

## **Illuminating the APIDA Experience in Engineering Education: A Scoping Review**

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# **Illuminating Asian American Experiences in Engineering Education: A Critical Scoping Review**

## **Abstract**

Scholars and policymakers in engineering education have been challenged by how to appropriately conceptualize and engage Asian Americans in their research and intervention programs due to the extensive diversity of identities and ethnicities encompassed under the term “Asian American.” While East Asians are “overrepresented” in engineering, and their experiences are not well presented in considerable diversity, equity, and inclusion (DEI) initiatives, other subgroups, such as Southeast Asian Americans, are substantially underserved in engineering education. Limited research has been directed to explore the interactions between their ethnic identities and the engineering identity among Asian American students. In this paper, we conduct a scoping review of the current literature in engineering education to explore the landscape of Asian American students’ experience in engineering. This review addresses two research questions: (1) What are the motivations of these studies in exploring Asian American engineering students’ experiences? (2) What are the gaps in the existing literature on Asian American students’ experience in engineering education? It also discusses how future researchers can be more inclusive of all Asian American identities in their research and how educators can bring these aspects into matters of diversity, equity, and inclusion (DEI). Such an exploratory study aims to highlight that Asian American students are rendered invisible or underserved in relation to resources and visibility by engineering education researchers and the institutions meant to support and guide these students, despite that some of these students are perceived as “overrepresented” explicitly or implicitly in engineering education. More fundamentally, we hope our work can help DEI research in engineering education further expand the scope of its theoretical and methodological foundations.

## **Introduction**

Scholars and policymakers in engineering education have been challenged by how to appropriately conceptualize and engage Asian Americans in their research and intervention programs due to the extensive diversity of identities and ethnicities encompassed under the term “Asian American.” While East Asians are overrepresented in engineering, and thus, their experiences are not well presented in considerable diversity, equity, and inclusion (DEI) initiatives, other subgroups, such as Southeast Asian Americans, are substantially underserved in engineering education [1]. Limited research has been directed to explore the interactions between their ethnic identities and the engineering identity among Asian American students. While Asian American identity has been explored in higher education, it has seldom been done in engineering education. Despite being overrepresented, Asian Americans are considered both a minority yet too overrepresented to be a minority. Thus, Asian Americans in engineering are left in the background. This paper aims to highlight the limited number of papers within engineering education that brings attention to Asian American students in engineering. We were curious to

see whether past research has disaggregated Asian American data and what researchers looked at when researching Asian American engineering students.

In order to unpack the prior research, we conducted a scoping review of the current literature in engineering education to explore the landscape of Asian American students' experience in engineering. As we were interested in exploring the landscape of research on Asian American students in engineering, we wanted to look at how past research framed this student population. This review addresses the two following research questions:

- (1) What are the motivations of these studies in exploring Asian American engineering students' experiences?
- (2) What are the gaps in the existing literature on Asian American students' experience in engineering education?

This review also discusses how future researchers can be more inclusive of all Asian American identities in their research and how educators can bring these aspects into matters of diversity, equity, and inclusion. Such an exploratory study aims to highlight that Asian American students are rendered invisible or underserved in relation to resources and visibility by engineering education researchers and the institutions meant to support and guide these students, despite that some of these students are perceived as "overrepresented" explicitly or implicitly in engineering education. More fundamentally, we hope our work can help DEI research in engineering education further expand the scope of its theoretical and methodological foundations.

Before we begin this paper, we want to clarify what we mean by "Asian American." Our definition of Asian American includes students of East Asian, West Asian, Central Asian, Southeast Asian, and South Asian descent [2]. Asian American Pacific Islander (AAPI) is another term often used in the literature; however, this distinction recognizes the differences between the two groups. Some definitions of Asian American include international students from Asia. While we hope that engineering education takes on the more inclusive terminology of APIDA or Asian Pacific Islander, and Desi Americans, we refer to the terms used by the various papers presented in this literature review.

