1 hour	1-2	3-5	6-10	11-15	16-20	Over 20
Studying/homework	○	○	○	○	○	○	○	○
Socializing with friends in person	○	○	○	○	○	○	○	○
Online social networks (Facebook, Twitter, etc.)	○	○	○	○	○	○	○	○
Partying	○	○	○	○	○	○	○	○
Student clubs/groups	○	○	○	○	○	○	○	○
Exercise or sports	○	○	○	○	○	○	○	○
Working (for pay)	○	○	○	○	○	○	○	○
Household/childcare duties	○	○	○	○	○	○	○	○

45. Military Status: (Mark one)

- ○ None
- ○ ROTC, cadet, or midshipman at a service academy
- ○ In the Reserves or National Guard
- ○ On Active Duty
- ○ A discharged veteran **NOT** serving on Active Duty, in Reserves, or in National Guard

46. How many years do you expect it will take you to graduate from this college?

○ 1 ○ 2 ○ 3 ○ 4 ○ 5 ○ 6+

○ I do not plan to graduate from this college.

47. What is your sexual orientation?

- ○ Heterosexual/Straight
- ○ Gay
- ○ Lesbian
- ○ Bisexual
- ○ Queer
- ○ Other

48. Do you identify as transgender?

○ Yes ○ No

49. Do you have any of the following disabilities or medical conditions? (Mark Yes or No for each item)

	Yes	No
Learning disability (dyslexia, etc.)	○	○
Attention deficit hyperactivity disorder (ADHD)	○	○
Autism spectrum disorder	○	○
Physical disability (speech, sight, mobility, hearing, etc.)	○	○
Chronic illness (cancer, diabetes, autoimmune disorders, etc.)	○	○
Psychological disorder (depression, etc.)	○	○
Other	○	○

50. Will you pursue a science-related research career? (Mark one)

- ○ Definitely yes
- ○ Probably yes
- ○ Uncertain
- ○ Probably no
- ○ Definitely no

51. To what extent are the following statements true of you: (Mark one in each row)

① Strongly Disagree ② Disagree Somewhat ③ Neutral ④ Agree Somewhat ⑤ Strongly Agree

I have a strong sense of belonging to a community of scientists	⑤ ④ ③ ② ①
I derive great personal satisfaction from working on a team that is doing important research	⑤ ④ ③ ② ①
I think of myself as a scientist	⑤ ④ ③ ② ①
I feel like I belong in the field of science	⑤ ④ ③ ② ①

52. Please indicate the importance to you personally of each of the following: (Mark one for each item)

(N) Not Important (S) Somewhat Important (V) Very Important (E) Essential

Becoming accomplished in one of the performing arts (acting, dancing, etc.)	(E) (V) (S) (N)
Becoming an authority in my field	(E) (V) (S) (N)
Obtaining recognition from my colleagues for contributions to my special field	(E) (V) (S) (N)
Influencing the political structure	(E) (V) (S) (N)
Influencing social values	(E) (V) (S) (N)
Raising a family	(E) (V) (S) (N)
Being very well off financially	(E) (V) (S) (N)
Helping others who are in difficulty	(E) (V) (S) (N)
Making a theoretical contribution to science	(E) (V) (S) (N)
Writing original works (poems, novels, etc.)	(E) (V) (S) (N)
Creating artistic works (painting, sculpture, etc.)	(E) (V) (S) (N)
Becoming successful in a business of my own	(E) (V) (S) (N)
Becoming involved in programs to clean up the environment	(E) (V) (S) (N)
Developing a meaningful philosophy of life	(E) (V) (S) (N)
Participating in a community action program	(E) (V) (S) (N)
Helping to promote racial understanding	(E) (V) (S) (N)
Keeping up to date with political affairs	(E) (V) (S) (N)
Becoming a community leader	(E) (V) (S) (N)
Improving my understanding of other countries and cultures	(E) (V) (S) (N)
Integrating spirituality into my life	(E) (V) (S) (N)

53. What is your best guess as to the chances that you will: (Mark one for each item)

(N) No Chance (L) Very Little Chance (S) Some Chance (V) Very Good Chance

Change major field	(V) (S) (L) (N)
Change career choice	(V) (S) (L) (N)
Participate in student government	(V) (S) (L) (N)
Get a job to help pay for college expenses	(V) (S) (L) (N)
Join a social fraternity or sorority	(V) (S) (L) (N)
Transfer to another college before graduating	(V) (S) (L) (N)
Participate in volunteer or community service work	(V) (S) (L) (N)
Seek personal counseling	(V) (S) (L) (N)
Communicate regularly with your professors	(V) (S) (L) (N)
Participate in student clubs/groups	(V) (S) (L) (N)
Participate in a study abroad program	(V) (S) (L) (N)
Work on a professor's research project	(V) (S) (L) (N)
Get tutoring help in specific courses	(V) (S) (L) (N)
Take courses from more than one college simultaneously	(V) (S) (L) (N)
Take a leave of absence from this college temporarily	(V) (S) (L) (N)
Take a course exclusively online	(V) (S) (L) (N)
Vote in a local, state, or national election	(V) (S) (L) (N)

The remaining ovals are provided for questions specifically designed by your college rather than the Higher Education Research Institute. If your college has chosen to use the ovals, please observe carefully the supplemental directions given to you.

