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Commentary

Asian Americans in STEM are not a monolith

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Despite tremendous diversity, Asian Americans in STEM are grouped and viewed as a homogeneous monolith, facing stereotypes and disparities. We propose solutions that include disaggregating the Asian American grouping and recognizing the diverse individual ethnic subgroups that comprise Americans of Asian ancestry to implement change within the STEM field.

INTRODUCTION

According to the most recent U.S. Census, Asian Americans (Americans who are of Asian ancestry) are one of the fastest-growing racial groups in the United States with an estimated population of 24 million (Table 1). Asian Americans also experience panethnicity, the consolidation of ethnic groups.[1] Comprised of individuals deriving from more than 20 countries in East and Southeast Asia and the Indian subcontinent,[2] Asian Americans encompass over 40 distinct ethnic subgroups, each with different cultures, traditions, beliefs, values, languages, skin colors, and colonization histories.[2] Despite this heterogeneity, Asian Americans are frequently perceived as one monolithic group (Figure 1). In comparison to the general U.S. population, as a singular group, Asian Americans have the highest median annual household income, the highest percentage of individuals age 25 or older who have obtained a bachelor's degree or higher, and one of the lowest poverty rates.[2] Asian Americans are also perceived as overrepresented in science, technology, engineering, and mathematics (STEM). However, this idea deceptively hides the reality for many Asian Americans: their experiences do not fit the homogenized narrative often portrayed as belonging to Asian Americans.[3] For instance, the Southeast Asian population has the lowest percentage of educational degree attainment when compared to other Asian American subgroups. Although an average of 54% of U.S. Asians have a bachelor's degree or higher, this percentage is a lot smaller in Southeast Asians (i.e., Vietnamese, 32%; Hmong and Burmese, 23%; and Laotian, 18%).[2] Furthermore, education attainment (the rate of attaining a higher education degree) in Laotian Americans is much lower than the 54% that is ascribed to Asian Americans. The term "Asian American" masks the tremendous variance that exists among the various ethnic subgroups making up this term.

"Asian American" was first coined in 1968 by University of California, Berkeley graduate student activists Emma Gee and Yuji Ichioka when they named their group the Asian American Political Alliance. They intended to unite people of Asian descent in the U.S. at a time when there was great social and political turmoil. Since its first usage, Asian American was further expanded to include Pacific Islanders (Polynesian, Micronesian, and Melanesian). Recently, unifying Asian Americans has been valuable in highlighting the racism that Asian Americans experience in the United States, particularly due to the increase in hate crimes and xenophobia against Asians during the COVID-19 pandemic. FBI reports published in 2021 showed that hate crime rates against Asian Americans increased by 77% from 2019 to 2020. While the term "Asian American" can unify, its usage can hide huge disparities amongst different ethnic subgroups, blocking access to resources for those who need them.

History of "Asian American" in STEM

Within the STEM field, the term "Asian American" was historically used advantageously to unite diverse subgroups into a single political voice, but it is now

Table 1. Glossary

Term	Definition
Asian American	Americans who have Asian ancestry—typically, this term excludes individuals from the Pacific Islands
East Asian	Ethno-cultural area of Asia including China, Japan, and Korea
Implicit bias	Stereotypes or prejudice without awareness of such a prejudice
Intentional mentoring	Mentoring that makes informed decisions to maximize achieving steps agreed upon by the mentor and mentee
Model minority	A stereotype that generalizes that all Asian Americans are successful, thus ignoring diversity
Pacific Islander	People with ancestry from the ethno-cultural area that includes Polynesia, Micronesia, and Melanesia
Panethnicity	The grouping of multiple nationalities and ethnicities under a single label
PWI(s)	Primarily white institution(s)
South Asian	Ethno-cultural area of Asia including Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, and Sri Lanka
Southeast Asian	Ethno-cultural area of Asia including Brunei, Burma (Myanmar), Cambodia, Timor-Leste, Indonesia, Laos, Malaysia, the Philippines, Singapore, Thailand, and Vietnam
STEM	Science, technology, engineering, and mathematics
Stereotype	A widely held and generalized belief about a group of people
Xenophobia	A dislike or fear from foreign individuals

