ACADEMIC CHALLENGE AND MOTIVATION AMONG ASIAN AND ASIAN AMERICAN COLLEGE STUDENTS IN COMPUTER SCIENCE

by

YICHI ZHANG

(Under the direction of Emily Rosenzweig)

ABSTRACT

Students' learning environments play a critical role in shaping their motivation and career commitment. However, the learning experiences of Asian and Asian American students in science, technology, engineering, and mathematics (STEM) remain understudied, despite the unique academic challenges they face that may be closely related to both motivation and career commitment. This study examined the academic challenges experienced by Asian and Asian American college students in computer science courses, their associations with motivational beliefs and career commitment, and how their challenges differ from those of non-Asian peers. The results highlighted the most salient challenges for Asian and Asian American students and showed close links between these challenges and students' motivational beliefs. The study also uncovered unique experiences of Asian and Asian American students compared with their non-Asian peers. Finally, implications for culturally responsive teaching are discussed as strategies to better support Asian and Asian American students in STEM fields.

INDEX WORDS: academic challenges, motivation, career commitment, Asian and Asian American, STEM education, situated expectancy-value theory

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Introduction

Students' career decisions and commitment are strongly associated with their motivation, and their motivation is influenced by the learning environments around them (Cayubit, 2022). These relations are particularly important to consider when studying Asian and Asian American students, given their growing proportion within the college-educated population and high rates of participation in Science, Technology, Engineering, and Mathematics (STEM) fields (Pew Research, 2021). Because Asian and Asian American students are often perceived as overrepresented and high achieving in STEM fields with less need for support, their academic experiences, such as the challenges they encounter during learning, are less frequently studied, and they are often grouped together with White peers in related research (Museus & Kiang, 2009). However, Asian and Asian American students also experience fluctuations in their grades and face distinct academic challenges that influence their motivation and career persistence (McGee, 2017). Exploring various academic challenges that Asian and Asian American students encounter during their studies, as well as the relations of these challenges to their learning motivation and career commitment, can provide important implications for instructors in developing equitable and culturally appropriate instructional strategies to better support these students in STEM fields. Therefore, the goal of the present study was to address the research gap by focusing on challenging academic experiences of Asian and Asian American students in college computer science courses.

Situated Expectancy-Value Theory

In this study, we operationalized motivation in terms of competence-related beliefs and perceived task values, as these factors have been found to be closely related to students' learning environments and career persistence (Eccles & Wigfield, 2020).

Situated Expectancy-Value Theory is one of the most influential models for understanding students' motivation for choosing to engage in tasks related to STEM fields (Eccles (Parsons) et al., 1983; Eccles & Wigfield, 2020). The theory posits two main constructs, expectancies for success and subjective task values, to be primary determinants of motivation (Eccles [Parsons] et al., 1983). Expectancies for success are individuals' beliefs about their ability to succeed in upcoming tasks and are closely related to other broader competence-related beliefs such as self-efficacy and self-concept (Bong & Skaalvik, 2003; Marsh et al., 2019). There are four components of subjective task values: utility value (i.e., perceived usefulness of a task for achieving goals), attainment value (i.e., importance of a task to personal identity), intrinsic value (i.e., personal enjoyment or interest related to a task), and cost (i.e., perceptions of time and effort required to complete a task). Researchers most frequently focus on three types of cost (Eccles & Wigfield, 2020): effort cost (i.e., perception of effort needed to complete a task), opportunity cost (i.e., what people perceive they need to give up to complete a task), and emotional cost (i.e., anticipated negative emotions associated with doing a task). Theoretically, when people perceive more value and less cost in a task, and expect they can do well, they are more likely to pursue and persist in the task.

Eccles & Wigfield (2020) recently renamed expectancy-value theory to be called "situated" expectancy-value theory (SEVT), in order to emphasize that motivational beliefs are not fixed but shaped by individuals' experiences in current achievement environments and will change dynamically over time. Supporting this view, lots of research has shown that factors associated with individuals' learning experiences in classroom contexts such as instructional clarity, teachers' support, and peer interactions predict changes in their competence-related beliefs and task values (Held & Mori, 2024; Ruiz-Alfonso et al., 2021; Kiefer et al., 2015). Moreover, challenging learning experiences such as stressful workload, unclear instructions and lack of teachers' support can lead to decreased motivational beliefs (Kristensen et al., 2023; Maulana et al., 2016; Rubach et al., 2023).

More broadly, the theoretical model has long posited that cultural values and sociocultural beliefs play a crucial role in determining people's beliefs, behaviors, and perceptions of activities in their environment (Eccles & Wigfield, 2020). For example, Sun et al. (2013) found that U.S. middle school students reported higher expectancy beliefs in physical education, whereas Chinese students placed greater attainment and utility values on physical education, likely due to stronger family expectations, a sense of social obligation, and the cultural emphasis on group harmony. Other work has shown that individuals' racial and cultural backgrounds are also associated with the challenging experiences they have in their environments. For example, students of color in college STEM programs report frequent racial microaggressions, including insensitive comments from instructors and exclusion from peer study groups (Lee et al., 2020). The theory also emphasizes the crucial role of proximal socializers, such as parents and teachers, whose beliefs and behaviors can shape students' motivation (Eccles & Wigfield, 2020). For example, Pinneo and Nolen (2024) found that ninth graders tended to have stronger academic motivation in science when their parents engaged more frequently in science-related activities with them.

Motivational beliefs have been shown to be closely related to future academic and career choices, persistence, and commitment. Students' competence-related beliefs, as well as their intrinsic, attainment, and utility values, are predictive of their likelihood of pursuing and persisting in STEM (e.g., Lauermann et al., 2017; Perez et al., 2014; Simon et al., 2015). Specifically, Lauermann et al. (2017) examined students' math and science motivation, career plans, and career attainment using data from a large longitudinal dataset that followed three cohorts of students from elementary school through high school and into adulthood. The study found that adolescents' math self-concept and utility value at the beginning of high school predicted positive changes in their perceived likelihood of pursuing a math- or science-related career by the end of high school. Moreover, students' likelihood of pursuing a math- or science-related career at the end of high school was found to be a strong predictor of math-related career attainment in adulthood.

Overall, students' motivation is closely tied to their immediate environment, and those from different sociocultural backgrounds may interpret their environments differently, leading to varied motivational beliefs and decision-making. Therefore, the Situated Expectancy-Value Theory is well-suited for this study to measure the motivation of students from diverse backgrounds and examine how the diverse challenges they face in the classroom learning envrionemnt predict their motivation and career commitment over time. Furthermore, this theory offers a lens to explore how students' diverse social and cultural backgrounds as well as the socializers surrounding them influence their academic and motivational experiences.

Asian and Asian American Students' Motivation and Career Commitment

There is a growing trend of students with Asian backgrounds pursuing degrees in STEM in the U.S. (Pew Research, 2021). However, in education and STEM research, Asian and Asian

American students have been frequently lumped into the same category as White students as majority groups, instead of being viewed as a separate cultural group with unique needs (Museus & Kiang, 2009).

Although Asian and Asian American students are often perceived as naturally high achieving (McGee, 2018), research has shown that they face unique challenges shaped by their diverse cultural, socioeconomic, and educational backgrounds (Assalone & Fann, 2016; Lin & Scherz, 2014; Suyemoto et al., 2009). With different cultural backgrounds and challenging experiences, Asian and Asian American students may perceive learning environment differently, leading to the differences in motivational beliefs and STEM career commitment. The aggregation of data may mask the unique voices of Asian and Asian American students and drive higher education practices that often exclude them from the conversations about underrepresented minority students' experience and needs (Kim et al., 2023).

There are some studies measuring Asian and Asian American students' motivation and career commitment in STEM fields based on Situated Expectancy Value Theory. Asian and Asian Americans are more likely to report higher utility values in STEM-related fields compared to students from other racial groups (Hsieh et al., 2021; Sun et al., 2013). Utility value has also been found to be a key predictor of Asian college students' career commitment in STEM (Riegle-Crumb et al., 2019). The importance of utility value to Asian students is linked to the strong expectations and utility values that many Asian cultures and families place on STEM as a pathway to future rewards and stable careers (Cooc & Kim, 2021). In addition, some studies have shown that Asian and Asian American students tend to report relatively lower expectancies for success or self-efficacy in STEM compared to their peers, even though they achieve higher levels of performance than others (Jones et al., 2023; Wilson et al., 2015). Research suggests that much of the high achievement among Asian Americans is due to greater academic effort and their motivation may be more tied to avoiding negative outcomes, such as academic failure, than confidence in success (Eaton & Dembo, 1997; Hsin & Xie, 2014; Zusho et al., 2005). These studies highlight potential differences in motivational patterns and the sociocultural antecedents of motivation among Asian and Asian American students. However, there has been little systematic research examining in depth the different motivational beliefs that Asian and Asian American students hold, indicating a need for further investigation in this area.

Academic Challenges Facing by Asian and Asian American Students

While limited research grounded in SEVT has specifically focused on Asian and Asian American students, many studies outside this framework discuss the unique cultural and social experiences that can lead to unique motivational challenges for these students. Although these studies do not frame their findings in motivational terms, they discuss experiences and phenomena that are highly relevant to students' motivational beliefs. This section will briefly review relevant challenging experiences faced by Asian and Asian American students in educational contexts that may be related to their learning motivation and career commitment.

Model Minority Stereotype

Many studies have examined Asian and Asian American students' experiences with the model minority stereotype, which suggests that they are hardworking, uncomplaining, and capable of achieving exceptional performance with little external assistance, particularly in STEM fields (Assalone & Fann, 2016; McGee, 2018; Park et al., 2021; Trytten et al., 2012). In a qualitative study by Assalone and Fann (2016), twenty-eight Asian American students attending community colleges shared their experiences of frequently being questioned about why they chose a two-year community college instead of a four-year university, which others assumed they should be able to attend effortlessly. These students reported facing not only higher academic expectations from professors, such as being held to a higher standard compared to their peers, but also greater demands from their classmates to provide academic assistance. Similarly, in a qualitative study by McGee (2018), an Asian student, whose experience is similar to many of other Asian students in STEM, was viewed as a failure by his peers because he didn't get the highest score in the class even though his score was still above the average.

When thinking of the effects of the model minority stereotype, some Asian students talked about the positive effects of the stereotype, which motivated them to study hard, perform better, and gave them confidence that they chose the right career path (Trytten et al., 2012). However, some studies have shown that Asian and Asian American students also experienced psychological pressure from the fear of disappointing others or being viewed negatively if they failed to fit the stereotype, and they had to work harder than others to achieve external expectations even at the cost of their health (Assalone & Fann, 2016; McGee, 2018; McGee et al., 2017). Park et al. (2021) suggested that underperforming Korean Americans who deeply internalized the model minority stereotype may be particularly vulnerable, exhibiting higher levels of depressive symptoms. Some students also considered changing their majors but were discouraged by stereotypes portraying them as good candidates for STEM employment but not much else, and they also doubted their ability to succeed in non-STEM fields (McGee, 2018). Ultimately, the model minority stereotype demotivated some students from pursuing advanced degrees and long-term careers in STEM, thereby limiting the diversity of STEM fields (Assalone & Fann, 2016; McGee, 2018; Trytten et al., 2012).