54. (A) (B) (C) (D) (E)	58. (A) (B) (C) (D) (E)	62. (A) (B) (C) (D) (E)	66. (A) (B) (C) (D) (E)	70. (A) (B) (C) (D) (E)
55. (A) (B) (C) (D) (E)	59. (A) (B) (C) (D) (E)	63. (A) (B) (C) (D) (E)	67. (A) (B) (C) (D) (E)	71. (A) (B) (C) (D) (E)
56. (A) (B) (C) (D) (E)	60. (A) (B) (C) (D) (E)	64. (A) (B) (C) (D) (E)	68. (A) (B) (C) (D) (E)	72. (A) (B) (C) (D) (E)
57. (A) (B) (C) (D) (E)	61. (A) (B) (C) (D) (E)	65. (A) (B) (C) (D) (E)	69. (A) (B) (C) (D) (E)	73. (A) (B) (C) (D) (E)

THANK YOU!

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24. Below is a list of different undergraduate major fields grouped into general categories. *(Fill in appropriate two-digit code on your survey)*

ARTS AND HUMANITIES
01 Art, fine and applied
02 English (language and literature)
03 History
04 Journalism/Communication
05 Classical and Modern Languages and Literature
06 Media/Film Studies
07 Music
08 Philosophy
09 Theatre/Drama
10 Theology/ Religion
11 Other Arts and Humanities

BIOLOGICAL & LIFE SCIENCES
12 Biology (general)
13 Animal Biology (zoology)
14 Ecology & Evolutionary Biology
15 Marine Biology
16 Microbiology
17 Molecular, Cellular, & Developmental Biology
18 Neurobiology/Neuroscience
19 Plant Biology (botany)
20 Agriculture/Natural Resources
21 Biochemistry/Biophysics
22 Environmental Science
23 Other Biological Science

BUSINESS
24 Accounting
25 Business Admin. (general)
26 Entrepreneurship
27 Finance
28 Hospitality/Tourism
29 Human Resources Management
30 International Business
31 Marketing
32 Management
33 Computer/Management Information Systems
34 Real Estate
35 Other Business

EDUCATION
36 Elementary Education
37 Music/Art Education
38 Physical Education/Recreation
39 Secondary Education
40 Special Education
41 Other Education

ENGINEERING
42 Aerospace/Aeronautical/ Astronautical Engineering
43 Biological/Agricultural Engineering
44 Biomedical Engineering
45 Chemical Engineering
46 Civil Engineering
47 Computer Engineering
48 Electrical/ Electronic/ Communications Engineering
49 Engineering Science/ Engineering Physics
50 Environmental/Environmental Health Engineering
51 Industrial/Manufacturing Engineering
52 Materials Engineering
53 Mechanical Engineering
54 Other Engineering

HEALTH PROFESSIONS
55 Clinical Laboratory Science
56 Health Care Administration/ Studies
57 Health Technology
58 Kinesiology
59 Nursing
60 Pharmacy
61 Therapy (occupational, physical, speech)
62 Other Health Profession

MATH AND COMPUTER SCIENCE
63 Computer Science
64 Mathematics/Statistics
65 Other Math and Computer Science

PHYSICAL SCIENCE
66 Astronomy & Astrophysics
67 Atmospheric Sciences
68 Chemistry
69 Earth & Planetary Sciences
70 Marine Sciences
71 Physics
72 Other Physical Science

SOCIAL SCIENCE
73 Anthropology
74 Economics
75 Ethnic/Cultural Studies
76 Geography
77 Political Science (gov't., international relations)
78 Psychology
79 Public Policy
80 Social Work
81 Sociology
82 Women's/Gender Studies
83 Other Social Science

OTHER MAJORS
84 Architecture/Urban Planning
85 Criminal Justice
86 Library Science
87 Security & Protective Services
88 Military Sciences/ Technology/Operations

89 OTHER

90 UNDECIDED

Turn over for Question 25

25. Below is a list of different careers grouped into general categories. *(Fill in appropriate two-digit codes on your survey)*

ARTS
01 Actor or Entertainer
02 Artist
03 Graphic Designer
04 Musician
05 Writer/Producer/Director

AGRICULTURE
06 Farmer or Forester
07 Natural Resource Specialist/Environmentalist

BUSINESS
08 Accountant
09 Administrative Assistant
10 Business Manager/Executive
11 Business Owner/Entrepreneur
12 Retail Sales
13 Sales/Marketing
14 Human Resources
15 Finance (e.g., Actuary, Banking, Loan Officer, Planner)
16 Management Consultant
17 Real Estate Agent/Realtor/ Appraiser/Developer
18 Sports Management

