# Work-in-Progress: A Scoping Literature Review of Theoretical Frameworks on Discrimination Against Asian Engineering Students

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## Abstract

This work-in-progress, a scoping literature review, conducts an analysis on the theoretical frameworks pertaining to the discriminations faced by Asian engineering students. In spite of the prevalent perception of Asian students being 'overrepresented' in many engineering fields, this label does not eliminate the real discrimination and hurdles they face. Notably, Asian student experiences both common and unique forms of discrimination, yet the literature specifically addressing the particular challenges they face in engineering disciplines is scarce. The study conducts a scoping review of existing studies addressing this critical area and focuses on theoretical frameworks used among them. These frameworks not only shed light on the current research landscape but also provide the direction for future empirical research, by highlighting the values of these frameworks in interpreting this complex socio-cultural phenomenon. The methodology of this scoping literature review is based on the foundational work of Arksey & O'Malley (2005) and Levac et al. (2010). This study identified nine relevant studies and the prevalent theoretical frameworks to be the Model Minority Theory & Stereotype, as well as the Critical Race Theory.


## Introduction

A diverse and inclusive learning environment is critical for college student learning. However, evidence from the literature has highlighted discriminatory behaviors towards various student populations. Among them, Asian students are commonly labeled as "overrepresented" in engineering disciplines. Nevertheless, Asian engineering students experience various forms of discrimination, including the iconic "Model Minority" stereotype (Trytten et al., 2009). Evidence from the literature has highlighted challenges faced by Asian engineering students such as stereotype threat (McGee et al., 2017), perpetual foreigner syndrome (Trytten et al., 2009), language-based discrimination (Trytten et al., 2009), and cultural barriers (Ma, 2010). Despite the known issues and documented cases of discrimination against Asian engineering students, much less studies have focused on this area of investigation. This limited dialogue is especially concerning considering the surging anti-Asian sentiment in recent years during and after the COVID-19 pandemic, during which time such sentiments, deeply rooted in societal, cultural, and political contexts, have been seeping into academic settings (Yang et al., 2023).

Given this context, the scoping review aims to provide incremental efforts to bridge the literature gap by assessing the theoretical frameworks used in existing studies related to discrimination against Asian engineering students. We present the current research landscape in this focused area with the scoping review approach outlined by Levac et al. (2010). We seek to reveal patterns, gaps, and trends in the discourse on discrimination faced by Asian engineering students through systematic identification, selection, and synthesis of the relevant literature. Specifically, our review focuses on answering the following research questions:

- **RQ1**: Which research methodologies have been used in studies investigating discriminatory experiences faced by Asian engineering students in postsecondary education?
- **RQ2**: Which theoretical frameworks have been employed in studies investigating discriminatory experiences faced by Asian engineering students in postsecondary education?

## Methods

We employed a five-stage framework as proposed by Arksey & O'Malley (2005) for this scoping review: 1) identifying the research questions, 2) identifying relevant studies, 3) selecting studies, 4) charting the data and 5) collating, summarizing, and reporting the results.

### Identifying Relevant Studies

Holistically, the scope of our study, as highlighted by our research questions RQ1 and RQ2, incorporates the research landscape surrounding discrimination faced by Asian engineering students in postsecondary education. The identified relevant studies need to be consistent with this research scope. In order to do that, we focus on both Asian American and Asian international college students within the engineering discipline, reflecting our centered research interest. Considering the scope of our study and the research questions, we established relevant studies in our review as studies that satisfy the following three conditions: a) the presence of Asian students, b) a focus on college engineering majors, and c) relevance to experiences of discrimination.

### Selecting Studies

We conducted the literature search using a variety of scholarly databases, including Semantic Scholar, Google Scholar, ERIC, and the American Society for Engineering Education conference proceedings repository to locate the relevant publications for this scoping review. We employed the following query term during the search: (Asian) AND (engineering) AND (discrimination OR discriminate), and applied the filter of "Field in Engineering or Education" to limit the search results, when applicable. Furthermore, in order to complement the database search and avoid potentially missing articles, we further manually reviewed publications in the Journal of Engineering Education and the Studies in Engineering Education, two relevant engineering education journals.

Because the initial search terms only yielded 109 results, we broadened our search criteria to capture a wider range of research papers. We relaxed the keyword of "engineering" to "STEM", and also added additional keywords including "anti-Asian", "microaggression," "bias", and "model minority" as alternatives of "discrimination". Both Google Scholar and Semantic Scholar were particularly helpful in providing many relevant and high-quality search results. Eventually, the updated search query yielded 251 studies.