Negative Experiences with Teachers and Advisors

Asian and Asian American students also face academic challenges related to negative advising experiences and being misunderstood in the classroom (Suyemoto et al., 2009). Research has shown that Asian American students encounter potential barriers to identifying, accessing and utilizing available academic and career resources (Tan, 2019). Many instructors lack an understanding of Asian and Asian American students' backgrounds and experiences, which may lead them to interpret students' challenges as unrelated to race but instead related to their low ability or ignore some of their challenges. A study by Anantharaman et al. (2024) used open-ended questions to explore the experiences of Asian women in STEM doctoral programs. Students reported that faculty members often dismissed the racism and injustice they experienced and placed the responsibility for addressing such issues on the students themselves. As a result, they may fail to provide targeted support, such as informing students about available resources they might not otherwise be aware of and helping them fully utilize those resources (Museus & Kiang, 2009).

A lack of understanding of Asian and Asian American students' cultural values also contributes to misunderstandings in the classroom. Asian cultural values, such as collectivism, humility, and indirect communication, may differ from classroom expectations in the U.S. educational system. For some Asian students, such as Japanese students, asking questions or expressing personal perspectives in class is seen as an interruption that takes time and attention away from others, based on their cultural values (Suyemoto et al., 2009). Instructors may misinterpret this behavior as disengagement. A study conducted by Li and Jia (2006) on East Asian college students' participation patterns in American classrooms found that these students often exhibited reluctance to participate verbally due to cultural norms that emphasize listening and humility over active participation. This participation pattern can lead to potential misinterpretations by instructors, further contributing to misunderstandings and barriers to academic success.

Mentoring experiences have been found to be closely related to students' academic and professional development and persistence in STEM fields through motivation across racial/ethnic groups (Beauchamp et al., 2022; Trolian & Parker III, 2017). A study by Rozhenkova et al. (2024), which conducted focus group sessions with college STEM students, found that dissatisfaction with advising experiences, particularly when all students are treated the same regardless of their circumstances and without care or understanding of their unique situations, contributes to major switching, reduced interest, and lower retention rates in STEM. Specifically, negative advising experiences among Asian and Asian American students can lead to feelings of being unsupported and isolated and decreased motivation. For these students, talking with an advisor or mentor about future career plans was found to negatively predict their competence-related beliefs and intrinsic value in STEM careers with a lack of individualized support identified as a potential reason (Zhang et al., 2025). An environment that misunderstands Asian and Asian American students' unique cultural values and lacks targeted support negatively affects their overall well-being and self-efficacy, even leading some to leave the STEM field (Kodama & Park, 2021).

Language Barriers

For non-native English-speaking Asian students, language can be a challenge when studying STEM. Sravanthi (2024) highlighted the importance of English proficiency in STEM education and summarized several language-related challenges in STEM learning, such as difficulty in comprehension and understanding, trouble with academic writing and reports, lack of confidence in group discussions and participation, and limited resources in languages other than English. The study also found that non-native English-speaking students with higher English proficiency tended to perform better in STEM subjects. Studies outside of STEM further emphasize that language proficiency is a major factor contributing to non-native English-speaking Asian students' difficulties in communication, such as fear of asking questions, and in understanding course content and instructions (Li & Jia, 2006; Wan, 2021). In addition, cultural differences and mismatches compound non-native English-speaking Asian students' barriers to both communication and understanding (Lin & Scherz, 2014; Liu, 2000). In addition, some Asian and Asian American students experience discrimination that positions them as linguistically incompetent (e.g., Zhang-Wu, 2021). Through two focus group interviews with college Asian American students, Suyemoto et al. (2009) found that students reported many of their instructors usually assumed that Asian and Asian American students had low English proficiency and communication problems.

Generally, language barriers can influence students' major and career choices. Difficulties in understanding professional concepts in STEM and limited access to resources in their native languages may discourage students from studying STEM or exploring career paths in STEM fields. However, some research suggests the opposite effect of language barriers on Asian and Asian American students' motivation to pursue STEM. For example, Shen (2015) found that Asian American college students who internalize the stereotype that they may struggle in careers requiring extensive reading, writing, and verbal communication in English are more likely to choose math and science majors.

Other Challenges in STEM Courses

Beyond the challenges identified in previous research on Asian and Asian American students, there are other academic difficulties frequently discussed in STEM learning that haven't been studied specifically with respect to Asian students. For example, students in STEM often report high academic workloads, struggling with complex concepts, and unengaging lectures especially in large STEM classes (Chen, 2013; Riegle-Crumb & King, 2010; Toven-Lindsey et al., 2015). Previous studies also examined the effects of some frequently reported academic challenges in STEM classroom, such as strict grading, difficult coursework and competitive environments, on students' learning motivation and persistence (Gallegos, 2020; Gasiewski et al., 2012). A study by Sutter et al. (2024) explored the challenges college students face and their impact on students' learning motivation in an introductory statistics course. The study found that students' perceived challenges negatively predicted their motivation and interest in statistics. Those who encountered more difficulties reported lower levels of motivation and a diminished desire to pursue further studies or careers involving statistics. Specifically, students' perceptions of course challenges were negatively related to their success expectancy and positively related to their perceptions of course costs.

Lack of Understanding about How Asian and Asian American Students Experience Challenges in STEM

Previous research on the unique challenges faced by Asian and Asian American students in STEM has primarily focused on the Model Minority Stereotype, negative experiences with teachers, and language barriers. Despite strongly emphasizing the need to explore Asian students' academic challenges, there is still limited research exploring a variety of specific challenges Asian students face within STEM classroom contexts or Asian students' experiences of unique challenges in specific subfields. In addition, many studies have shown that students' challenging academic experiences are closely associated with their motivation and career commitment, highlighting the importance of examining students' academic challenges. However, the unique relationships among a variety of academic challenges, distinct motivational constructs and career commitment for Asian and Asian American students remains unclear. For example, it is possible that the model minority stereotype faced by Asian students is closely tied to their increased effort costs and self-efficacy in learning STEM. As mentioned in the pervious section, model minority stereotype may create pressure for Asian students to work harder in order to meet the high expectations it imposes, while also reinforcing their confidence that pursuing STEM is the right path for them. Moreover, Eccles and Wigfield (2024) emphasized the need for more research on how culture, ethnicity and gender influence the development of individuals' expectancies and values. Examining the academic challenges faced by Asian and Asian American students and how these challenges relate to their motivational beliefs can help reveal their unique cultural values and experiences. Incorporating these perspectives would add more nuance to the Situated Expectancy-Value Theory by capturing the distinct sociocultural contexts that inform motivation within this student group.

A mixed methods research design is necessary to develop a more comprehensive and nuanced understanding of the challenging experiences of Asian and Asian American students in STEM courses (Creswell & Clark, 2017). Through open-ended questions, students can self-articulate their academic challenges, providing richer and more contextualized insights into how they interpret those challenges, which is helpful for exploring challenges that haven't been identified by previous studies and provide specific supports. Meanwhile, quantitative data allow the study to examine students' experiences of challenges identified by prior research and to explore relationships among academic challenges, motivational constructs, and career commitment unique to Asian and Asian American students.

Present Study

To extend on previous research, this study focuses on the challenging academic experiences of Asian students by using a mixed methods approach to examine the academic challenges they encounter in computer science courses, and the associations between these challenges, their learning motivation, and career commitment. In addition, the study aims to examine whether Asian and Asian American students' challenging experiences differ from those of non-Asian students in the sample, allowing for a more direct comparison with prior STEM research, which hasn't specifically examined Asian students. Specifically, the study is going to examine the following research questions:

1. What academic challenges do Asian and Asian American college students report facing early in a semester in studying computer science?
2. To what extent do Asian and Asian American students experience a set of common academic challenges identified in prior research?
3. How does reporting different challenges predict Asian and Asian American students' end-of-semester motivational beliefs for computer science (competence-related beliefs, utility value, intrinsic value, attainment value and cost)?
4. How does reporting different challenges predict Asian and Asian American students' end-of-semester career commitment in computer science?
5. Do results look different for non-Asian students?

Method

Sample

Participants were 309 college students enrolled in two computer science courses (each course was taught by multiple professors) during the Fall 2024 semester at a large public southeastern U.S. university. Participants were 48.3% Asian or Asian American, 38.0% White, 9.5% Black/African American, and 10.6% other racial or ethnic identities (students could select more than one race/ethnicity). Participants were 39.9% women, 58.9% men, and 1.1% non-binary; 39.2% first-year students, 30.8% second-year students, 24.3% third-year students, 4.2% fourth-year students, and 1.5% students not in a typical year of college. Computer science was the most common major reported by students in the courses (60.9%) followed by Computer System Engineering (10.4%), Data Science (7.9%) and other majors (20.8%). The study was reviewed by the university's office of human subjects research and deemed to be exempt from IRB approval prior to being conducted; all the participants were treated in accordance with APA ethical guidelines.

Procedure

Students were recruited to participate through announcements given by their computer science instructors. In exchange for their participation, students received a small amount of extra credit at the end of the semester. Students completed two 10-25 minutes online surveys through Qualtrics, one at the beginning and one at the end of the semester. The surveys asked about their attitudes and learning experiences in computer science, including academic challenges, motivational beliefs, commitment and satisfaction, perceptions of benefits and challenges, and background information.

Measures

Self-Reported Academic Challenges

At the beginning of the semester, students were asked to respond to an open-ended question, “In your experience, what challenges have you encountered while taking CSCI 1301 (or CSCI 1302)? Please list as many as come to mind.” We coded these self-reported responses for common themes in terms of types of challenges reported by students (see Analytic Strategy section).

Common Academic Challenges

At the end of the semester, students were asked to report the extent to which they experienced four common challenges identified from a review of previous studies on Asian and Asian American students, using eight items developed by the research team (see Table 3 for details). All items were rated on a 7-point scale, ranging from 1 (Not at all) to 7 (A great deal). Two items were used to measure students’ barriers to communication as a manifestation of language barriers ($\alpha = .85$; e.g., “Communicating with instructors and peers in this class makes me nervous.”). Two items were used to access students’ barriers to understanding as a manifestation of language barriers ($\alpha = .88$; e.g., “I struggle to understand some of the topics referenced by the instructor without more detailed explanations.”). Two items were used to measure students’ negative experiences with instructors ($\alpha = .80$; e.g., “I think instructors sometimes don’t understand my unique background and needs.”), and two items focused on students’ concerns about meeting high expectations imposed by model minority stereotype (α

= .80; e.g., “Others place higher expectations on me compared to my peers.”). An average score was computed for each common challenge based on the responses to the two relevant items.

Career Commitment

At both the beginning and the end of the semester, students’ commitment to computer science-related careers was measured through four items that were created by the research team. Each item was rated on a 7-point scale, ranging from 1 (Not at all true) to 7 (Very true) (α = .940; e.g., “I definitely want to pursue a computer science career.”). An average score was computed based on the responses to the four items.