COMMUNICATIONS
19 Journalist
20 Public Relations/Media Relations
21 Advertising

EDUCATION
22 College Administrator/Staff
23 College Faculty
24 Early Childcare Provider
25 Elementary School Teacher
26 Secondary School Teacher in Science, Technology, Engineering, or Math (STEM)
27 Secondary School Teacher in a non-STEM subject
28 Librarian
29 Teacher's Assistant/ Paraprofessional
30 K-12 Administrator
31 Other K-12 Professional

GOVERNMENT
32 Military
33 Federal/State/Local Government Official
34 Protective Services (e.g., Homeland Security, Law Enforcement, Firefighter)
35 Postal Worker

HEALTHCARE SUPPORT
36 Dietician/Nutritionist
37 Home Health Worker
38 Medical/Dental Assistant (e.g., Hygienist, Lab Tech, Nursing Asst.)
39 Registered Nurse
40 Therapist (e.g., Physical, Occupational, Speech)

INFORMATION TECHNOLOGY
41 Computer Programmer/Developer
42 Computer/Systems Analyst
43 Web Designer

LAW
44 Lawyer/Judge
45 Paralegal

MEDICAL PRACTITIONERS
46 Clinical Psychologist
47 Dentist/Orthodontist
48 Medical Doctor/Surgeon
49 Optometrist
50 Pharmacist
51 Veterinarian

SCIENCE AND ENGINEERING
52 Engineer
53 Research Scientist (e.g., Biologist, Chemist, Physicist)
54 Urban Planner/Architect

SERVICE INDUSTRY
55 Custodian/Janitor/Housekeeper
56 Food Service (e.g., Chef/Cook, Server)
57 Hair Stylist/Aesthetician/ Manicurist
58 Interior Designer
59 Skilled Trades (e.g., Plumber, Electrician, Construction)
60 Social/Non-Profit Services

61 CLERGY

62 HOMEMAKER/STAY AT HOME PARENT

63 OTHER

64 UNDECIDED

Carefully detach this section after answering Questions 24 and 25

2017 YOUR FIRST COLLEGE YEAR SURVEY

CIRP

Please print your responses below in ALL CAPS.

NAME: FIRST | MI | LAST

When were you born? Month (01-12) Day (01-31) Year

EMAIL: Print letters carefully.

STUDENT ID# *(as instructed)*:

SERIAL #

Congratulations on your progress during your first college year. We are very interested in your experiences as a first-year college student. This form has been designed to provide feedback that can help improve the first-year college experience. Thank you very much for your help with this important project.

MARKING INSTRUCTIONS
- Use a No. 2 pencil or a blue or black ink pen only.
  CORRECT: ●
  INCORRECT: ✓ ⊗ ◒ ◕
- Mark out any answer you wish to change with an "X" if you are using a pen.
  CHANGE: ●

Group Code: A: B:

1. Your sex: ○ Male ○ Female

2. Are you: (Mark all that apply)
- ○ White/Caucasian
- ○ African American/Black
- ○ American Indian/Alaska Native
- ○ East Asian (e.g., Chinese, Japanese, Korean, Taiwanese)
- ○ Filipino
- ○ Southeast Asian (e.g., Cambodian, Vietnamese, Hmong)
- ○ South Asian (e.g., Indian, Pakistani, Nepalese, Sri Lankan)
- ○ Other Asian
- ○ Native Hawaiian/Pacific Islander
- ○ Mexican American/Chicano
- ○ Puerto Rican
- ○ Other Latino
- ○ Other

3. Do you identify as transgender? ○ Yes ○ No

4. What is your sexual orientation? (Mark one response only)
- ○ Heterosexual/Straight
- ○ Gay
- ○ Lesbian
- ○ Bisexual
- ○ Queer
- ○ Other

5. Are you currently a full-time or part-time student? (Mark one response only)
- ○ Full-time undergraduate
- ○ Part-time undergraduate
- ○ Not enrolled

6. What year did you first enter: (Mark one in each column)

	Your 1st College	This College
2016 or 2017	○	○
2015	○	○
2014	○	○
2013	○	○
2012 or earlier	○	○

7. How often in the past year did you: (Mark one in each row)

	Frequently	Occasionally	Not at All
Ask questions in class	F	O	N
Support your opinions with a logical argument	F	O	N
Seek solutions to problems and explain them to others	F	O	N
Evaluate the quality or reliability of information you received	F	O	N
Take a risk because you felt you had more to gain	F	O	N
Seek alternative solutions to a problem	F	O	N
Look up scientific research articles and resources	F	O	N
Explore topics on your own, even though it was not required for a class	F	O	N
Accept mistakes as part of the learning process	F	O	N
Analyze multiple sources of information before coming to a conclusion	F	O	N
Take on a challenge that scares you	F	O	N

8. Since entering this college, how often have you interacted with the following people (e.g., by phone, e-mail, text, or in person): (Mark one in each row)

	Daily	2 or 3 times per week	Once a week	1 or 2 times per month	1 or 2 times per term	Never
Faculty during office hours	1	2	3	4	5	6
Faculty outside of class or office hours	1	2	3	4	5	6
Academic advisors/ counselors	1	2	3	4	5	6
Graduate students/ teaching assistants	1	2	3	4	5	6
Close friends at this institution	1	2	3	4	5	6
Close friends not at this institution	1	2	3	4	5	6
Your parents/guardians	1	2	3	4	5	6
Your siblings or extended family	1	2	3	4	5	6