## **Methods**

For this study, we only aimed to examine the literature on engineering disciplines, including engineering education. While much of the literature on Asian Americans in STEM occurs in the field of higher education, focusing on engineering education allows us to map out how Asian American students have been discussed in relation to engineering. Therefore, we searched for literature exclusively in the Engineering Village's Compendex database to center articles within the engineering discourse. Exclusively searching in Compendex allowed us to center our results in the engineering space. In contrast, other research may include work from higher education and the social sciences, where most of the literature on Asian American students is located. Given that our initial goal was to conduct a scoping review, we decided to keep the initial search as

broad as possible. Searching the terms “Asian American” and “students” narrowed our search. In an effort to focus on student experiences in engineering, we included “engineering,” “computing,” or “STEM.” Including “computing” and “STEM” allowed for a larger range of papers in our search. We employed the following search string in the “Expert Search” mode:

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((Asian American) WN ALL) AND ((students) WN ALL) AND (((engineering) WN ALL) OR ((computing) WN ALL) OR ((STEM) WN ALL)))
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We found 138 records in this initial research. The two authors employed the three following inclusion/exclusion criteria to screen further these 138 papers:

- Criterion 1: Are undergraduate students the focus of the research project?
- Criterion 2: Do research questions address Asian American students?
- Criterion 3: Is the data empirical research?

These three criteria were chosen to center on Asian American undergraduate engineering students. The first criterion allowed us to limit the participants studied to undergraduate students. We wanted to exclude graduate students and K-12 experiences for this scoping review, as we are interested in understanding the experiences of Asian American students in the engineering college setting. The second criterion ensures that the research addressed Asian American students in the article. Again, while much of the research in engineering education research which highlights DEI efforts, it is common to leave out or barely acknowledge Asian American experiences. The third criterion was chosen to ensure that the research included observed or recorded data, which led to data including student experiences.

From our criteria, only three of the 138 papers strictly fulfilled the three criteria (see Table 1 in Appendix). It is worth noting that two of the three papers are from the same project conducted by the same group of researchers. While we were screening these papers, we also found that some other papers may not include Asian American students in the research questions but did include them in the findings. In these cases, Asian American students were often treated as a “comparison group.” We further included these six papers that only met criteria 2 and 3 in Table 2 in Appendix. In the analysis, we included papers in Table 1 and Table 2. In other words, only nine out of 138 papers were included in the analysis. As our initial search was conducted in September 2022, other papers may be left out of this search that addresses Asian American engineering students.

## **Findings**

This analysis focuses on three articles published in the landscape of engineering education that addresses our three criteria. The first paper [3] focuses on Asian American engineering students’ experiences related to stereotypes, such as the model minority myth and the forever foreigner trope [3], [4]. This paper was published in the conference proceedings for ASEE and is limited in scope. The second paper, conducted by the same research team, expands on the topics discussed

in the first paper but with a clearer and more concise data analysis of interview transcripts [5]. The third paper focuses on classroom engagement of Asian American undergraduate engineering students in the University of California system [6]. These last two papers were published in the Journal of Engineering Education.

### **Motivations to Study Asian American Students in Engineering**

It is worth noting that none of the nine papers were initially designed or motivated to directly address the experiences or concerns of Asian American students in engineering. Data in these studies were often derived from much larger projects which may or may not focus on minority students in engineering, including the three papers that have Asian American students in their research questions. To some extent, at least in the engineering education literature, we have investigated in this paper, Asian American students have not yet become a research topic or been “problematized.” Although other fields, such as psychology and higher education, have explicitly shown how Asian American students differ from their peers, engineering education research should continue to follow this trend. When Asian Americans are disaggregated by subgroups, we see differences in outcomes of classroom engagement [6], which could help educators address cultural differences in the classroom. Future research should continue to include and highlight differences between various ethnic groups in engineering rather than assume Asian American as a singular group which most of the articles we found do.