Motivational Beliefs for Computer Science

At both the beginning and the end of the semester, students were asked about their motivational beliefs regarding computer science learning. Motivational beliefs were assessed using scales adapted from previous research based on Situated Expectancy-Value Theory. All items were rated on a 7-point scale, ranging from 1 (Not at All True) to 7 (Very True). Average scores were computed for each motivational construct based on the responses to the relevant items. Four items were used to assess students' *competence related beliefs* (adapted from Eccles & Wigfield, 1995; α = .85; e.g., “I think I will receive a good grade in computer science courses.”). Four items were used to measure students’ *attainment value* perceptions (adapted from Conley, 2012; α = .88; e.g., “Being someone who is good at computer science is important to me.”). *Intrinsic value* perceptions were assessed with three items (adapted from Conley, 2012; α = .88; e.g., “I like learning computer science.”). *Utility value* perceptions were assessed with three items (adapted from Conley, 2012; α = .87; e.g., “Computer science will be useful for me later in life.”). Students’ *perceived costs* were measured using16 items (adapted from Flake et al., 2015), including five items for *effort cost* (α = .92; e.g., “Studying computer science is too much work.”), six items for *emotional cost* (α = .91; e.g., “Studying computer science is too exhausting.”), and five items for *loss of valued alternatives cost* (α = .95; e.g., “Learning computer science causes me to miss out on other things I care about.”). All Cronbach’s alpha values reported above were calculated from the current sample, indicating strong internal consistency across all constructs.

Analytic Strategy

Thematic analysis was conducted to examine all students’ responses to the open-ended question about their academic challenges. Thematic analysis is a widely used qualitative method for identifying, analyzing, and interpreting key features of data in relation to participants’ lived experiences, views, and perspectives (Clarke & Braun, 2017). A team of two trained coders engaged in all steps of the analysis. First, both coders independently reviewed all open-ended responses and generated a list of themes representing the challenges students reported. Second, they discussed their themes and reached consensus on a set of coding themes. Third, the lead coder developed a coding scheme with detailed instructions and rules. Then, the coders tested the coding scheme by coding 20 randomly selected responses, refining the scheme as needed and repeating this process until the it was finalized. Once consensus was achieved, the two coders conducted a formal reliability check by test-coding a random sample of 60 responses. Interrater reliability was assessed by calculating Cohen’s kappa for each individual theme across the two coders, which ranged from .692 to 1.000. Upon establishing interrater reliability, the two coders coded all open-ended responses independently and then resolved disagreements through consensus.

For Research Question 1, the analysis included only Asian and Asian American students who responded to the beginning-of-semester survey (n = 127). For Research Question 2, the study used only the sample of Asian and Asian American students who completed the end-of-semester survey (*n* = 88). For Research Questions 3 and 4, the analyses were based on Asian and Asian American students who completed both the beginning- and end-of-semester surveys (*n* = 88). Students who selected Asian or Asian American as one of their identities were included in the Asian and Asian American student sample. The study analyzed Research Question 5 using all students who completed the relevant surveys for Research Questions 1–4, including both Asian and Asian American and non-Asian students (Research Question 1: *N* = 309, *n* of Asian and Asian American = 127, *n* of non-Asian = 182; Research Questions 2-4: *N* = 212, *n* of Asian and Asian American = 88, *n* of non-Asian = 124).

For Research Question 1, the study conducted descriptive analysis to assess the academic challenges Asian and Asian American students face when studying computer science by examining frequency and types of challenges reported in the coding themes and exploring patterns in students' experiences.

For Research Question 2, the study conducted descriptive analysis to assess the extent to which Asian and Asian American students experienced a set of challenges identified in prior research. This was done by calculating mean scores and standard deviations for each challenge and comparing the means to the midpoint of the scale and to scores for other challenges.

For Research Question 3, each motivational belief was analyzed in a separate multiple regression model to examine the associations between students' self-reported academic challenges (i.e., whether or not they referenced each type of challenge theme that was coded in response to Research Question 1) and their motivation to study computer science at the end of the semester (utility value, intrinsic value, attainment value, and perceived costs). We applied the same analytic approach to examine the associations between students' common academic challenges (i.e., the extent to which students experienced each common challenge identified in prior research and measured for Research Question 2) and their end-of-semester motivation. The corresponding motivational belief measured at the beginning of the semester was included as a control variable in each model and was standardized prior to analysis.

For Research Question 4, the study used a multiple regression model to examine the associations between different self-reported academic challenges and students' computer science career commitment at the end of the semester. We used another multiple regression model to analyze the associations between different common academic challenges and students' career commitment at the end of the semester. Career commitment measured at the beginning of the semester was included as a control variable in each model and was standardized prior to analysis.

For Research Question 5, the study used Chi-square tests to examine differences in the frequency with which different self-reported academic challenge themes faced by Asian or Asian American students compared to non-Asian students. Independent samples *t*-tests were conducted to assess differences in the extent to which Asian and Asian American and non-Asian students reported experiencing the four common academic challenges that were reported in prior literature. In addition, regression models with interaction terms were used to test whether the associations between academic challenges and motivation or career commitment differed by race/ethnicity. This was done by adding variables representing students' race/ethnicity (Asian/Asian American = 1, non-Asian = 0) and interaction terms between race/ethnicity and each academic challenge to the regression models for Research Questions 3 and 4.

To reduce the number of associations and comparisons in Research Questions 2–4, and to ensure that all regression predictors had sufficient variability for analysis, we focused only on the five most frequently self-reported academic challenge themes identified in Research Question 1 in analyzing these questions.

Results

Academic Challenges in Computer Science Course

Self-Reported Challenges

For Research Question 1, students' responses to the open-ended question asking about their challenges in computer science class were coded into 16 themes (see Table 1 for examples): Ability General, Adjustment, Coding Ability, Competitiveness and Pressure, Instructor and Class, Knowledge Application, Lack of Interest, Mention Positives, No Challenge, Personal Traits, Prior Knowledge, Putting in Effort, Social Other and Environment, Time Consuming, Time Management, Understanding/Learning/Memorizing. The Cohen's Kappas scores across two coders for each theme ranged from 0.692 to 1. Each student's response could be coded into more than one theme, with most students reporting challenges that fell into two themes.

As shown in Table 2, the most frequent reported challenge among Asian and Asian American students was Understanding/Learning/Memorizing (38.7% of responses fell into this category). Many students described difficulties with grasping specific concepts, learning new material, or retaining information. For example, one student explained, *"*Learning and understanding the purpose and function of various programming concepts can be difficult when interacting with the material for the first time." Some students mentioned that the topics or learning materials were generally hard for them to keep up with. As one student indicated, "It's a little hard to keep up with the jargon and shortcuts."

The second most frequently reported challenge was Coding Ability (29.8% of responses fell into this category). Students described difficulties with writing, debugging, and optimizing code, as one student mentioned, “Knowing how to properly and efficiently type code has been a challenge for me. There are always better ways to type codes than how I do it." Several students also specifically mentioned challenges with using certain software or coding languages, such as, “The software (Eclipse) also got some time to figure out as its all new.”

Students’ open-ended responses revealed that a lack of relevant prior knowledge or being new to the content taught in the class was a prominent reason for reporting challenges related to both Understanding/Learning/Memorizing and Coding Ability. For example, one student said that “The biggest challenge I have faced is never being introduced or taking a real computer science class before college. Because of this I have struggled with learning some of the well-known conventions that people who have taken such classes before are used to.” Another student mentioned “Coding in java definitely has a learning curve. Having no prior experience with coding I definitely struggled with the complexity.”

The third frequently reported challenge concerned Instructor and Class (27.6% of responses fell into this category). Some students described negative instructional experiences, such as “The professor has been difficult to understand, as he explains one thing in a lengthy way but without enough detail.” Others mentioned challenges related to class materials, format, or pace. For instance, one student said, “The content we learned in class, although aligned with the labs and projects, is much more bookish and focused on memorization rather than hands-on practice.” In addition to talking about challenges, several students also suggested that the class could be improved to enhance their experience by including more hands-on practice, instructional videos and examples. As one student wrote, “Although the readings are very useful, I sometimes feel they can use more detail and more examples.”

The fourth most frequently mentioned challenge was Putting in Effort (17.7% of responses fell into this category). Students noted that the course required putting in lots of effort. One student shared, “All the application takes a lot of effort and a long process to setup.” Several students also mentioned needing to do research or self-study outside of class to figure things out, which took extra effort, possibly because that the class didn’t cover all the things they needed. As one student explained, “We did not learn about the command prompt in the AP course, and my current teacher didn’t really explain how to use it at all, so I went home and kind of figured out how to use it by myself to some extent.” In addition, students also mentioned the heavy workload in this course. One student said, “I feel that I have as heavy of a workload in this course as I have had with all of my courses combined in previous semesters.” Specifically, they pointed to the large amount of reading and information they need to take in. For example, one student shared, “Another challenge would be reading the textbook that is required, as it has a lot of pages.”

The fifth most common challenge was Adjustment (15.3% of responses fell into this category), which referred to students’ efforts to adapt to a new class format, coding language, or coding environment, often due to discrepancies between what was used in the current class and what they had previously encountered. One student explained, “I did AP CSA in high school and my teacher had a very different format for the class so adjusting is taking a bit of time.” Another student wrote, “The main challenge has been the change to a Linux environment as it is different than what we were doing in 1301 and any other coding I had done in the past.”

There were multiple other themes that emerged relating to students’ self-reported challenges, which occurred less often (see Table 1 for examples of each). Specifically, 10.5% of responses fell into Mention Positives, where students noted benefits or positive features of the course; 8.9% of responses fell into Ability General, where students mentioned that the class content or tasks were hard in general; 8.9% of students reported challenges related to Prior Knowledge, referring to a lack of prior knowledge or experience related to course content or tasks; and 8.1% of students reported challenges related to Time Management, which involved difficulties with balancing or organizing time. Additionally, 7.3% of responses were coded as Time Consuming, where students noted the course required a lot of time; 6.3% of responses were coded as Competitiveness and Pressure, where students compared themselves to others or felt pressure to keep up; and 6.3% of responses were coded as Knowledge Application, where students struggled to apply what they learned in practice. Finally, 4.6% of responses were coded as No Challenge, where students reported experiencing no challenges at all in learning computer science; 1.6% of responses were coded as Lack of Interest, where students reported getting bored or having decreased interest in the class; 1.6% of responses was coded as Personal Traits, which referred to challenges tied to general individual characteristics; and 0.8% of responses were coded as Social Other and Environment, which included challenges in the broader environment outside of the classroom or the negative influences from other people.

Common Academic Challenges

For the 7-point scale questions administered at the end of the semester assessing the extent to which students experienced four common academic challenges identified through a review of prior research, Asian and Asian American students reported mean scores below the scale midpoint on three of the common challenges, indicating that they experienced these challenges to a low extent on average (see Table 3). However, they reported relatively higher scores on the common challenge related to concerns about meeting high expectations, with a mean score above the scale midpoint (*M* = 4.07, *SD* = 1.36). This challenge thus seemed more common than the others.