9. Do you have any concern about your ability to finance your college education? (Mark one response only)
- ○ None (I am confident that I will have sufficient funds)
- ○ Some (but I probably will have enough funds)
- ○ Major (not sure I will have enough funds to complete college)

10. How much of the past year's educational expenses (room, board, tuition, and fees) were covered from each of the following sources? (Mark one answer for each possible source)

	None	$1 to $2,999	$3,000 to $5,999	$6,000 to $9,999	$10,000 to $14,999	$15,000 or more
Family resources (parents, relatives, spouse, etc.)	1	2	3	4	5	6
My own resources (income from work, work-study, etc.)	1	2	3	4	5	6
Aid which need not be repaid (grants, scholarships, military, etc.)	1	2	3	4	5	6
Aid which must be repaid (loans)	1	2	3	4	5	6

11. Since entering this college, how often have you felt: (Mark one in each row)

	Frequently	Occasionally	Not at All
Lonely or homesick	F	O	N
Isolated from campus life	F	O	N
Unsafe on this campus	F	O	N
Worried about your health	F	O	N
That your courses inspired you to think in new ways	F	O	N
That your job responsibilities interfered with your schoolwork	F	O	N
That your family responsibilities interfered with your schoolwork	F	O	N
Family support to succeed	F	O	N
That faculty provided me with feedback that helped me assess my progress in class	F	O	N
That my contributions were valued in class	F	O	N
That faculty encouraged me to ask questions and participate in discussions	F	O	N

12. Please rate your satisfaction with your college in each area: (Mark one in each row)

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied	Can't Rate/ No Experience
General education and core curriculum courses	VS	S	N	D	VD	CR
Your overall academic experience	VS	S	N	D	VD	CR
Career services	VS	S	N	D	VD	CR
Classroom facilities	VS	S	N	D	VD	CR
Computer facilities/labs	VS	S	N	D	VD	CR
Library resources	VS	S	N	D	VD	CR
Laboratory facilities and equipment	VS	S	N	D	VD	CR
Technology resources	VS	S	N	D	VD	CR
Academic advising	VS	S	N	D	VD	CR
Student housing (e.g., res. halls)	VS	S	N	D	VD	CR
Financial aid office	VS	S	N	D	VD	CR
Financial aid package	VS	S	N	D	VD	CR
Student health services	VS	S	N	D	VD	CR
Student psychological services	VS	S	N	D	VD	CR
Orientation for new students	VS	S	N	D	VD	CR
Opportunities for community service	VS	S	N	D	VD	CR
First-year programs (e.g., first-year seminar, learning community, linked courses, common book)	VS	S	N	D	VD	CR

13. Rate yourself on each of the following traits as compared with the average person your age. We want the most accurate estimate of how you see yourself. (Mark one in each row)

	Highest 10%	Above Average	Average	Below Average	Lowest 10%
Academic ability	H	AA	A	BA	L
Artistic ability	H	AA	A	BA	L
Compassion	H	AA	A	BA	L
Creativity	H	AA	A	BA	L
Drive to achieve	H	AA	A	BA	L
Emotional health	H	AA	A	BA	L
Leadership ability	H	AA	A	BA	L
Mathematical ability	H	AA	A	BA	L
Physical health	H	AA	A	BA	L
Public speaking ability	H	AA	A	BA	L
Risk-taking	H	AA	A	BA	L
Self-confidence (intellectual)	H	AA	A	BA	L
Self-confidence (social)	H	AA	A	BA	L
Spirituality	H	AA	A	BA	L
Understanding of others	H	AA	A	BA	L
Writing ability	H	AA	A	BA	L

14. Since entering this college, how has it been to: (Mark one in each row)

	Very Easy	Somewhat Easy	Somewhat Difficult	Very Difficult
Understand what your professors expect of you academically	VE	SE	SD	VD
Develop effective study skills	VE	SE	SD	VD
Adjust to the academic demands of college	VE	SE	SD	VD
Manage your time effectively	VE	SE	SD	VD
Develop close friendships with other students	VE	SE	SD	VD

15. How would you rate yourself in the following areas: (Mark one in each row)

	A Major Strength	Somewhat Strong	Average	Somewhat Weak	A Major Weakness
Ability to see the world from someone else's perspective	MS	SS	A	SW	MW
Tolerance of others with different beliefs	MS	SS	A	SW	MW
Openness to having my own views challenged	MS	SS	A	SW	MW
Ability to discuss and negotiate controversial issues	MS	SS	A	SW	MW
Ability to work cooperatively with diverse people	MS	SS	A	SW	MW
Critical thinking skills	MS	SS	A	SW	MW
Ability to manage your time effectively	MS	SS	A	SW	MW