marginalizing Asian American ethnic subgroups. The STEM field has followed the federal government's lead in defining who is Asian American. For instance, the U.S. federal government first used the term "Asians and Pacific Islanders" in the 1980 census. In the 1970 census, Asian Indians were classified as white. This highly diverse group organized to advocate that they be counted as a distinct racial and ethnic group, and the Census Bureau responded in the 1980 census by placing them under the Asian American category, which includes Chinese, Filipino, Japanese, Asian Indian, Hawaiian, Samoan, Tongan, Chamorro/Guamanian, and other Pacific Islander populations. As a direct impact of these aggregated statistics, many people who identify as Asian American are not seen as underrepresented in STEM. The standards set by the National Institutes of Health (NIH) do not classify Asian Americans as an underrepresented group. Although the NIH acknowledges that underrepresentation can be determined on a "case by case" basis, this creates an unnecessary barrier for underrepresented Asian American ethnic subgroups. Thus, certain fellowships, grant funding, and educational opportunities intended for underrepresented groups are usually not extended to Asian American ethnic subgroups that have been historically marginalized in STEM. Such standards do the opposite of what they are intended to do: elevate historically marginalized groups to make the STEM field more inclusive and equitable.

In 1997, the U.S. federal government revised the Standards for the Classification of Federal Data on Race and Ethnicity. The single "Asian or Pacific Islander" category was split into "Asian" and "Native Hawaiian or Other Pacific Islander." Disaggregation of the classification was important as it became apparent that data aggregation caused the erasure of multiple cultures.[4] It was more harmful for Pacific Islanders to be included in the Asian or Pacific Islander dataset, as they had less of a voice compared to the larger Asian subgroup.[4] More specifically, the category "Asian or Pacific Islander," comprised of subgroups from many diverse cultures and ethnicities, did not paint a detailed picture of what was happening in the microcosms of each community. Not only did this term erase disparities that some ethnicities experienced, but it also perpetuated hierarchies within the Asian American category.[5] By creating separate categories, the data on Pacific Islanders were no longer overwhelmed by the aggregate data of the much larger Asian group. Since this change occurred within the federal government, the STEM field has conformed to the U.S. government's categories. Some institutions have gone further to disaggregate other ethnic subgroups from the Asian American term beyond Pacific Islanders. However, STEM fields have not disaggregated the Asian American term.

This aggregation of data in STEM not only causes but continues to perpetuate stereotypes and implicit biases within STEM against Asian Americans. While certain Asian ethnic subgroups in the U.S. (including foreign nationals) have done well, their success has been applied to all Asian Americans. The underlying implication is that the successes of certain Asian ethnic subgroups in STEM equate to success for everyone within the Asian American term. This false assumption renders ethnic subgroups invisible and perpetuates the model minority myth (discussed below), which underscores the importance of finding solutions to recognize, assess, and assist historically marginalized Asian American ethnic subgroups in STEM.

MODEL MINORITY MYTH

The term "model minority" has been applied for the last six decades to successful Asian Americans and used as evidence that the "American Dream" is attainable by all members of society through docility, hard work, and perseverance.[5] As Ellen Wu argues, even the Chinese and Japanese have in the past partaken in the perpetuation of the model minority myth, which may have been an unintended consequence of these two subgroups trying to obtain justice, freedom, and equality within America's rampant political exclusion of Asian immigrants. Regardless, the model minority and its seemingly "positive traits" had an ulterior motive—to silence Black, Hispanic, and Indigenous communities from speaking out against social injustice. This rhetoric was successful in pitting people from historically marginalized groups against each other by creating a hierarchy that continues today. American society continues to place Asian Americans on a pedestal, an imagery embodying the possibilities that minorities can attain through their own effort without federal or institutional support systems. To this day, the model minority myth has not only driven a wedge between Asian