Descriptive Statistics and Correlations Among Continuous Variables

Descriptive statistics and correlations among key study variables are reported in Table 4. Overall, students reported high motivation for learning computer science and strong computer science career commitment, with scores above the scale midpoint on self-efficacy, attainment value, intrinsic value, utility value, and career commitment, and scores below the scale midpoint on effort cost, emotional cost, and loss of valued alternatives cost. Descriptive statistics for each variable by race (Asian and Asian American, non-Asian) are reported in Table 5. Asian and Asian American students reported descriptively lower motivation and career commitment compared to their non-Asian peers, on average.

Associations Between Academic Challenges and STEM Learning Motivation and Career Commitment

Self-Reported Challenges

Table 6 reports the associations between the top five most frequently reported academic challenges and learning motivation for computer science, using challenge themes that emerged in the coding of students' open-ended responses. Among Asian and Asian American students, reporting challenges related to Understanding/Learning/Memorizing was positively associated with end-of-semester perceived emotional cost, $\beta = 0.16$, $p = .037$ (see Table 6). Therefore, students who reported this challenge early in the semester were more likely to report higher emotional cost at the end of the semester, controlling for their perceived emotional cost early in the semester. There were no other statistically significant relationships observed between self-reported challenges and motivational beliefs. Additionally, there were no significant results in terms of how students' self-reported academic challenges predicted career commitment at the end of the semester, controlling for their career commitment early in the semester (see Table 7).

Common Academic Challenges

Table 8 reports the associations between the common academic challenges that prior literature suggested Asian and Asian American students might experience and end-of-semester motivation for learning computer science, controlling for corresponding beginning-of-semester motivational beliefs. Among Asian and Asian American students, those who reported experiencing higher levels of barriers to understanding were more likely to report lower self-efficacy (β = -0.30, p = .009), intrinsic value (β = -0.25, p = .015) and attainment value (β = -0.23, p = .033), and higher effort cost (β = 0.26, p = .017) and emotional cost (β = 0.18, p = .047) at the end of the semester. Similarly, those who reported experiencing higher levels of the common challenge related to negative experiences with instructors were more likely to report lower end-of-semester utility value (β = -0.33, p = .006), and attainment value (β = -0.26, p = .010). Moreover, those who reported experiencing higher levels of barriers to communication were more likely to report lower intrinsic value (β = -0.27, p = .027) and higher emotional cost (β = 0.22, p = .043) at the end of the semester. However, one common challenge was associated with Asian and Asian American students' end-of-semester motivational beliefs in unexpected patterns. Specifically, students who reported higher levels of concerns about meeting high expectations tended to report higher end-of-semester utility value (β = 0.32, p = .009) and attainment value (β = 0.41, p < .001).

Similar to the findings for self-reported challenges, no statistically significant associations were found between common challenges and Asian and Asian American students' end-of-semester career commitment after controlling for their career commitment at the beginning of the semester (see Table 9).

Differences Between Asian and Asian American and Non-Asian Students

In terms of self-reported academic challenges, the top five academic challenges most frequently reported by Asian and Asian American students were the same as those reported by non-Asian students (see Table 2). Furthermore, Chi-square tests showed that there were no significant group differences in the relative proportions of Asian versus non-Asian students reporting each of the top five self-reported challenges (see Table 10).

For the common challenges rated on 7-point scales at the end of the semester, the independent samples *t*-tests showed that Asian and Asian American students reported statistically significantly higher scores than non-Asian students on the challenge related to negative experiences with instructors (Asian and Asian American: $M = 2.82$, $SD = 1.49$, non-Asian students: $M = 2.21$, $SD = 1.30$), $t(205) = 3.09$, $p = .002$, $d = -0.37$ (see Tables 3 and 11).

There were few differences between Asian and non-Asian students in the relations between self-reported academic challenges in the open-ended responses and STEM learning motivation or career commitment. However, when students identified challenges related to Coding Ability, this predicted end-of-semester utility value for Asian and Asian American students more negatively than it did for non-Asian students, $\beta = -0.19$, $p = .047$ (See Table 12). As shown in Figure 1, among Asian and Asian American students, those who reported the Coding Ability challenge had lower end-of-semester utility value compared to their Asian peers who did not report this challenge. In contrast, non-Asian students who reported the Coding Ability challenge had higher utility value than non-Asian peers who did not report this challenge.

Differences emerged in the associations between common academic challenges and end-of-semester motivational beliefs between Asian and Asian American and non-Asian students (see Table 13). When students reported higher levels of the challenge related to negative experiences with instructors, this predicted end-of-semester attainment value for Asian and Asian American students more *negatively* than it did for non-Asian students, $\beta = -0.34$, $p = .026$. However, higher levels of concerns about meeting high expectations predicted end-of-semester attainment value for Asian and Asian American students more *positively* than it did for non-Asian peers, $\beta = 0.45$, $p = .026$. Few differences were found between Asian and non-Asian students in the associations between common academic challenges identified in previous research and their end-of-semester career commitment.

Discussion

This study set out to examine Asian and Asian American students' challenging academic experiences, how these predict their end-of-semester computer science learning motivation and career commitment, and how their experiences differ from those of their non-Asian peers. There are three major findings of this study. First, we found that the most salient self-reported challenges for students were related to understanding, coding, and instructor/class, and the most salient common challenge students experienced was related to high expectations from others. This provides instructors with insights into what students perceive as challenging. Second, challenges related to understanding, communication and negative interactions with instructors were found associated with students' lower self-efficacy and positive motivational beliefs, as well as higher perceived cost, whereas challenges related to high expectations from others were associated with higher positive motivational beliefs. These patterns indicate unique cultural backgrounds of Asian and Asian American students and offer important implications for how instructors can promote students' motivation in a culturally responsive manner. Third, compared to non-Asian students, Asian and Asian American students reported higher levels of negative experiences with instructors. Moreover, compared to non-Asian students, challenges related to negative experiences with instructors and coding ability showed stronger negative associations with Asian and Asian American students' motivational beliefs, whereas challenges related to meeting high expectations showed stronger positive associations. This uncovers the unique experiences of Asian and Asian American students and further underscores the importance of providing culturally responsive support for their learning and motivation.

Salient Academic Challenges for Asian and Asian American Students in Computer Science Course

As mentioned in the Introduction, previous studies have identified some frequently reported academic challenges faced by students in STEM fields, including heavy academic workloads, struggles with complex concepts, difficulties with coding and programming, and negative instructional experiences (e.g., Chen, 2013; Gallegos, 2020). However, little research has examined in detail which challenges are unique or more salient to Asian and Asian American students. Similarly, previous research on Asian and Asian American students has broadly discussed some academic challenges more common among this group, such as the Model Minority Stereotype (Sravanthi, 2024; Suyemoto et al., 2009; Trytten et al., 2012), but this body of research has not specifically examined the extent to which students experience these challenges in the context of computer science courses. To extend relevant research, we examined the challenges faced by Asian and Asian American students in computer science courses in two ways: self-reported challenges collected from open-ended questions and the extent to which students experienced common challenges identified in previous research through 7-point scales.

In terms of self-reported challenges, our findings indicate that the most frequently self-reported challenges of Asian and Asian American students overlap with those found in previous research but offer more nuanced insights into which challenges are most salient for Asian and Asian American students and how these challenges manifest among this group.

The most frequent challenge, reported by more than one-third of Asian and Asian American students (38.7%) in the course, was Understanding/Learning/Memorizing, which included difficulties in understanding, learning, and memorizing specific concepts or knowledge, as well as keeping up with the course material or the class in general. Following

Understanding/Learning/Memorizing, more than a quarter of Asian and Asian American students (29.8%) reported facing challenges related to Coding Ability, including difficulties with writing, debugging, and optimizing code, programming and problem-solving, and using different software, coding languages, or environments. A common trend in students' responses was that a lack of prior knowledge or experience related to the class content was associated with students experiencing both challenges. This finding aligns with previous research on college students' difficulties in studying computer programming, which indicates that beginners often struggle to understand programming concepts due to limited surface knowledge and a lack of prior programming experience (Gallegos, 2020; Qian & Lehman, 2017). There have been many studies demonstrating the importance and positive effects of building baseline proficiencies and scaffolding knowledge and skills on students' computer science learning (Belland et al., 2017; Kim et al., 2018). Our findings extend the importance of supporting students' foundational knowledge in computer science learning specifically to the Asian and Asian American student group.

More than a quarter of Asian and Asian American students (27.6%) also reported facing challenges related to their instructor or the class. Previous research has talked about instructional limitations as both a key reason why college students leave STEM fields and a major concern for those who still persist in STEM fields (Gallegos, 2020). Building on this, our study identified key instructional challenges that Asian and Asian American students were concerned about in computer science courses, such as instructors being hard to understand, materials being too bookish, formats being lecture-dominated, and the course pace being either too fast or too slow. Students also articulated expectations for how computer science courses can better support them, including more hands-on practice, additional videos to aid learning, and more examples. These findings highlight the needs for future instruction and course design to prioritize clear and accessible teaching, incorporate varied and interactive learning formats, and offer flexible pacing and supplemental resources to better meet diverse students' needs. Additionally, prior studies have demonstrated the effectiveness of some active learning and interactive techniques in STEM education, such as group problem-solving activities, real-time feedback, and studio or workshop course designs (Deslauriers et al., 2011; Freeman et al., 2014). Some of these approaches may be relevant for addressing the instructor and class related challenges reported by students in computer science courses and could be adapted to better suit future computer science learning environment.

In terms of common challenges from prior research applied specifically to CS learning, our findings revealed that Asian and Asian American students were more concerned about meeting high expectations from others than about difficulties in understanding, communication, and interactions with instructors, with this challenge receiving a mean score higher than that of other common challenges. This finding suggests that Asian and Asian American students may be experiencing the effects of the model minority stereotype, which places them under heightened academic standards and expectations from professors and peers, increasing their anxiety about disappointing others if they fail to meet these expectations (Assalone & Fann, 2016). According to prior research, stereotypes about Asian and Asian American students are particularly pronounced in STEM fields (Wolfgram et al., 2025). Prior research has also shown that Asian and Asian American students who do not conform to dominant STEM achievement narratives are often framed through a "failed minority" or deficit lens (Wolfgram et al., 2025), compounding the pressure and amplifying the negative consequences of not fitting the stereotypes. Asian and Asian American students' experiences of the model minority stereotype also connect to prior work on identity and stereotype threat faced by underrepresented students in STEM (Cheryan et al., 2020; Totonchi et al., 2021) and extend this line of research specifically to Asian and Asian American students in the context of computer science learning. Another possible explanation is that many Asian parents have higher educational expectations for their children compared with parents of other racial or ethnic backgrounds, viewing education as the key to upward mobility and social prestige (Lee & Zhou, 2014; Yamamoto & Holloway, 2010). Especially, Asian American families often put high expectations on pursuing STEM fields, which are regarded as prestigious pathways offering stability, social recognition, and lucrative career opportunities (Cooc & Kim, 2021), leading students to worry about failing to meet these expectations (Saw et al., 2013). These combined high cultural and social expectations in STEM fields may help explain why students experienced this challenge to a greater extent in computer science courses. Therefore, it's important for instructors to actively challenge the stereotypes and misconceptions faced by Asian and Asian American students while also consider the major role of family expectation underlying the challenges these students experience.