Next, we used three following conditions to define a study as relevant to our scope and filtered out the rest:

- The research must specifically examine the experience of Asian students in the United States. Research conducted in other countries were excluded.
- The research should focus on postsecondary education. Studies related to workplace or other contexts were not considered.
- The research should incorporate at least one significant finding related to the discrimination encountered by Asian engineering students, even if this is not the primary research question the study aims to address.

After refining the search criteria, we identified nine studies. These studies are listed in Table 1.

**Table 1**

*Selected Studies*

| | |
|---|---|
| 1 | Bahnson, M., Hope, E., Satterfield, D., Alexander, A., Briggs, A., Allam, L., & Kirn, A. (2022). Students' Experiences of Discrimination in Engineering Doctoral Education. *2022 ASEE Annual Conference & Exposition*. https://peer.asee.org/41006.pdf |
| 2 | Lee, M. J., Collins, J. D., Harwood, S. A., Mendenhall, R., & Huntt, M. B. (2020). "If you aren't White, Asian or Indian, you aren't an engineer": Racial microaggressions in STEM education. *International Journal of STEM Education*, *7*(1), 48. https://doi.org/10.1186/s40594-020-00241-4 |
| 3 | Ma, Y. (2010). Model minority, model for whom? An investigation of Asian American students in science/engineering. *AAPI Nexus: Policy, Practice and Community*, *8*(1), 43–74. |
| 4 | McGee, E. O., Thakore, B. K., & LaBlance, S. S. (2017). The burden of being "model": Racialized experiences of Asian STEM college students. *Journal of Diversity in Higher Education*, *10*(3), 253. |
| 5 | Nguyen, L. M., Gabiam, N., & Poleacovschi, C. (2021). Work in Progress: Perception of the Culture of Disengagement by Minoritized Students. *2021 ASEE Virtual Annual Conference Content Access*. https://peer.asee.org/work-in-progress-perception-of-the-culture-of-disengagement-by-minoritized-students |
| 6 | Sue, D. W., Bucceri, J., Lin, A. I., Nadal, K. L., & Torino, G. C. (2009). *Racial microaggressions and the Asian American experience.* https://psycnet.apa.org/journals/aap/S/1/88/ |
| 7 | Trytten, D. A., Lowe, A. W., & Walden, S. E. (2012). "Asians are good at math. What an awful stereotype" The model minority stereotype's impact on Asian American engineering students. *Journal of Engineering Education*, *101*(3), 439–468. |
| 8 | Trytten, D., Lowe, A. W., & Walden, S. (2009). Racial Inequality Exists In Spite Of Overrepresentation: The Case Of Asian American Students In |

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|---|---|
| | Engineering Education. *2009 Annual Conference & Exposition*, 14–1002. https://peer.asee.org/racial-inequality-exists-in-spite-of-overrepresentation-the-case-of-asian-american-students-in-engineering-education |
| 9 | Wong, P., Lai, C. F., Nagasawa, R., & Lin, T. (1998). Asian Americans as a Model Minority: Self-Perceptions and Perceptions by other Racial Groups. *Sociological Perspectives*, *41*(1), 95–118. https://doi.org/10.2307/1389355 |

### Charting the Data

A detailed data charting process was conducted on the nine identified studies for our review. Based on the focus of our research questions on theoretical frameworks, we systematically captured and organized crucial information from each study, including participant population, methodology, and theoretical framework.

- Participant Population: We documented the detailed demographic information of the sample used in each study to understand its context and scope.
- Methodology: Each study was classified based on the research methods used as qualitative, quantitative or mixed-method. We also documented the specific methodologies used, such as regression analysis in quantitative studies and thematic analysis in qualitative studies. This detailed methodological breakdown allows us to situate and discern potential correlations between the choice of research methods and the theoretical frameworks adopted more effectively.
- Theoretical Framework: We cataloged and summarized the theoretical frameworks on which each study was based, as they directly answer our research questions.

### Collating, Summarizing, and Reporting the Results

The phase of collating, summarizing, and reporting the results enables a critical evaluation of the current research landscape by identifying gaps and inconsistencies in the literature. During this phase, we developed a narrative synthesis to organize and interpret the data extracted from the earlier charting phase. By doing so, we presented a cohesive narrative and highlighted emergent key themes and patterns across the studies. On top of that, we gained insights into the diversity and convergence in methodologies and theoretical frameworks.