16. Since entering this college, how often have you: (Mark one in each row)

	Frequently	Occasionally	Not at All
Attended a religious service	F	O	N
Been bored in class	F	O	N
Demonstrated for a cause (e.g., boycott, rally, protest)	F	O	N
Studied with other students	F	O	N
Consumed beer	F	O	N
Consumed wine or liquor	F	O	N
Felt overwhelmed by all you had to do	F	O	N
Felt depressed	F	O	N
Performed volunteer work	F	O	N
Contributed money to help support my family	F	O	N
Asked a professor for advice after class	F	O	N
Worked on a local, state, or national political campaign	F	O	N
Socialized with someone of another sexual orientation	F	O	N
Been late to class	F	O	N
Posted on a course-related online discussion board	F	O	N
Performed community service as part of a class	F	O	N
Discussed religion	F	O	N
Discussed politics	F	O	N
Maintained a healthy diet	F	O	N
Had adequate sleep	F	O	N
Helped raise money for a cause or campaign	F	O	N
Publicly communicated your opinion about a cause (e.g., blog, email, petition)	F	O	N
Felt anxious	F	O	N

17. Please indicate the extent to which you agree or disagree with the following statements: (Mark one in each row)

	Strongly Agree	Agree	Disagree	Strongly Disagree
I have felt discriminated against at this institution because of my race/ethnicity, gender, sexual orientation, religion, or disability status	SA	A	D	SD
I see myself as part of the campus community	SA	A	D	SD
There is a lot of racial tension on this campus	SA	A	D	SD
There is little that a person can do to be better at math - you are either "good" or "bad" at math	SA	A	D	SD
Sexual violence is prevalent on this campus	SA	A	D	SD
I have been able to find a balance between academics and extracurricular activities	SA	A	D	SD
Faculty empower me to learn here	SA	A	D	SD
If asked, I would recommend this college to others	SA	A	D	SD
At least one staff member has taken an interest in my development	SA	A	D	SD
I feel valued at this institution	SA	A	D	SD
Intelligence is something that can be improved by studying or working harder	SA	A	D	SD
In class, I have heard faculty express stereotypes based on race/ethnicity, gender, sexual orientation, religion, or disability status	SA	A	D	SD
I am interested in seeking information about current social and political issues	SA	A	D	SD
I feel a sense of belonging to this campus	SA	A	D	SD
At least one faculty member has taken an interest in my development	SA	A	D	SD
I feel I am a member of this college	SA	A	D	SD
I have effectively led a group to a common purpose	SA	A	D	SD
It's important for me to be thinking about my career path after college	SA	A	D	SD
I have a clear idea of how to achieve my career goals	SA	A	D	SD

18. What is your overall grade average (as of your most recently completed academic term)?
(Mark one response only)

- ○ A or A+
- ○ A-
- ○ B+
- ○ B
- ○ B-
- ○ C+
- ○ C
- ○ D
- ○ I did not receive grades in my courses

19. Please rate your satisfaction with your college in each area: (Mark one in each row)

	Very Satisfied	Satisfied	Neutral	Dissatisfied	Very Dissatisfied
Amount of contact with faculty	VS	S	N	D	VD
Ability to find a faculty or staff mentor	VS	S	N	D	VD
Racial/ethnic diversity of faculty	VS	S	N	D	VD
Racial/ethnic diversity of student body	VS	S	N	D	VD
Gender diversity of faculty	VS	S	N	D	VD
Class size	VS	S	N	D	VD
Relevance of coursework to everyday life	VS	S	N	D	VD
Relevance of coursework to future career plans	VS	S	N	D	VD
Overall quality of instruction	VS	S	N	D	VD
Respect for the expression of diverse beliefs	VS	S	N	D	VD
Availability of campus social activities	VS	S	N	D	VD
Overall sense of community among students	VS	S	N	D	VD
Overall college experience	VS	S	N	D	VD
Administrative response to incidents of:					
Campus emergencies	VS	S	N	D	VD
Discrimination	VS	S	N	D	VD
Sexual assaults	VS	S	N	D	VD

20. Please rate your agreement with the following statements: This institution has contributed to my: (Mark one in each row)

	Strongly Agree	Agree	Disagree	Strongly Disagree
Knowledge of a particular field or discipline	SA	A	D	SD
Knowledge of people from different races/cultures	SA	A	D	SD
Understanding of the problems facing your community	SA	A	D	SD
Understanding of national issues	SA	A	D	SD
Understanding of global issues	SA	A	D	SD
Ability to conduct research	SA	A	D	SD
Ability to work as part of a team	SA	A	D	SD
Problem-solving skills	SA	A	D	SD
Foreign language ability	SA	A	D	SD

21. To what extent have you experienced the following with students from a racial/ethnic group other than your own? (Mark one in each row)

	Very Often	Often	Sometimes	Seldom	Never
Dined or shared a meal	V	O	SM	S	N
Had meaningful and honest discussions about race/ethnic relations outside of class	V	O	SM	S	N
Had guarded, cautious interactions	V	O	SM	S	N
Shared personal feelings and problems	V	O	SM	S	N
Had tense, somewhat hostile interactions	V	O	SM	S	N
Had intellectual discussions outside of class	V	O	SM	S	N
Felt insulted or threatened because of your race/ethnicity	V	O	SM	S	N
Felt ignored or invisible because of your race/ethnicity	V	O	SM	S	N
Studied or prepared for class	V	O	SM	S	N
Socialized or partied	V	O	SM	S	N