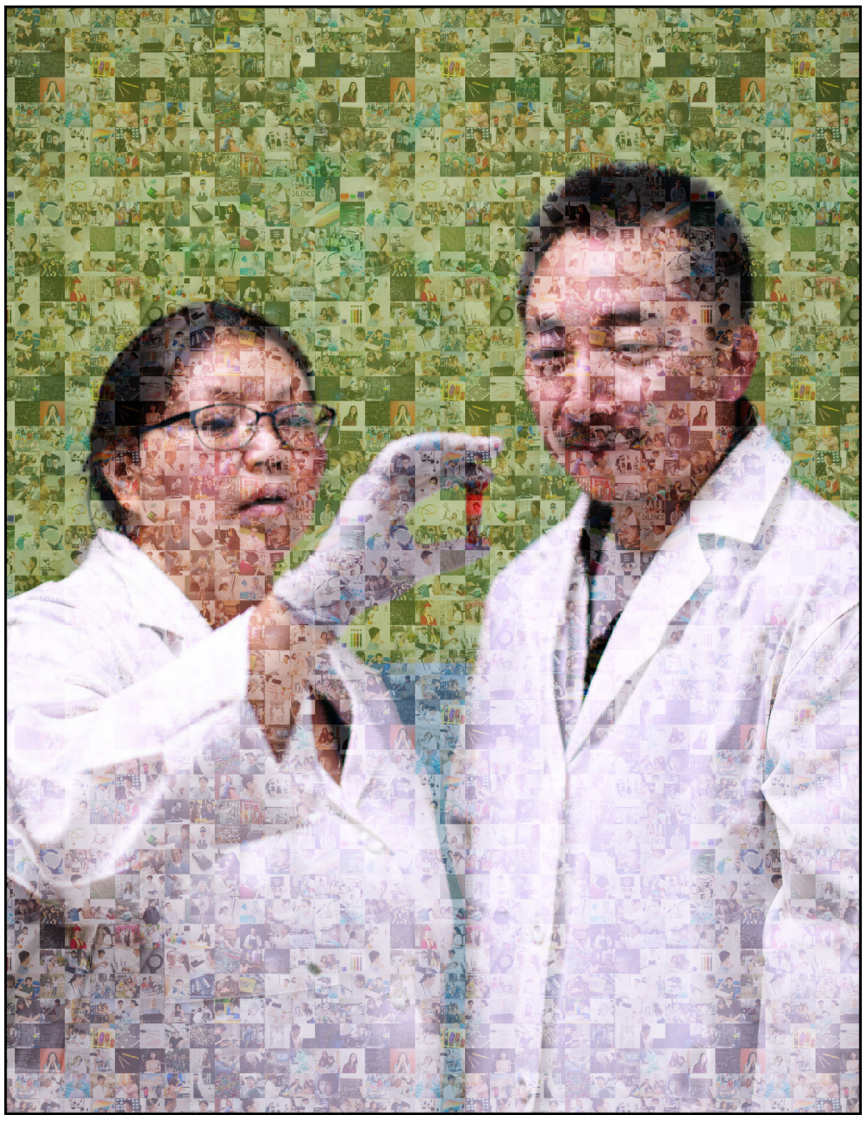

Figure 1. Asian Americans in STEM
The image of two scientists is portrayed; however, they are made up of many different images of Asian Americans from different ethnic backgrounds.

Americans and other minorities but has also obscured the discrimination various Asian American ethnic subgroups face and silenced their lived experiences.

The model minority myth is pervasive in STEM, where Asian Americans are perceived as overrepresented. Unfortunately, this is in line with the National Science Foundation's (NSF) stance that "Asians are overrepresented among [science and engineering] degree recipients and among employed scientists and engineers." Furthermore, the aggregation of Asian Americans into a monolith may contribute to lower efforts to recruit and retain underrepresented Asian American subgroups (e.g., Filipino, Hmong, Thai, Burmese, etc.) into the STEM pipeline. Kang and colleagues' recent study shows that Chinese, Indian, and Sri Lankan students were more likely to enroll in highly selective 4-year colleges versus other Asian subgroups, such as Filipino students, who were ~60% less likely to choose an STEM major.[6] They note that their study could not include other Asian American ethnic subgroups (e.g., Hmong or Burmese) because the original dataset omitted inclusion of such subgroups. Lastly, they implore "[p]olicymakers and administrators in higher education […] to acknowledge the heterogeneity of STEM major selection among Asian American students and come up with sustainable solutions" to address the specific needs of underrepresented Asian American students in STEM. Once assessed by specific ethnic minority groups, this difference is even starker, as Southeast Asians and Pacific Islanders have lower PhD and grant award amounts akin to that of other minority groups.[2] These data provide convincing evidence against the view that Asian Americans are uniformly represented in STEM.[6] Unfortunately, Asian Americans are being "cut off from the resources and services that other minority groups receive" because they are "inaccurately perceived" and expected to do well.[7]