Although this study focuses on the most salient self-reported and common academic challenges faced by Asian and Asian American students in computer science courses, other challenges that students reported are also worthy of instructors' attention, such as those related to putting in effort, adjustment and time management. Supported by prior research, factors related to workload and time management are also closely associated with students' motivation and engagement in STEM learning (Aina et al., 2024; Fu et al., 2025).

Taken together, although some of the students' self-reported academic challenges in our study have been frequently discussed in prior research on STEM students in general, the results provide a more nuanced understanding of which challenges are most salient for Asian and Asian

American students, how they articulate and interpret these challenges, and what expectations they hold for how the course could be better designed to support them. While prior research has discussed the common academic challenges faced by Asian students in general educational contexts, the results of this study further illustrate how these challenges are experienced specifically within the computer science context, highlighting the stereotypes and the important role of family that underlie Asian and Asian American students' experiences. The combination of students' self-reported and common challenges extends our understanding of Asian and Asian American students' challenging learning experiences in computer science learning context, which can help instructors better allocate their efforts and consider the unique social and cultural backgrounds of these students when supporting them in addressing academic challenges.

Academic Challenges Closely Associated with Learning Motivation for Computer Science

A common trend in past studies is that students' challenging academic experiences often lead to decreased motivational beliefs (Kristensen et al., 2023; Maulana et al., 2016; Rubach et al., 2023). Our study similarly found that several academic challenges, notably those related to understanding, communication, and negative experiences with instructors, were closely associated with reduced positive motivational beliefs and/or higher perceived cost among Asian and Asian American students.

The common challenges related to negative experiences with instructors were associated with Asian and Asian American students' lower utility value and attainment value reported at the end of the semester. Our findings are somewhat consistent with prior work on Asian and Asian American students, which has shown that negative advising experiences can undermine students' motivation by lowering their self-efficacy and intrinsic value (Kodama & Park, 2021; Zhang et al., 2025). However, differing from that work, our findings suggest that instructors' lack of understanding of students' unique cultures and backgrounds is also closely associated with students' perceived usefulness of studying computer science for achieving their goals, as well as its meaningfulness to their identity. Prior research on culturally responsive teaching has shown that when instruction fails to validate and integrate students' diverse cultures and backgrounds, students may feel disconnected from the class content and question their sense of belonging, which in turn leads them to view the content as less useful to their communities and identities and to perceive school success as less affirming their identity (Abacioglu et al., 2020; Zeng et al., 2025). To better support Asian students, training programs for instructors should emphasize culturally responsive advising and teaching that recognize how students' culture and backgrounds shape their behaviors or lead to unique needs (Schell, 2023).

Academic challenges related to understanding were also linked to students' lower positive motivational beliefs and higher perceived costs. In terms of the associations with perceived cost, both the self-reported Understanding/Learning/Memorizing challenge and greater endorsement of both common barriers to understanding that prior research had examined were associated with higher perceived emotional cost among Asian and Asian American students. Supported by prior research (Zhou & Kim, 2006; Hsin & Xie, 2014), one possible explanation is that Asian American families, especially immigrants, invest substantial time and financial resources into their children's education, viewing academic success not only as a way to uphold cultural traditions but also to honor family sacrifices. Therefore, these students often face intense academic pressure due to internalized family and cultural expectations for high achievement (Shen, 2015), which can heighten their emotional responses to difficulties in both understanding and make the study of computer science stressful. In addition to providing relevant academic supports, instructors may want to try to normalize challenges as a natural part of learning process and foster growth mindset by emphasizing the value of effort, learning from mistakes, and improvement rather than only focusing on the final outcome or grade (Bateman & Cunningham, 2025; Seo et al., 2025).

Additionally, the common challenge related to understanding was also associated with Asian and Asian American students' higher perceived effort cost. Prior work (Albertson, 2021), though focused on international Asian students, reported that some students find it difficult to understand certain topics mentioned by instructors because of cultural and language differences. Asian and Asian American students often associate academic achievement with effort (Sue & Okazaki, 2022; Yan & Gaier, 1994), attributing their failures to a lack of effort. In other words, this suggests that students may feel they need to put in more effort to overcome cultural and language differences, which may help explain the positive connection between understanding barriers and cost perceptions here. This finding further reinforces the importance of culturally responsive teaching in helping students navigate cultural and language differences as well as in mitigating some of the unique costs faced by Asian students.

In terms of associations with positive motivational beliefs, the common challenge related to barriers to understanding was associated with Asian and Asian American students' lower self-efficacy, intrinsic value and attainment value. A prior study in a college statistics course by Sutter et al. (2024) showed that students with stronger concerns about understanding the concepts at the start of the course experienced greater declines in expectancy over the term and reported lower future interest in statistics. Our results extend this work by demonstrating similar relationships among Asian and Asian American students in computer science courses. According to prior research, racial minority students who face higher levels of negative stereotype threat experience declines in attainment value in STEM (Totonchi et al., 2021). When students anticipate being judged by negative stereotypes about their group, they may create psychological distance between their identity and the domain, gradually devaluing the domain as a coping mechanism (Woodcock et al., 2012). Therefore, it is possible that difficulties in understanding course content and instructions lead Asian and Asian American students to worry about the negative consequences of failing to meet stereotypes or others' expectations. As a result, they may devalue the importance of studying computer science to their identity as a way to protect their self-worth. While promoting understanding is important for fostering positive motivational outcomes, the findings also highlight the need to raise awareness among non-Asian peers and faculty about the stereotypes faced by Asian and Asian American students. Actively challenging the misperceptions and biases held about Asian Americans can help cultivate more inclusive learning environments where students worry less about negative judgment when they do not fit the mold (Wei et al., 2020).

The common barrier related to communication was associated with Asian and Asian American students' lower intrinsic value and higher emotional cost. This aligns with prior research, though not specifically focused on students in STEM fields, showing that language- and culture-related communication obstacles contribute to greater communication anxiety, making students feel that asking questions or interacting with others is stressful and high-stakes (Chu & Walters, 2013; Liu, 2000). Communication anxiety has been found to be closely related to Chinese high school students' higher emotional cost and lower intrinsic value of English learning (Dong et al., 2022). Our findings extend prior research by demonstrating that these relationships also hold for a broader population of Asian and Asian American students in STEM fields. Past studies have suggested several strategies to help minimize risks for Asian and Asian American students and make them feel more comfortable engaging in class discussions. These include incorporating written communication during or after class, providing personal space and wait time for formulating questions or responses, offering one-on-one communication to address individual concerns (Bao, 2020; Hodne, 1997; Tani, 2008). These strategies may be helpful for addressing communication challenges reported by students in computer science courses.

Unexpectedly, the common challenge related to concerns about meeting high expectations was found to be linked to *increased* positive motivational beliefs. Prior research has suggested that higher expectations can motivate Asian and Asian American students to study harder and perform better (Trytten et al., 2012). Our study extends this work by identifying specific ways in which high expectations may motivate students. When perceiving higher expectations from others, Asian and Asian American students reported higher end-of-semester attainment value and utility value. It is possible that students' internalization of the model minority stereotype, which views Asian and Asian American students as expected to perform well, particularly in STEM fields (Assalone & Fann, 2016; McGee, 2018), along with cultural norms that emphasize academic achievement as a means of honoring family and fulfilling obligations (Cooc & Kim, 2021), increases their perceived importance of succeeding in computer science related tasks to their identity. Moreover, research has mentioned that Asian and Asian American students' motivation is highly influenced by their parents' expectations and beliefs (e.g., Mun & Hertzog, 2019). Some studies have shown that students who perceive higher parental expectations and value for STEM also report significantly higher utility value for STEM (Harackiewicz et al., 2012; Nalipay et al., 2021; Williams & Weiss, 2018). Although these studies do not focus specifically on Asian and Asian American students, they offer a potential explanation for why utility value increased in our study when students perceived high expectations for success in computer science, particularly from their families.

At the same time, however, higher expectations can also cause significant harm to Asian and Asian American students' psychological well-being and physical health because of the fear of failing to meet these expectations and disappointing others (McGee, 2018; Naumann et al., 2012; Rajagopal & Durkee, 2024; Tuan, 1998). As a result, while high expectations can sometimes be associated with positive motivational outcomes, instructors may still need to be careful to avoid placing too much pressure on students. These findings reinforce the idea that instructors should not only set appropriate expectations but also establish mastery goals, monitor progress, and provide emotional support to sustain students' motivation and engagement (Rubie-Davies & Hattie, 2025). This approach may be particularly effective for Asian and Asian American students. Instructors could also help students identify and distinguish between their personal values regarding education and their parents' values and expectations, reducing the negative consequences of failing to meet high expectations from their families while sustaining their motivation. More broadly, the positive associations between concerns about meeting high expectations and motivational beliefs found in our study reveal that not all challenging experiences are detrimental to students' motivation. Rather than attempting to eliminate all challenges, instructors should be thoughtful about the diverse challenges Asian and Asian American students face and provide desirable difficulties that promote their motivation.

Differences Between Asian and Asian American and Non-Asian Students

Few significant differences were found between Asian and non-Asian students in terms of frequency of self-reported challenges and their associations with career commitment, and only one significant difference emerged in the associations between self-reported challenges and motivational beliefs. Similarly, few significant differences were found in the associations between students' common academic challenges and their career commitment. However, several common academic challenges were experienced more strongly by Asian and Asian American students or were more negatively associated with their motivational beliefs compared to those of non-Asian students.

Asian and Asian American students, compared to their non-Asian peers, reported experiencing higher levels the common challenge related to negative experience with instructors. This is consistent with previous research showing that Asian and Asian American students' academic advising experiences can be less positive than those of their non-Asian peers (Schell, 2023; Sechelski & Slate, 2018). This finding reinforces instructors' lack of awareness regarding cultural mismatches in academic advising and their limited understanding of students' unique backgrounds and needs. The underrepresentation of Asian Americans in advisory roles (Kodama & Huynh, 2017), who share similar values and concerns with students, may further contribute to students' feelings of being misunderstood and unsupported. It is important for advisors to adopt a holistic and culturally sensitive approach by acknowledging how cultural norms and family expectations shape students' behaviors and needs, validating their desire to remain responsive to those norms and expectations, and becoming more familiar with resources targeted to Asian American students (Kodama & Huynh, 2017). Moreover, institutions should also consider hiring more Asian American advisors who share similar experiences and backgrounds with students, given the current underrepresentation of Asian Americans staff.

The study also showed that perceptions of instructors' misunderstanding, or lack of understanding of students' culture and background were stronger negative predictors of attainment value for Asian and Asian American students compared to their non-Asian peers. For non-Asian students, particularly White students, cultural perspectives often align more closely with mainstream campus expectations (Edman, 2009). As a result, cultural validation and support are less central to their attainment value. Moreover, our findings suggest that concerns about meeting high expectations were a stronger positive predictor of attainment value for Asian and Asian American students. These patterns further emphasize how family and cultural norms, experiences of cultural disconnection, and the model minority stereotype uniquely shape the educational experiences of Asian and Asian American students. Aligning instructional approaches with Asian and Asian American students' cultural norms, while actively mitigating the effects of stereotypes, is critical to supporting their attainment value.