22. Where did you primarily live while attending college this past year?
(Mark one response only)

On Campus

Special interest housing
- ○ First-year student housing
- ○ Cultural or minority student housing
- ○ Single-sex housing
- ○ Special academic program housing
- ○ Other special interest housing

Regular college housing
- ○ Residence hall
- ○ Apartment
- ○ Fraternity or sorority housing
- ○ Other residential housing

Off Campus
- ○ At home with family
- ○ Fraternity or sorority house
- ○ Rented apartment or house
- ○ Other

23. Indicate the importance to you personally of each of the following: (Mark one in each row)

	Essential	Very Important	Somewhat Important	Not Important
Becoming accomplished in one of the performing arts (acting, dancing, etc.)	E	V	S	N
Becoming an authority in my field	E	V	S	N
Integrating spirituality into my life	E	V	S	N
Becoming successful in a business of my own	E	V	S	N
Obtaining recognition from my colleagues for contributions to my special field	E	V	S	N
Influencing the political structure	E	V	S	N
Influencing social values	E	V	S	N
Raising a family	E	V	S	N
Being very well off financially	E	V	S	N
Helping others who are in difficulty	E	V	S	N
Making a theoretical contribution to science	E	V	S	N
Writing original works (poems, novels, etc.)	E	V	S	N
Creating artistic works (painting, sculpture, etc.)	E	V	S	N
Developing a meaningful philosophy of life	E	V	S	N
Participating in a community action program	E	V	S	N
Helping to promote racial understanding	E	V	S	N
Keeping up to date with political affairs	E	V	S	N
Becoming a community leader	E	V	S	N
Improving my understanding of other countries and cultures	E	V	S	N
Becoming involved in programs to clean up the environment	E	V	S	N

24. Since entering this college, have you:
(Mark Yes or No for each item)

	Yes	No
Decided to pursue a different major	Y	N
Remained undecided about a major	Y	N
Failed one or more courses	Y	N
Taken an honors course	Y	N
Taken a remedial or developmental course	Y	N
Enrolled in a formal program where a group of students takes two or more courses together (e.g., FIG, learning community, linked courses)	Y	N
Participated in an academic support program	Y	N
Participated in a common book or summer reading program in which all students read and discuss the material	Y	N
Taken a course or first-year seminar designed to help first-year students adjust to college	Y	N
Taken courses from more than one institution simultaneously	Y	N
Taken a course exclusively online	Y	N

25. Since entering this college, have you:
(Mark Yes or No for each item)

	Yes	No
Changed your career choice	Y	N
Held a full-time job (approx. 40 hours) while taking classes	Y	N
Joined a social fraternity or sorority	Y	N
Joined a pre-professional or departmental club	Y	N
Participated in an undergraduate research program	Y	N
Played club, intramural, or recreational sports	Y	N
Played intercollegiate athletics (e.g., NCAA or NAIA-sponsored)	Y	N
Sought personal counseling	Y	N
Strengthened your religious or spiritual beliefs/convictions	Y	N
Had a roommate of a different race/ethnicity	Y	N
Accumulated excessive credit card debt	Y	N
Been a leader in an organization	Y	N
Voted in a national, state, or local election	Y	N
Been made aware of your college's sexual harassment/assault reporting policy	Y	N
Participated in:		
Student government	Y	N
Leadership training	Y	N
An ethnic/racial student organization	Y	N
An LGBTQ student organization	Y	N
A women's advocacy group	Y	N

26. Since entering this college, how much time have you spent during a typical week:
(Mark one in each row)

	None	< 1 hr/ wk	1-2 hrs/wk	3-5 hrs/wk	6-10 hrs/wk	11-15 hrs/wk	16-20 hrs/wk	Over 20 hrs/wk
Attending classes/labs	1	2	3	4	5	6	7	8
Studying/homework	1	2	3	4	5	6	7	8
Socializing with friends in person	1	2	3	4	5	6	7	8
Using social media	1	2	3	4	5	6	7	8
Partying	1	2	3	4	5	6	7	8
Participating in student clubs/groups	1	2	3	4	5	6	7	8
Exercising/sports	1	2	3	4	5	6	7	8
Working (for pay) on campus	1	2	3	4	5	6	7	8
Working (for pay) off campus	1	2	3	4	5	6	7	8
Performing household/childcare duties	1	2	3	4	5	6	7	8
Commuting	1	2	3	4	5	6	7	8
Praying/meditating	1	2	3	4	5	6	7	8

33. Military Status:
(Mark one response only)
- ○ None
- ○ ROTC, cadet, or midshipman at a service academy
- ○ In Reserves or National Guard
- ○ On Active Duty
- ○ A discharged veteran NOT serving on Active Duty, in the Reserves, or in the National Guard