## Results and Discussion

Table 2 presents the participant population, methodology, and theoretical framework used among the 9 selected studies. We observed variations in terms of participant population of focus among these selected studies. Some studies investigated on specific Asian engineering student subgroups, such as Asian American students, while others included broader groups which are potentially more relevant to our research, such as Asian American or Asian STEM college students in general. While no study perfectly matched our target population, their methodologies and theoretical frameworks may still be broadly applicable.

**Table 2**

*Tabulation of Selected Studies*

| Study | Participant Population | Methodology Used | Theoretical Framework Employed |
|---|---|---|---|
| Bahnson et al., 2022 | 913 Engineering doctoral students | Quantitative study (descriptive analysis) | General discrimination and microaggressions |
| Lee et al., 2020 | 1,688 STEM students | Mixed methods (Poisson regressions & thematic analysis) | Campus racial climate; Racial microaggressions |
| Ma, 2010 | 838 students / 40 Pacific Islanders | Quantitative study (logistic regression) | Pipeline model; Cultural capital and habitus; Model minority stereotype |
| McGee et al., 2017 | 23 Asian STEM college students | Qualitative study (narrative methodology) | Model minority stereotype; Critical race theory; Stereotype threat; Stereotype management |
| Nguyen et al., 2021 | 11 Minoritized engineering students | Qualitative study (narrative methodology) | Racial and gendered microaggressions; Ideology of depoliticization; The culture of disengagement |
| Sue et al., 2009 | 10 Asian American | Qualitative study (focus group discussion) | Critical race theory; Racial microaggressions |
| Trytten et al., 2012 | Asian American engineer students | Mixed methods (descriptive analysis & narrative methodology) | Model minority stereotype; Critical race theory |
| Trytten et al., 2009 | 56 Asian American engineering students | Mixed methods (descriptive analysis & narrative methodology) | Racial identity development; model minority stereotype; Preference-based/racially-based discrimination; "Forever foreigner" stereotype |
| Wong et al., 1998 | 1,257 students | Quantitative study (descriptive analysis) | Model minority stereotype |

**RQ1: Which research methodologies have been used?**

Among the nine selected studies investigating discrimination against Asian students, they have equally used qualitative, quantitative, and mixed-method with three studies in each category. As an example of qualitative research, Nguyen et al.

(2021) employed a narrative methodology to investigate the experiences of minoritized engineering students, including Asian students, with microaggressions and their perspectives on sociopolitical engagement in engineering. Through in-depth interviews and identified themes, the study explored students' interpretations of microaggressions and their views on discussing these issues in engineering classrooms.

Studies have used quantitative method to investigate discrimination against Asian students as well. For example, Lee et al. (2020) used a series of Poisson regressions to assess whether race, gender, or class year could predict the likelihood of microaggressions. The study applied a campus racial climate framework to conceptualize the role of racial microaggressions. Conversely, Bahnson et al. (2022) focused on groups with multiple marginalized identities, and conducted a descriptive analysis quantifying the frequency of discrimination and unfair treatment with a sample of 913 engineering doctoral students.

Finally, as an example as studies using mixed-method, Trytten et al. (2012) used mixed methods to examine the experiences of Asian American students in engineering education. Trytten et al. (2012) conducted a quantitative descriptive analysis using data on ethnicity, generational status, and academic classification collected from a demographic survey, followed by a narrative analysis to gain detailed insights into their encounters with discrimination and stereotypes with data collected from qualitative semi-structured interviews.

**RQ2: Which theoretical frameworks have been employed?**

We found that commonly used theoretical frameworks include the 1) Model Minority Theory & Stereotype, the 2) Critical Race Theory, and 3) Other Frameworks.

***Model Minority Theory & Stereotype***

The "model minority" myth is a stereotype originated around the 1960s that typifies Asian international and Asian American students as all high-achieving, academically successful, and well-assimilated, particularly in STEM fields (Wing, 2007; Yu, 2006). Five out of the nine studies in our review incorporated the model minority stereotype as a significant lens of their analysis (Ma, 2010; McGee et al., 2017; Trytten et al., 2012; Trytten et al., 2009; Wong et al., 1998).

The research conducted by McGee et al. (2017) is a good example using the framework of the model minority stereotype. It challenged this stereotype by introducing counternarratives based on the experiences of 23 high-achieving Asian college students in STEM fields. It argued that model minority stereotype oversimplifies the experiences and diversity present within Asian American communities, and fail to acknowledge the challenges faced by individuals within this heterogeneous racial group. This study featured a 5-step phenomenological research design and examined how Asian students perceive, negotiate, challenge, and cope with distress stemming from such stereotypes.