The model minority myth places unrealistic expectations on Asian Americans to perform well academically and occupationally, creating the perception, expectation, and internalization of the stereotype that all Asian Americans have an inherent ability to excel in STEM. For Asian American graduate students and postdoctoral fellows, this stereotype manifests when they are often viewed as work machines. As a result, Asian trainees feel pressure to perform at an extreme level, which causes symptoms of imposter syndrome and feelings of shame as students face a fear of letting others down. Recently, Wei and colleagues showed a positive correlation between feelings of imposter syndrome and psychological distress that was driven by interpersonal shame (e.g., dishonoring family, feeling that others view them negatively, etc.) among Asian American university students.[8]

PROPOSED SOLUTIONS

Change on a macro level

Government and private funding agencies should disaggregate the Asian American grouping in STEM to provide historically marginalized Asian American ethnic subgroups the ability to apply for federal and private support meant to help underrepresented minorities.[9] If the funding agencies implement such changes, it is likely that the STEM field will follow. However, the STEM field can also lead by actively disaggregating the Asian American grouping to demonstrate to funding agencies how doing so could provide

equity to specific Asian American ethnic subgroups. Perhaps if the STEM field implements such changes, funding agencies will take notice and follow.

Data on specific ethnic subgroups of Asian Americans in STEM are generally lacking. Thus, demographic data on specific ethnic subgroups of Asian Americans in STEM that are distinct from foreign nationals should be collected by the U.S. Government, institutions of higher education, and scientific societies. This is urgently needed and will provide data to inform funding agencies, institutions, and society on how to recognize Asian American ethnic subgroups that continue to be underrepresented in STEM.

Change on a mezzo level

Education is essential for achieving positive outcomes and awareness. Most people in STEM are unaware that certain Asian American ethnic subgroups are underrepresented. Institutions of higher education should take the led by expanding DEI (diversity, equity, and inclusion) initiatives and training to facilitate awareness of the issues associated with Asian American ethnic subgroups in STEM. Likewise, scientific societies in STEM should recruit scientists who are members of Asian American ethnic subgroups into leadership positions and highlight them at their annual conferences. Their presence and experience would go far toward educating members of their scientific society. Scientists who are members of Asian American ethnic subgroups can use social media to educate a wider audience on these issues.

To ensure a welcoming academic environment for students and faculty from Asian American backgrounds, institutions can take specific steps to boost their self-confidence and promote inclusivity. Within STEM, recognizing and celebrating the achievements of individual Asian American scientists is one effective approach. Institutions can also actively highlight individual scientists and their contributions to the STEM field, perhaps during Asian American and Pacific Islander Month each May. These events not only showcase the institution's commitment to diversity but also increase cultural awareness and highlight and appreciate the individuality of Asian American scientists. Events can include panel discussions, lectures, cultural festivals, and food events that highlight the culture, history, and accomplishments of each Asian American subgroup. Celebrating the contributions of Asian Americans through awards can effectively recognize and promote their accomplishments to the STEM fields.

Scientific journals can use their social media presence to intentionally highlight different ethnic Asian American scientists, especially those who are marginalized. This is not limited to Asians, but also applies to other groups who are treated as monoliths (e.g., LGBTQ+ individuals, Hispanics, etc.).

Increasing the representation of Asian Americans from across subgroups in institutional leadership positions, faculty, and the student body can promote diversity and inclusion, lead to better representation of different perspectives and experiences, and benefit the entire institution. By implementing these steps, research institutes and universities can foster a more welcoming, supportive, and inclusive environment for Asian Americans and other minority groups.