27. Since entering this college, indicate how often you:
(Mark one in each row)

	Frequently	Occasionally	Not at All
Turned in course assignment(s) late	F	O	N
Tutored another student	F	O	N
Contributed to class discussions	F	O	N
Discussed course content with students outside of class	F	O	N
Skipped class	F	O	N
Received tutoring	F	O	N
Communicated regularly with your professors	F	O	N
Worked on a professor's research project	F	O	N
Turned in course assignments that did not reflect your best work	F	O	N
Had difficulty getting along with your roommate(s)/ housemate(s)	F	O	N
Witnessed academic dishonesty/cheating	F	O	N
Went home for the weekend	F	O	N
Received advice/counseling from another student	F	O	N
Fell asleep in class	F	O	N
Had difficulty getting the courses you need	F	O	N
Texted or used social media during class	F	O	N
Worked with classmates on group projects	F	O	N
Accessed your campus' library resources electronically	F	O	N
Made a presentation in class	F	O	N
Used the institution's course catalog (paper or online)	F	O	N

28. How would you characterize your political views?
(Mark one response only)
- ○ Far left
- ○ Middle-of-the-road
- ○ Conservative
- ○ Liberal
- ○ Far right

29. Are you currently registered to vote? (Mark one response only)
- ○ Ineligible
- ○ Yes
- ○ No

30. If you could make your college choice over, would you still choose to enroll at your current (or most recent) college?
(Mark one response only)
- ○ Definitely yes
- ○ Probably yes
- ○ Probably no
- ○ Definitely no
- ○ Not sure yet

31. Since entering this college, how often have you utilized the following services: (Mark one in each row)

	Frequently	Occasionally	Not at All
Study skills advising	F	O	N
Financial aid advising	F	O	N
Student health services	F	O	N
Student psychological services	F	O	N
Writing center	F	O	N
Disability resource center	F	O	N
Career services	F	O	N
Academic advising	F	O	N
Campus safety services (Safe Walk, Public Safety/ Police Dept., etc.)	F	O	N

32. What do you think you will be doing in fall 2017?
(Mark one response only)
- ○ Attending your current (or most recent) institution
- ○ Attending another institution
- ○ Don't know/have not decided yet
- ○ Not attending any institution

34. Please indicate your current major using the codes provided on the attached fold out

35. To what extent are the following statements true of you:
(Mark one in each row)

	Strongly Agree	Agree	Somewhat Agree	Neutral	Disagree Somewhat	Disagree	Strongly Disagree
I have a strong sense of belonging to a community of scientists	SA	A	SA	N	DS	D	SD
I derive great personal satisfaction from working on a team that is doing important research	SA	A	SA	N	DS	D	SD
I think of myself as a scientist	SA	A	SA	N	DS	D	SD
I feel like I belong in the field of science	SA	A	SA	N	DS	D	SD

36. How confident are you that you can:
(Mark one in each row)

	Absolutely	Very	Moderately	Somewhat	Not at All
Use technical science skills (use of tools, instruments, and/or techniques)	A	V	M	S	N
Generate a research question	A	V	M	S	N
Determine how to collect appropriate data	A	V	M	S	N
Explain the results of a study	A	V	M	S	N
Use scientific literature to guide research	A	V	M	S	N
Integrate results from multiple studies	A	V	M	S	N
Ask relevant questions	A	V	M	S	N
Identify what is known and not known about a problem	A	V	M	S	N
Understand scientific concepts	A	V	M	S	N
See connections between different areas of science and mathematics	A	V	M	S	N

37. Will you pursue a science-related research career?
- ○ Definitely yes
- ○ Probably yes
- ○ Uncertain
- ○ Probably no
- ○ Definitely no

38. Did you transfer to this institution from another college/university?
- ○ Yes
- ○ No

39. Is English your primary language?
- ○ Yes
- ○ No

40. Do you plan to do any of the following this summer?
(Mark Yes or No for each item)

	Yes	No
Take courses at this institution	Y	N
Take courses at another institution	Y	N
Work for pay	Y	N
Perform volunteer work	Y	N
Participate in an internship	Y	N
Travel	Y	N

The remaining ovals are provided for additional questions that may be supplied by your institution.

41.	A B C D E	48.	A B C D E	55.	A B C D E
42.	A B C D E	49.	A B C D E	56.	A B C D E
43.	A B C D E	50.	A B C D E	57.	A B C D E
44.	A B C D E	51.	A B C D E	58.	A B C D E
45.	A B C D E	52.	A B C D E	59.	A B C D E
46.	A B C D E	53.	A B C D E	60.	A B C D E
47.	A B C D E	54.	A B C D E		

THANK YOU!

2017 YOUR FIRST COLLEGE YEAR (YFCY) SURVEY INFORMATION SHEET

PURPOSE OF THE STUDY

You are asked to complete this survey as part of a national study conducted by the Higher Education Research Institute (HERI) at the University of California, Los Angeles. This study is designed to explore students' academic involvement, social activities, health and wellness, and interaction with faculty and peers during the first college year. Your college or university may then use this information to improve their services for first-year students and better design first-year programs and classes. The ultimate goal is to enhance student life in the first college year.