When encountering challenges related to Coding Ability, Asian and Asian American students tended to report lower utility value compared to non-Asian peers. Prior research indicates that Asian Americans often place a stronger emphasis on the utility value of education, particularly in STEM fields (Xie & Goyette, 2003). As discussed above, this is possibly due to cultural and familial high expectations around academic and career success. Therefore, when facing difficulties in improving skills related to writing codes, debugging and using various coding software that are perceived as essential for achieving future success, the decline in perceived usefulness of computer science seems more salient for Asian students. To enhance students' utility value, instructors can support their development of coding skills while also more consistently and proactively help students connect challenging coding skills to their future goals.

Overall, Asian and Asian American students' learning and motivation would benefit if instructors provided support that not only directly addressed their most salient academic challenges but also considered the social and cultural factors underlying these challenges. On the one hand, instructors can promote students' understanding and coding abilities, meet the diverse needs of their classes, and foster motivation by scaffolding foundational knowledge, offering clear and accessible instruction, and incorporating varied learning formats. On the other hand, instructors may need to recognize the unique experiences of Asian and Asian American students, including the heightened expectations associated with the model minority stereotype, potential cultural disconnections or misalignments that occur in classroom instructions, and the high expectations and utility value their family placed on educational achievement and STEM pathways. They should also reflect on their own potential biases or misunderstandings about this group. By developing such awareness, instructors can more effectively provide culturally responsive teaching and advising by normalizing challenges, setting appropriate expectations, challenging stereotypes, and fostering a comfortable and inclusive learning environment.

Limitations and Future Directions

There are several limitations to consider when interpreting the results, and these also provide important implications for future research. First, while this study focused on Asian and Asian American students' challenging academic experiences, the open-ended question did not explicitly ask about the unique challenges they faced as Asian and Asian American students or the specific social and cultural factors underlying their perceived challenges. We intentionally framed the question this way to avoid limiting responses due to demand characteristics and to collect as much information as possible, given that their experiences are underexplored. However, as a result, students may not have considered or articulated challenges directly tied to their cultural identities or backgrounds that they did experience. Similarly, although the study measured Asian and Asian American students' experiences with certain academic challenges that may be unique or more common for them at the end of the semester, the items were not explicitly framed as stemming from their social or cultural backgrounds. This may have limited the ability to fully capture the challenges specifically shaped by their cultural and social contexts.

It may also have increased the likelihood that non-Asian students reported high scores on the same challenges but for different reasons, thereby reducing the observed differences between Asian and non-Asian students. To better understand the experiences of Asian and Asian American students and how they differ from those of other groups, future studies should design more open-ended and survey questions that invite students to reflect on how their cultural backgrounds, identities, and social contexts shape their academic experiences.

Second, the study found very few associations between students' academic challenges and their end-of-semester career commitment. It is possible that one semester is not enough to detect meaningful predictive patterns between challenges and commitment. According to Social Cognitive Career Theory (Lent et al., 1994), long-standing motivational beliefs developed over time have a stronger impact on career commitment than immediate classroom challenges. Future studies should consider longitudinal designs that track students' experiences and beliefs across multiple semesters to capture how challenges accumulate or shift over time and how these patterns shape career commitment.

Third, items assessing the extent to which students experienced some common challenges mention in previous research were measured at the end of the semester instead of at the beginning, which limits the ability to determine whether early perceptions of these challenge predicted end-of-semester motivation and career commitment. Future research could measure these challenges at multiple points across the semester to capture both initial perceptions and how they evolve over time, providing a full picture of their predictive role in shaping motivation and career commitment.

Forth, this study was conducted in Fall 2024, and since then, significant sociopolitical and technological shifts may influence how the findings are interpreted. Following the change in the U.S. presidential administration in 2025, new government policies and evolving public discourse may have affected Asian and Asian American students' experiences and perceptions of challenges in higher education, as well as their STEM-related career plans. Additionally, the rapid advancement of technology, especially artificial intelligence (AI), and its growing application in education have begun to reshape students' learning motivation, engagement, and outcomes (Mohamed et al., 2025; Vieriu & Petrea, 2025). AI learning tools can enhance students' motivation by providing personalized feedback, adaptive challenges, and opportunities for self-directed learning that strengthen their sense of competence and autonomy, whereas overreliance on AI may diminish critical thinking skills and cognitive engagement (Li et al., 2025; Vieriu & Petrea, 2025). Future research should examine how these emerging contextual factors, interacting with students' unique cultural backgrounds, influence students' motivation and career intentions in STEM over time.

Conclusion

This study enhances the understanding of Asian and Asian American students' unique learning experiences that shape their motivation in STEM. We examined both self-reported and common academic challenges faced by Asian and Asian American students in computer science courses, their associations with computer science career commitment and motivational beliefs, and how these experiences differ from those of their non-Asian peers. The findings revealed that the most salient challenges for Asian and Asian American students were related to understanding, coding ability, instructor/class, and high expectations. Specifically, challenges involving understanding, communication, and negative experiences with instructors were closely associated with negative motivational beliefs, whereas challenges related to high expectations were more strongly associated with positive motivational beliefs. Moreover, differences between

Asian and non-Asian students centered on negative experiences with instructors and on distinct patterns linking negative experiences with instructors, coding ability, and high expectations to motivational beliefs. Overall, this study underscores the important role of family and cultural values and norms, stereotypes, and cultural disconnections in shaping Asian and Asian American students' learning experiences and motivation, and points to implications for culturally responsive teaching and advising to better support these students.

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Table 1

Themes from Open-Ended Responses About Challenges in Computer Science

Themes	Examples
Ability General	"The class content is difficult."
Adjustment	"I have found emacs to be difficult to adjust to at times, and the amount of outside reading this class takes is also an adjustment."
Coding Ability	"Thinking as a programmer."
Competitiveness and Pressure	"Also, a lot of the students in this class have previous coding experience and I do not, which makes me sometimes feel behind."
Instructor and Class	"The professor has been difficult to understand as he explains one thing in a length way but not detailed."
Knowledge Application	"I find understanding concepts easy, but when I am tasked in homework, I feel useless because I find it hard to technically execute in code."
Lack of Interest	"The class content is disengaging and difficult."
Mention Positives	"Keeping up with readings alongside other classes can be hard, but they seem helpful."
No Challenge	"There hasn't been any challenge yet."
Personal Traits	"I have had focus troubles."
Prior Knowledge	"I have never coded before, so I struggled a lot in the beginning."
Putting in Effort	"There is a lot of work to do every day for the class."
Social Other and Environment	"Besides that, 8 AMs have been difficult to attend with how I need to get to my parking spot an hour and a half before class because of poor traffic--I have to wake up at 5 AM."
Time Consuming	"It is a very time-consuming class."
Time Management	"Additionally, the biggest challenge is time management."
Understanding/Learning/ Memorizing	"Not always understanding the context of when to use code to achieve the goal."

Note: The Cohen's Kappas scores for each theme across two coders ranged from 0.692 to 1. Each student's response could be coded into more than one category.

Table 2

Frequencies and Percentages of Self-Reported Academic Challenges

Challenges	Asian and Asian American	Non-Asian	Total
Understanding/Learning/Memorizing	48 (38.7%)	62 (39.5%)	110 (39.1%)
Coding Ability	37 (29.8%)	37 (23.7%)	74 (26.4%)
Instructor and Class	35 (27.6%)	41 (26.3%)	76 (27.1%)
Putting in Effort	22 (17.7%)	33 (21.0%)	55 (19.6%)
Adjustment	19 (15.3%)	17 (10.9%)	36 (12.9%)
Mention Positives	13 (10.5%)	17 (10.9%)	30 (10.7%)
Ability General	11 (8.9%)	17 (10.9%)	28 (10.1%)
Prior Knowledge	11 (8.9%)	13 (8.3%)	24 (8.6%)
Time Management	10 (8.1%)	16 (10.3%)	26 (9.3%)
Time Consuming	9 (7.3%)	10 (6.4%)	19 (6.8%)
Competitiveness and Pressure	8 (6.3%)	10 (6.4%)	18 (6.4%)
Knowledge Application	8 (6.3%)	11 (7.1%)	19 (6.8%)
No Challenge	5 (4.6%)	9 (5.8%)	14 (5.0%)
Lack of Interest	2 (1.6%)	5 (3.2%)	7 (2.5%)
Personal Traits	2 (1.6%)	12 (7.7%)	14 (5.0%)
Social Other and Environment	1 (0.8%)	6 (3.8%)	7 (2.5%)

Note: n of Asian and Asian American Students = 124, *n* of non-Asian Students = 156. The percentages represent the proportion of students within each group (Asian and Asian American, non-Asian, and total students) who reported experiencing each type of self-reported academic challenge. All self-reported challenges were coded by two coders based on student open-ended responses to academic challenges in computer science courses. Students could indicate more than one challenge in their responses.

Table 3

Mean Scores on Common Academic Challenges Among Asian and Asian American and Non-Asian Students

	Asian And Asian American		Non-Asian	
Common Challenges	***M***	***SD***	***M***	***SD***
Barriers to Communication	3.53	1.77	3.27	1.58
I lack confidence about asking questions in class (either to my instructors or my peers).				
Communicating with instructors and peers in this class makes me nervous.				
Barriers to Understanding	3.78	1.44	3.67	1.48
I struggle to understand the content of the readings and course assignments.				
I struggle to understand some of the topics referenced by the instructor without more detailed explanations.				
Concerns about Meeting High Expectations	4.07	1.36	3.83	1.33
Others place higher expectations on me compared to my peers.				
I think failing to perform well in this class would reflect very poorly on me.				
Negative Experiences with Instructor	2.82	1.49	2.21	1.30
I think my instructors sometimes misunderstand my behaviors or intentions in the class.				
I think instructors sometimes don't understand my unique background and needs.				

Note: n of Asian and Asian American Students = 86*, n* of non-Asian Students = 121. Each student's score for each common challenge was calculated as the average of their responses to the two relevant items.

Table 4

Correlations and Descriptive Statistics for Key Study Variables

Variable	1.	2.	3.	4.	5.	6.	7.	8.
1. Self-Efficacy								
2. Intrinsic Value	.665**							
3. Attainment Value	.367**	.583**						
4. Utility Value	.467**	.600**	.688**					
5. Loss of Valued Alternatives Cost	-.393**	-.334**	-.009	-.157*				
6. Emotional Cost	-.590**	-.488**	-.072	-.206**	.755**			
7. Effort Cost	-.526**	-.505**	-.106	-.261**	.771**	.884**		
8. Career Commitment	.444**	.650**	.681**	.700**	-.184**	-.241**	-.280**	
M	4.69	4.77	4.99	5.67	3.71	3.94	3.82	4.80
SD	1.15	1.38	1.30	1.21	1.53	1.38	1.33	1.30
n	204	204	204	204	204	204	204	204

Note: *$p < .05$; **$p < .01$

Table 5

Mean Scores for Computer Science Learning Motivation and Career Commitment

	Asian And Asian American		Non-Asian	
Variable	***M***	***SD***	***M***	***SD***
Self-Efficacy	4.63	1.10	4.74	1.19
Intrinsic Value	4.50	1.45	4.96	1.30
Attainment Value	4.98	1.23	5.01	1.35
Utility Value	5.59	1.16	5.72	1.24
Loss of Valued Alternatives Cost	3.77	1.53	3.67	1.53
Emotional Cost	4.14	1.37	3.80	1.37
Effort Cost	4.05	1.35	3.65	1.29
Career Commitment	4.73	1.58	4.86	1.79

Note: n of Asian and Asian American Students = 85, *n* of non-Asian Students = 119.