### *Critical Race Theory*

Critical Race Theory (CRT) and its variants represent another frequently used theoretical frameworks in the selected studies (McGee et al., 2017; Sue et al., 2009; Trytten et al., 2012). CRT concerts the intersection of race, power, and law, as well as social construction of race and how racism is systemically embedded in legal and societal structures (Delgado & Stefancic, 2000, 2023; Ladson-Billings, 2021). One of the case studies that portrayed the usage of CRT in discrimination against Asian engineering students is Trytten et al. (2012) who used the CRT approach to look at the experience of Asian American undergraduate engineering students. The application of CRT principles is evident in several ways, such as choosing semi-structured interviews with racial/ethnic minority students as opposed to using only surveys. In addition, the authors decided to collect information such as languages spoken at home and generations of family in the U.S. based on CRT. Another manifestation is the decision to analyze data separately for each racial/ethnic group instead of aggregating across groups, demonstrating a commitment to nuanced examination and understanding.

Beyond the studies as a part of this scoping review, researchers (Yang et al., 2023) also used Asian Critical Theory (AsianCrit) to unravel the structural forces and narratives that position Asians and Asian-Americans within a racialized engineering culture. This investigation explores how these forces continuously reshape their racialization and minoritization in engineering education.

### *Other Frameworks*

In addition to the commonly used Model Minority Theory and Critical Race Theory, studies have also explored the discrimination experienced by Asian students through a broader range of other theoretical frameworks. These include campus racial climate, cultural capital and habitus, the culture of disengagement, the ideology of depoliticization, and general theories related to stereotypes, discrimination, and microaggressions (Bahnson et al., 2022; Lee et al., 2020; Ma, 2010; Nguyen et al., 2021; Sue et al., 2009; Trytten et al., 2009). These other frameworks offers comprehensive interpretative insights and multifaceted analysis of this discrimination issue experience by Asia engineering students by examining its roots from different lens that originated from diverse sociological, psychological, and historical perspectives.

As an example, Ma (2010) addressed the concept of cultural capital and habitus in relation to Asian American students compared to other racial groups. The study examined how cultural capital, defined as resources and knowledge related to cultural activities, varies among different socioeconomic strata and racial groups. Ma (2010) noted that the sample of Asian American students investigated have relatively high socioeconomic standing on average, yet they are perceived to have less cultural capital compared to their peers coming from similar socio-economic backgrounds.

Finally, these theoretical frameworks used are not standalone and isolated perspectives, and studies have combined different theories in one framework as well.

From a phenomenological perspective, they offer unique insights with different lenses on a complex, systemic issue. For example, Sue et al. (2007) combined insights from the microaggressions theory and model minority stereotype by highlighting how microaggressions perpetuates the model minority stereotype. The study investigated the forms, dynamics, and impacts of racial microaggressions experienced by Asian American students and identified eight microaggressive themes, including embrace alienation, ascription of intelligence, exoticization of Asian women, denial of racial reality, second-class citizenship, and invisibility (Sue et al., 2007). Such exploration in turn develops a more refined view regarding the reactions of Asian students to microaggressions, consequently enriching the depth and breadth of research in this area.

## Conclusion and Future Directions

This scoping literature review concentrated on identifying the existing theoretical frameworks that address discrimination faced by Asian engineering students, in order to enhance our understanding of the current landscape in this field and potentially provide guidance for the direction of future studies. We identified nine studies examining the discrimination experiences encountered by Asian engineering students in this scoping review. The Model Minority Theory & Stereotype, as well as the Critical Race Theory are the most used theoretical frameworks used among the nine studies.

This exploration of the literature has also enabled us to map the landscape of discrimination within academic settings, uncovering various forms of bias and underscoring the necessity to tackle these challenges holistically. To date, the comparison of experiences between Asian American students and Asian international students in the engineering field remains a less explored area. We aim to continue investigating this topic by comparing and contrasting the experiences of these two groups in respect to their distinct social, economic, and cultural backgrounds.

We also note that there has been a rising number of studies investigating COVID-19-fueled discrimination and anti-Asian racism since 2020. The COVID-19 pandemic has allowed systemic discrimination to manifest in innovative ways, and many of the Asian/Asian American communities are differentially affected by them. This phenomenon called the need for extending research efforts on discrimination and necessitating timely and responsive interventions from institutions and policymakers. Such heightened xenophobia and racism can exacerbate the existing challenges faced by Asian engineering students, adding an extra layer of bias based on pandemic-related stereotypes. In future research endeavors, researchers need to further examine the newly manifested forms of discrimination with both well-established and innovative theoretical frameworks modeling discrimination, which may gain new insights into this phenomenon and to formulate the most effective policies and strategies.

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