The vast majority of the 138 papers that appeared in the initial search results did not meet at least two of the inclusion/exclusion criteria, despite the term “Asian American students” in either their abstracts and/or full texts. It is equally valuable to examine potential motivations for these papers to simply mention Asian American students and *what goal(s) these quick mentions serve*. It is interesting to see that quite a few of these papers often address concerns of other minority students, such as Latinx students or African American students, while at the same time equating Asian students with white students. This again plays into the model minority myth, which wrongly places Asians as the “standard” for what minorities “should” strive for [7] [8] [9] [10]. At least 18 papers include language in their abstracts which equate Asian and white students, thus contradicting the claims in other papers which cite Asian Americans as a minority group. While Asian American students are overrepresented in engineering, there must be an acknowledgment that Asian American students also have barriers to education that should be considered before making such claims.

So far, we have arrived at a paradox: including Asian American students in engineering education research are motivated that either *they are overrepresented like their white peers* or that *they still belong to minority groups to some degree and in certain scenarios*. No matter what motivational approach engineering education researchers may take to address Asian American students, it is relatively clear that Asian American student experiences are left unexamined.

In these papers, Asian students were treated as *one* kind of minority students, with in-depth analyses of the cultural experiences of Asian American students absent. For instance, there has

not been much discussion on further distinguishing the unique experiences of different cultural groups within the Asian American student population. Foreign-born Asian students were not distinguished from Asian students born in the United States, which can bring into question whether most of this research is geared towards US citizens or international students and the nuanced dilemma with transnational adoptees in the US. Are there similarities between US-born Asian Americans, foreign-born Asian Americans, adoptees, and international engineering students? In other scenarios, students of mixed-race identity with Asian backgrounds may also be lost within the data. Here we want to highlight the work and calls to action from various fields, including higher education and the social sciences, which argue to disaggregate the data of Asian Americans [2][8].

Initially, we planned to include this research question for this paper: how do Asian American students' cultural identities intersect with their engineering identity? When reporting our findings for this paper, we could hardly find any evidence from the already small number of papers selected to respond to this research question. In other words, none of the nine papers selected have critically examined how Asian American students' cultural experiences interact with their experience as engineering students. It is unclear how Asian students' cultural values and experiences contribute to their ways of defining and solving engineering problems or how their engineering learning experience has helped them reflect on their *cultural identities as Asians*. We hope that future research on Asian American engineering students considers their various cultural identities when discussing matters regarding race, particularly of Asian American students.

## **Discussion and Future Research**

Future research needs to address the extreme cultural diversity within the Asian American community, which has been a focal discussion among Asian American studies researchers [2]. Recent studies in higher education have shown that Filipino students are 60% less likely to major in STEM fields than other Asian American students [11] and Hmong and Laotian students are less likely to be included in statistical data. However, these groups are often included in the Asian American category, which does not correctly reflect the group as a whole.

One of our articles disaggregates the Asian American population into ethnic subgroups. However, only quantitatively analyzes classroom engagement among each subgroup [6]. Engineering education researchers should take note of the potential differences that may occur due to the perceived notion that Asian Americans are the same. Thus, we hope that more qualitative research can be conducted centering Asian American experiences in engineering to highlight the vast differences these students face. We also call for an urgent need for educational policymakers and administrators to develop policies to serve the specific needs of a wide range of underserved groups within the Asian American community.

While many of the papers included refer to the same population as Asian Americans, Asians, and/or AAPI, higher education has begun to utilize the terminology of APIDA. This more

inclusive term includes Asian, Pacific Islander, and Desi Americans [12][13][14]. Though APIDA still acts as a unifying term, it highlights the differences under the Asian American umbrella [12]. We encourage other engineering education researchers to utilize the term “APIDA” and explore Asian American and APIDA issues in engineering while maintaining an acceptance of the various ethnicities that encompass Asian American.