Table 6

Results of Regression Analyses Predicting End-of-Semester Motivational Beliefs from Self-Reported Academic Challenges

	SE				UV				AV				IV			
Variables	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***
Intercept	1.76	0.48			2.64	0.60			2.00	0.45			0.88	0.48		
SE T1	0.62	0.09	0.61	<.001												
UV T1					0.50	0.10	0.52	<.001								
AV T1									0.59	0.08	0.63	<.001				
IV T1													0.80	0.09	0.70	<.001
Understanding/ Learning/Memorizing	-0.14	0.21	-0.06	.502	0.27	0.24	0.11	.259	0.31	0.22	0.13	.151	-0.10	0.25	-0.03	.687
Instructor and Class	-0.26	0.23	-0.10	.273	-0.15	0.26	-0.06	.559	-0.13	0.24	-0.05	.595	-0.15	0.27	-0.05	.587
Coding Ability	-0.13	0.23	-0.05	.573	-0.38	0.25	-0.15	.133	-0.31	0.23	-0.12	.183	-0.48	0.26	-0.15	.072
Putting in Effort	0.17	0.25	0.06	.501	-0.23	0.29	-0.08	.428	0.15	0.26	0.05	.569	-0.07	0.30	-0.02	.826
Adjustment	0.28	0.26	0.10	.296	0.19	0.30	0.06	.513	0.14	0.28	0.04	.618	0.36	0.31	0.10	.254

Variables	LVAC B	LVAC S.E.	LVAC β	LVAC *p*	EmC B	EmC S.E.	EmC β	EmC *p*	EfC B	EfC S.E.	EfC β	EfC *p*
Intercept	1.49	0.36			1.13	0.30			1.40	0.35		
LVAC T1	0.64	0.09	0.63	<.001								
EmC T1					0.76	0.07	0.76	<.001				
EfC T1									0.71	0.08	0.69	<.001
Understanding/ Learning/Memorizing	0.28	0.28	0.09	.326	0.43	0.20	0.16	.037	0.32	0.23	0.11	.174
Instructor and Class	0.19	0.31	0.06	.533	0.39	0.22	0.13	.087	0.12	0.25	0.04	.627
Coding Ability	0.26	0.30	0.08	.380	0.22	0.22	0.07	.324	0.13	0.25	0.04	.603
Putting in Effort	0.06	0.34	0.02	.867	-0.28	0.25	-0.08	.258	-0.15	0.28	-0.04	.589
Adjustment	0.10	0.35	0.02	.785	0.07	0.25	0.02	.789	0.25	0.29	0.07	.383

Note: Each end-of-semester motivational belief was analyzed in a separate multiple regression model, controlling for the corresponding beginning-of-semester motivational belief. Motivational Beliefs: SE =Self-Efficacy, UV = Utility Value, AV = Attainment Value, IV = Intrinsic Value, LVAC = Loss of Valued Alternatives Cost, EmoC = Emotional Cost, EfC = Effort Cost. SE T1 = beginning-of-semester self-efficacy, UV T1 = beginning-of-semester utility value, AV T1 = beginning-of-semester attainment value, IV T1 = beginning-of-semester intrinsic value, LVAC T1= beginning-of-semester loss of valued alternatives Cost, EmC T1 = beginning-of-semester emotional cost, EfC T1 = beginning-of-semester effort cost. All self-reported challenges were coded by two coders based on student open-ended responses to academic challenges in computer science courses.

Table 7

Results of Regression Analyses Predicting End-of-Semester Career Commitment from Self-Reported Academic Challenges

Variables	**B**	**S.E.**	**β**	***p***
Intercept	0.99	0.38		
Career Commitment T1	0.78	0.06	0.81	<.001
Understanding/ Learning/Memorizing	-0.13	0.22	-0.04	.547
Instructor and Class	-0.06	0.24	-0.02	.800
Coding Ability	-0.27	0.24	-0.08	.261
Putting in Effort	-0.15	0.26	-0.04	.580
Adjustment	0.15	0.27	0.04	.595

Note: All self-reported challenge variables were included in one multiple regression model predicting end-of-semester career commitment, controlling for the beginning-of-semester career commitment. Career Commitment T1 = beginning-of-semester career commitment. All self-reported challenges were coded by two coders based on student open-ended responses to academic challenges in computer science courses.

Table 8

Results of Regression Analyses Predicting End-of-Semester Motivational Beliefs from Common Academic Challenges

	SE				UV				AV				IV			
Variables	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***
Intercept	3.86	0.53			3.30	0.64			2.61	0.46			2.78	0.57		
SE T1	0.40	0.09	0.40	<.001												
UV T1					0.40	0.09	0.41	<.001								
AV T1									0.47	0.08	0.50	<.001				
IV T1													0.59	0.09	0.51	<.001
Challenge 1	-0.13	0.08	-0.21	.109	0.02	0.10	0.03	.840	-0.04	0.09	-0.06	.606	-0.22	0.10	-0.27	.027
Challenge 2	-0.23	0.09	-0.30	.009	-0.14	0.10	-0.18	.154	-0.19	0.09	-0.23	.033	-0.26	0.10	-0.25	.015
Challenge 3	-0.11	0.07	-0.15	.145	-0.25	0.09	-0.33	.006	-0.21	0.08	-0.26	.010	-0.06	0.09	-0.07	.482
Challenge 4	0.12	0.09	0.15	.165	0.27	0.10	0.32	.009	0.37	0.09	0.41	<.001	0.20	0.10	0.19	.058

	LVAC				EmC				EfC			
Variables	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***
Intercept	0.93	0.43			0.87	0.32			0.91	0.36		
LVAC T1	0.48	0.09	0.49	<.001								
EmC T1					0.54	0.08	0.53	<.001				
EfC T1									0.50	0.09	0.50	<.001
Challenge 1	0.12	0.11	0.14	.302	0.17	0.08	0.22	.043	0.07	0.09	0.10	.424
Challenge 2	0.08	0.12	0.08	.504	0.17	0.09	0.18	.047	0.24	0.10	0.26	.017
Challenge 3	0.14	0.11	0.13	.211	0.04	0.08	0.05	.584	0.07	0.09	0.08	.415
Challenge 4	0.05	0.11	0.04	.685	-0.00	0.08	-0.00	.969	0.01	0.09	0.01	.886

Note: Each end-of-semester motivational belief was analyzed in a separate multiple regression model, controlling for the corresponding beginning-of-semester motivational belief. Motivational Beliefs: SE =Self-Efficacy, UV = Utility Value, AV = Attainment Value, IV = Intrinsic Value, LVAC = Loss of Valued Alternatives Cost, EmoC = Emotional Cost, EfC = Effort Cost, SE T1 = beginning-of-semester self-efficacy, UV T1 = beginning-of-semester utility value, AV T1 = beginning-of-semester attainment value, IV T1 = beginning-of-semester intrinsic value, LVAC T1= beginning-of-semester loss of valued alternatives Cost, EmC T1 = beginning-of-semester emotional cost, EfC T1 = beginning-of-semester effort cost. Common Academic Challenge: Challenge 1 = Barriers to Communication, Challenge 2 = Barriers to Understanding, Challenge 3 = Negative Experiences with Instructor, Challenge 4 = Concerns about Meeting High Expectations.

Table 9

Results of Regression Analyses Predicting End-of-Semester Career Commitment from Common Academic Challenges

Variables	**B**	**S.E.**	**β**	***p***
Intercept	1.09	0.48		
Career Commitment T1	0.75	0.06	0.78	<.001
Challenge 1	-0.14	0.09	-0.16	.123
Challenge 2	-0.07	0.10	-0.07	.461
Challenge 3	0.02	0.09	0.02	.836
Challenge 4	0.16	0.10	0.14	.101

Note: All challenges variables were included in one multiple regression model predicting end-of-semester career commitment, controlling for the beginning-of-semester career commitment. Career Commitment T1 = beginning-of-semester career commitment. Common Academic Challenge: Challenge 1 = Barriers to Communication, Challenge 2 = Barriers to Understanding, Challenge 3 = Negative Experiences with Instructor, Challenge 4 = Concerns about Meeting High Expectations.

Table 10

Differences in Self-Reported Academic Challenges Between Asian and Asian American and Non-Asian Students

Challenges	***χ2***	***df***	***p***
Understanding/ Learning/Memorizing	0.21	1	.650
Instructor and Class	0.00	1	.963
Coding Ability	0.34	1	.558
Putting in Effort	0.15	1	.695
Adjustment	2.27	1	.132

Note: *N* of Valid Case = 203. All self-reported challenges were coded by two coders based on student open-ended responses to academic challenges in computer science courses.

Table 11

Comparison of Mean Scores on Common Academic Challenges Between Asian and Asian American and Non-Asian Students

Challenges	***t***	***df***	***p***	**Cohen's *d***
Barriers to Communication	1.14	205	.257	-0.15
Barriers to Understanding	0.54	206	.590	-0.09
Negative Experiences with Instructor	3.09	205	.002	-0.37
Concerns about Meeting High Expectations	1.26	205	.208	-0.16

Note: n of Asian and Asian American Students = 86, *n* of non-Asian Students = 121.