PROCEDURES

To participate in this study, please complete and submit the attached survey. Most respondents complete this questionnaire in about 25 minutes, although individual progress will vary by how quickly you move through the questions.

You may decide not to complete the survey for any reason at any time without consequence of any kind. The Higher Education Research Institute does not offer payment for participation. Your participation and responses to the questionnaire indicate your consent to participate in the study.

POTENTIAL BENEFITS TO SUBJECTS AND/OR SOCIETY

You may have the opportunity to reflect on your experiences in college as you complete the survey, which may enhance self-understanding. Your responses to the survey also may help to improve the first year of college at campuses across the country.

POTENTIAL RISKS AND DISCOMFORTS

There could be survey items that you are uncomfortable answering or to which you would simply prefer not to respond. Your participation in this study is strictly voluntary, and you will be under no obligation whatsoever to answer any questions that you are not inclined to answer. You may choose not to answer any specific questions you do not want to answer and still remain in the study.

CONFIDENTIALITY

Please note that your responses will be used for research purposes only and will be strictly confidential. Any information that is obtained in connection with this study and that can be identified with you will remain confidential. Your identified responses will be returned to your institution for institutional assessment purposes. Before receiving any responses, your school is required to certify in advance that the data will only be used for research purposes and will not be used to investigate specific individuals. Names and email addresses will not be returned to your institution, however Student ID Numbers will be included in the final data file to allow your institution to merge responses with other campus data.

IDENTIFICATION OF INVESTIGATORS

If you have any questions or concerns about the research, please contact the Managing Director of HERI and Director of CIRP, Dr. Kevin Eagan at this address:

Higher Education Research Institute
UCLA Graduate School of Education and Information Studies
Box 951521
Los Angeles, CA 90095-1521
Email: heri@ucla.edu
Phone: 310-825-1925

RIGHTS OF RESEARCH SUBJECTS

You may withdraw your consent at any time and discontinue participation without penalty. You are not waiving any legal claims, rights or remedies because of your participation in this research study. If you have questions regarding your rights as a research subject, contact the UCLA Office for Protection of Research Subjects, 10889 Wilshire Blvd, Suite 830, Los Angeles, CA 90095-1406.

Below is a list of different MAJOR fields. ***Fill in the appropriate two-digit code on your survey*** **for your current major.**

ARTS AND HUMANITIES
01 Art, fine and applied
02 English (language and literature)
03 History
04 Journalism/Communication
05 Classical and Modern Languages and Literature
06 Media/Film Studies
07 Music
08 Philosophy
09 Theatre/Drama
10 Theology/Religion
11 Other Arts and Humanities

BIOLOGICAL & LIFE SCIENCES
12 Biology (general)
13 Animal Biology (zoology)
14 Ecology & Evolutionary Biology
15 Marine Biology
16 Microbiology
17 Molecular, Cellular, & Developmental Biology
18 Neurobiology/Neuroscience
19 Plant Biology (botany)
20 Agriculture/Natural Resources
21 Biochemistry/Biophysics
22 Environmental Science
23 Other Biological Science

BUSINESS
24 Accounting
25 Business Admin. (general)
26 Entrepreneurship
27 Finance
28 Hospitality/Tourism
29 Human Resources Management
30 International Business
31 Marketing
32 Management
33 Computer/Management Information Systems
34 Real Estate
35 Other Business

EDUCATION
36 Elementary Education
37 Music/Art Education
38 Physical Education/Recreation
39 Secondary Education
40 Special Education
41 Other Education

ENGINEERING
42 Aerospace/Aeronautical/Astronautical Engineering
43 Biological/Agricultural Engineering
44 Biomedical Engineering
45 Chemical Engineering
46 Civil Engineering
47 Computer Engineering
48 Electrical/Electronic Communications Engineering
49 Engineering Science/Engineering Physics
50 Environmental/Environmental Health Engineering
51 Industrial/Manufacturing Engineering
52 Materials Engineering
53 Mechanical Engineering
54 Other Engineering

HEALTH PROFESSIONS
55 Clinical Laboratory Science
56 Health Care Administration/Studies
57 Health Technology
58 Kinesiology
59 Nursing
60 Pharmacy
61 Therapy (occupational, physical, speech)
62 Other Health Profession

MATH AND COMPUTER SCIENCE
63 Computer Science
64 Mathematics/Statistics
65 Other Math and Computer Science

PHYSICAL SCIENCE
66 Astronomy & Astrophysics
67 Atmospheric Sciences
68 Chemistry
69 Earth & Planetary Sciences
70 Marine Sciences
71 Physics
72 Other Physical Science

SOCIAL SCIENCE
73 Anthropology
74 Economics
75 Ethnic/Cultural Studies
76 Geography
77 Political Science (gov't., international relations)
78 Psychology
79 Public Policy
80 Social Work
81 Sociology
82 Women's/Gender Studies
83 Other Social Science

OTHER MAJORS
84 Architecture/Urban Planning
85 Criminal Justice
86 Library Science
87 Security & Protective Services
88 Military Sciences/Technology/Operations
89 OTHER
90 UNDECIDED

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