In our future research, we aim to employ similar methods to examine how Asian American engineering students are addressed in social sciences literature from fields such as psychology and higher education. We hope this review highlights to engineering educators the diverse nature of Asian American as a group and the harms that come with stereotypes such as “model minority.” Though Asian American as a demographic will never holistically describe a population, we hope that the diverse nature of the group is considered when representing Asian America.

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## Appendix

Table 1: *Papers Meeting Our Three Inclusion/Exclusion Criteria*

<b>Author (Year)</b>	<b>Article</b>	<b>RQs</b>	<b>Methods</b>	<b>Publication</b>
Trytten, Deborah A.; Lowe, Anna Wong; Walden, Susan E. (2009)	Racial Inequality Exists in Spite of Overrepresentation: The Case of Asian American Students in Engineering Education	No explicit questions stated but clearly this study was addressing Asian American engineering students.	Longitudinal, qualitative, and quantitative (academic transcripts, surveys, semi-structured interviews)	ASEE Conference Proceedings
Trytten, Deborah; Lowe, Anna Wong; Walden, Susan (2012)	“Asians are Good at Math. What an Awful Stereotype”: The Model Minority Stereotype’s Impact on Asian American Engineering Students	<p>To what degree do academic data support the assertion that AsAm engineering students conform to MMS?</p> <p>How do AsAm engineering students express the impact of the facets of the MMS on their lived experiences?</p> <p>What facets of the MMS are more often reported than others among AsAm engineering students?</p> <p>How do AsAm engineering students perceive their fellow racial/ethnic peers fit within the MMS?</p>	Mixed methods (analysis of academic transcript data, surveys, semi-structured interviews)	Journal of Engineering Education

<p>Ing, Marsha; Victorino, Christine (2016)</p>	<p>Differences in Classroom Engagement of Asian American Engineering Students</p>	<p>Do Asian American subgroups interpret classroom engagement in comparable ways?</p> <p>Are the levels of classroom engagement similar across Asian American subgroups?</p> <p>Is the variation in classroom engagement similar across Asian American subgroups?</p> <p>Does classroom engagement relate to academic performance across Asian American subgroups?</p>	<p>Quantitative (University of California Undergraduate Experience Survey UCUES)</p>	<p>Journal of Engineering Education</p>
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Table 2

*Papers Only Meeting 2 of 3 Criteria*

<b>Author (Year)</b>	<b>Article</b>	<b>Publication</b>
Berger, Meghan; Luster-Teasley, Stephanie; Poleacovschi, Cristina; Smith, Kalynda Chivon; Feinstein, Scott Grant; Jones-Johnson, Gloria; Gonzalez-Diaz, Luis (2020)	A tale of two universities: An intersectional approach to examining microaggressions amongst undergraduate engineering students at an HBCU and a PWI	2020 ASEE Conference Proceedings
Lord, Susan M.; Chen, John C.; McGaughey, Karen J.; Chang, Victor W. (2013)	Measuring propensity for lifelong learning: Comparing Chinese and U.S. engineering students	2013 IEEE Global Engineering Conference Proceedings
Chen, John C.; Lord, Susan M.; McGaughey, Karen J.(2013)	Engineering students' development as lifelong learners	2013 ASEE Conference Proceedings
Besterfield-Sacre, Mary; Moreno, Magaly; Shuman, Larry J.; Atman, Cynthia J.(2013)	Gender and ethnicity differences in freshmen engineering student attitudes: A cross-institutional study	Journal of Engineering Education
Chierichetti, Maria; Backer, Patricia Ryaby (2021)	Student Experiences after the move to fully online instruction: A case study of one large public institution	2021 IEEE Frontiers in Education Conference Proceedings
Backer, Patricia R.(2016)	Assessment of a writing workshop model for first-year engineering students	2016 ASEE Conference Proceedings