Table 12

Differences in the Effect of Self-Reported Academic Challenges on End-of-Semester Motivational Beliefs Between Asian and Asian American and Non-Asian Students

	SE				UV				AV				IV			
Variables	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***
Intercept	0.88	0.38			1.84	0.49			1.37	0.31			0.84	0.37		
SE T1	0.66	0.06	0.62	<.001												
UV T1					0.58	0.07	0.51	<.001								
AV T1									0.68	0.05	0.70	<.001				
IV T1													0.76	0.06	0.68	<.001
Asian Vs. Not	0.64	0.25	0.27	.012	0.35	0.07	0.51	<.001	0.18	0.25	0.07	.478	0.25	0.28	0.09	.375
Understanding/ Learning/Memorizing	0.21	0.19	0.09	.264	-0.12	0.21	-0.05	.570	-0.05	0.19	-0.02	.802	-0.11	0.21	-0.04	.601
Instructor and Class	0.18	0.21	0.07	.407	0.52	0.23	0.19	.025	0.27	0.21	0.10	.194	0.14	0.23	0.05	.552
Coding Ability	0.03	0.22	0.01	.899	0.31	0.24	0.12	.189	0.10	0.22	0.00	.964	0.05	0.24	0.02	.815
Putting in Effort	0.59	0.22	0.20	.007	0.14	0.24	0.05	.563	0.12	0.22	0.04	.597	0.09	0.24	0.03	.713
Adjustment	0.32	0.29	0.10	.272	0.15	0.32	0.04	.642	0.06	0.29	0.02	.837	0.43	0.32	0.11	.183
Asian Vs. Not × Understanding/ Learning/Memorizing	-0.35	0.29	-0.11	.229	0.35	0.32	0.11	.276	0.36	0.29	0.10	.214	0.02	0.32	0.00	.957
Asian Vs. Not × Instructor and Class	-0.45	0.32	-0.12	.163	-0.65	0.35	-0.17	.065	-0.39	0.32	-0.10	.226	-0.28	0.36	-0.07	.428
Asian Vs. Not × Coding Ability	-0.14	0.32	-0.04	.653	-0.70	0.35	-0.19	.047	-0.30	0.32	-0.08	.344	-0.53	0.35	-0.13	.131
Asian Vs. Not × Putting in Effort	-0.42	0.34	-0.10	.222	-0.41	0.38	-0.09	.275	0.00	0.34	0.00	.998	-0.15	0.38	-0.03	.691
Asian Vs. Not × Adjustment	-0.04	0.40	-0.01	.921	0.09	0.44	0.02	.843	0.13	0.40	0.03	.742	-0.08	0.44	-0.02	.851

Variables	LVAC B	S.E.	β	*p*	EmC B	S.E.	β	*p*	EfC B	S.E.	β	*p*
Intercept	1.89	0.25			1.53	0.23			1.72	0.23		
LVAC T1	0.64	0.06	0.65	<.001								
EmC T1					0.77	0.05	0.73	<.001				
EfC T1									0.69	0.05	0.69	<.001
Asian Vs. Not	-0.42	0.31	-0.14	.185	-0.41	0.25	-0.15	.103	-0.27	0.26	-0.10	.303
Understanding/ Learning/Memorizing	-0.04	0.24	-0.01	.881	-0.12	0.19	-0.04	.518	-0.04	0.19	-0.02	.826
Instructor and Class	-0.03	0.26	-0.01	.916	-0.09	0.21	-0.03	.684	-0.17	0.22	-0.06	.451
Coding Ability	-0.14	0.27	-0.04	.598	0.13	0.22	0.04	.565	0.00	0.22	0.00	.988
Putting in Effort	-0.04	0.27	-0.11	.142	-0.22	0.22	-0.07	.315	-0.41	0.23	-0.12	.073
Adjustment	-0.31	0.36	-0.07	.403	-0.20	0.29	-0.05	.503	-0.43	0.30	-0.11	.156
Asian Vs. Not × Understanding/ Learning/Memorizing	0.31	0.36	0.08	.389	-0.12	0.19	-0.04	.518	0.36	0.30	0.10	.221
Asian Vs. Not × Instructor and Class	0.22	0.40	0.05	.582	0.55	0.29	0.15	.059	0.29	0.33	0.07	.385
Asian Vs. Not × Coding Ability	0.41	0.40	0.09	.308	0.09	0.32	0.02	.782	0.12	0.33	0.03	.709
Asian Vs. Not × Putting in Effort	0.46	0.43	0.08	.283	-0.06	0.34	-0.01	.864	0.26	0.35	0.05	.459
Asian Vs. Not × Adjustment	0.40	0.50	0.07	.423	0.27	0.40	0.05	.510	0.68	0.41	0.14	.101

Note: Coefficients reported represent the interactions between being Asian vs. non-Asian and self-reported challenges in predicting various end-of-semester motivational beliefs. Each end-of-semester motivational belief was analyzed in a separate multiple regression model, controlling for the corresponding beginning-of-semester motivational belief. Motivational Beliefs: SE =Self-Efficacy, UV = Utility Value, AV = Attainment Value, IV = Intrinsic Value, LVAC = Loss of Valued Alternatives Cost, EmC = Emotional Cost, EfC = Effort Cost, SE T1 = beginning-of-semester self-efficacy, UV T1 = beginning-of-semester utility value, AV T1 = beginning-of-semester attainment value, IV T1 = beginning-of-semester intrinsic value, LVAC T1= beginning-of-semester loss of valued alternatives Cost, EmC T1 = beginning-of-semester emotional cost, EfC T1 = beginning-of-semester effort cost. Asian Vs. Not: Asian and Asian American student = 1, non-Asian student = 0. All self-reported challenges were coded by two coders based on student open-ended responses to academic challenges in computer science courses.

Table 13

Differences in the Effect of Common Academic Challenges on End-of-Semester Motivational Beliefs Between Asian and Asian American and Non-Asian Students

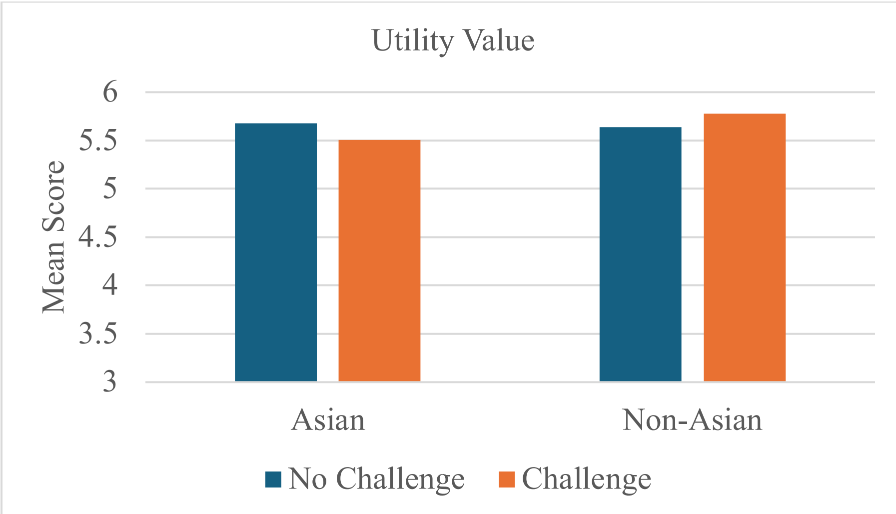
	SE				UV				AV				IV			
Variables	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***
Intercept	3.61	0.49			3.16	0.54			1.81	0.39			2.53	0.48		
Asian Vs. Not	0.04	0.43	0.02	.923	-0.50	0.51	-0.20	.329	0.06	0.45	0.02	.895	0.20	0.48	0.07	.685
SE T1	0.44	0.07	0.41	<.001												
UV T1					0.51	0.07	0.45	<.001								
AV T1									0.64	0.05	0.66	<.001				
IV T1													0.60	0.06	0.54	<.001
Challenge1	-0.02	0.07	-0.03	.750	-0.05	0.08	-0.07	.506	0.04	0.07	0.05	.569	-0.11	0.07	-0.13	.142
Challenge2	-0.31	0.07	-0.39	<.001	-0.10	0.08	-0.12	.184	-0.13	0.07	-0.15	.051	-0.24	0.07	-0.25	<.001
Challenge3	-0.05	0.07	-0.06	.515	-0.15	0.09	-0.18	.089	0.07	0.08	0.08	.373	-0.01	0.08	-0.01	.948
Challenge4	0.02	0.07	0.03	.735	0.07	0.08	0.07	.420	0.02	0.07	0.02	.778	0.12	0.08	0.11	.124
Asian Vs. Not × Challenge1	-0.10	0.11	-0.18	.345	0.08	0.13	0.14	.519	-0.07	0.11	-0.11	.567	-0.11	0.12	-0.17	.354
Asian Vs. Not × Challenge2	0.10	0.11	0.17	.388	-0.03	0.13	-0.05	.817	-0.02	0.12	-0.04	.850	-0.01	0.12	-0.02	.923
Asian Vs. Not × Challenge3	-0.06	0.11	-0.09	.574	-0.08	0.13	-0.12	.521	-0.26	0.12	-0.34	.026	-0.06	0.12	-0.07	.643
Asian Vs. Not × Challenge4	0.08	0.11	0.15	.464	0.17	0.13	0.31	.199	0.26	0.12	0.45	.026	0.08	0.12	0.12	.539

	LVAC				EmC				EfC			
Variables	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***	**B**	**S.E.**	**β**	***p***
Intercept	0.18	0.37			0.18	0.28			0.44	0.29		
Asian Vs. Not	0.71	0.54	0.23	.186	0.71	0.39	0.26	.071	0.49	0.42	0.18	.248
LVAC T1	0.53	0.05	0.55	<.001								
EmC T1					0.53	0.05	0.50	<.001				
EfC T1									0.49	0.05	0.49	<.001
Challenge1	0.12	0.08	0.13	.146	0.22	0.06	0.26	<.001	0.16	0.06	0.20	.013
Challenge2	0.05	0.08	0.05	.521	0.28	0.06	0.29	<.001	0.26	0.06	0.28	<.001
Challenge3	0.18	0.09	0.16	.061	0.01	0.07	0.01	.946	0.06	0.07	0.06	.442
Challenge4	0.24	0.09	0.21	.006	0.07	0.06	0.07	.269	0.03	0.07	0.03	.627
Asian Vs. Not × Challenge1	0.00	0.14	0.00	.997	-0.04	0.10	-0.06	.671	-0.09	0.11	-0.14	.417
Asian Vs. Not × Challenge2	0.02	0.14	0.02	.902	-0.10	0.10	-0.15	.323	-0.01	0.11	-0.02	.929
Asian Vs. Not × Challenge3	-0.05	0.14	-0.06	.714	0.04	0.10	0.05	.710	0.02	0.11	0.02	.892
Asian Vs. Not × Challenge4	-0.19	0.14	-0.28	.161	-0.07	0.10	-0.12	.477	-0.02	0.11	-0.03	.855

Note: Coefficients reported represent the interactions between being Asian vs. non-Asian and common academic challenges mentioned in previous research in predicting various end-of-semester motivational beliefs. Each end-of-semester motivational belief was analyzed in a separate multiple regression model, controlling for the corresponding beginning-of-semester motivational belief. Motivational Beliefs: SE =Self-Efficacy, UV = Utility Value, AV = Attainment Value, IV = Intrinsic Value, LVAC = Loss of Valued Alternatives Cost, EmC = Emotional Cost, EfC = Effort Cost, SE T1 = beginning-of-semester self-efficacy, UV T1 = beginning-of-semester utility value, AV T1 = beginning-of-semester attainment value, IV T1 = beginning-of-semester intrinsic value, LVAC T1= beginning-of-semester loss of valued alternatives Cost, EmC T1 = beginning-of-semester emotional cost, EfC T1 = beginning-of-semester effort cost. Asian Vs. Not: Asian and Asian American student = 1, non-Asian student = 0. Common Academic Challenge: Challenge 1 = Barriers to Communication, Challenge 2 = Barriers to Understanding, Challenge 3 = Negative Experiences with Instructor, Challenge 4 = Concerns about Meeting High Expectations.

Figure 1

Students' End-of-Semester Utility Value by Race and Coding Ability Challenge



Note: β = -0.19, p = .047. Utility value was measured on a 7-point scale. The coefficient is standardized beta coefficient representing the interaction between race (Asian and Asian American, non-Asian) and coding ability challenge in predicting students' end-of-semester utility value, controlling for their beginning-of-semester utility value.