Institutions that aim to promote diversity may still encounter the issue of invisibility. For instance, predominantly white institutions (PWIs) might seek to enhance diversity by hiring ethnically diverse faculty solely based on their ethnicity, resulting in a colorblind environment, microaggressions (indirect, subtle, or inadvertent acts of discrimination), and a lack of regard for the qualifications of the new hire. Moreover, marginalized Asians and Pacific Islanders are still underrepresented at the faculty level. Therefore, search committees should be aware of a candidate's ethnic origin, rather than grouping all Asian Americans under a single label. It is also important to avoid "tokenizing" individuals from different subgroups of Asians by expecting one person or a few individuals to represent the entire diversity of a group. These measures are necessary to establish a genuinely diverse workforce that respects and values individual differences.

Change on a micro level

How can change be effected at the level of individuals? Those of us who belong to Asian American ethnic subgroups that are underrepresented in STEM can engage colleagues, educating them about the issues discussed in this commentary. Institutions can also effect change on an individual level. Murray and colleagues suggest implementing interventions such as implicit bias training,[10] cultural responsiveness, and cultural humility training, as well as placing deserving individuals into leadership positions based on less biased criteria. Individual training should be implemented at an earlier stage, and cultural humility should be continually developed throughout an individual's career. This approach can promote institutional change to address the problem of the model minority myth and bring awareness to the disaggregation of the Asian-American monolith.

Early intervention is also key to solving these issues. Interventions that enhance students' science identities have proven beneficial in cultivating interest and success in STEM.[11] Past studies have shown that how students view and define themselves in relation to science can have major impacts on future outcomes.[12] Targeted initiatives to help trainees better envision themselves as scientists and leaders in their respective communities would play an important role in combating the issues discussed here. These interventions should come from two major levels. At the university level, universities should offer courses that emphasize the contributions of scientists from these groups. Alternatively, they could also introduce Scientist Spotlights, a set of metacognitive homework assignments that feature counter-stereotypical examples of scientists from different disciplines, into different classes to raise awareness of scientific identity.[13] At the department level, departments should highlight the achievements of either faculties or trainees from these Asian American subgroups in newsletters or interviews to provide more opportunities for individuals to speak about the challenges they face and how their diverse background(s) impact their scientific achievements and the enrichment of STEM.

Lastly, intentional mentoring is a valuable approach to complement institutional change.[14] Mentors should be aware of their own biases, which could impact

their advocacy for mentees or career advice. Collaborating with diverse Asian American individuals, facilitating grant access, and prioritizing diversity efforts that acknowledge the ongoing challenges Asian Americans face, especially those who come from marginalized backgrounds, are crucial steps that mentors can take to effect change. Together with broader institutional changes, these efforts can help create a more inclusive and equitable STEM community.

Further considerations

Disaggregating the Asian American monolith is just the beginning, as future studies can address other groups in STEM that are treated as a single aggregated category, including but not limited to those identifying as Hispanic American or LGBTQ+. For example, Hispanics are often treated as a single group despite coming from unique cultural backgrounds, with the term encompassing those with ties to Latin and Central America, the Caribbean, and various other countries. LGBTQ+ individuals are also treated as a monolith, often grouped together due to divergence from hetero- and cisnormative expectations of sexual orientation and gender identity, despite each subgroup facing their own unique challenges. Overall, classifying groups of people into generalized categories fails to capture the unique history and tradition of their specific identities. Treating all groups as a monolithic category is harmful and ignores individuality.

Conclusion

Asian Americans in STEM are negatively impacted when aggregated into a monolithic group. The term itself comprises Americans with ancestries from at least twenty different countries in Asia, each with different languages and vastly different cultures. What happens in the general population often gets mirrored in the STEM community. Asian Americans continue to face bias and fight the model minority myth within the general and STEM communities. The STEM community has an opportunity to lead the general community by disaggregating the Asian American term to acknowledge individual ethnic subgroups. By considering Asian Americans a monolith, many Asian American subgroups will continue to be unnoticed and marginalized in STEM.

DECLARATION OF INTERESTS

The authors declare no competing interests.

REFERENCES

1. Okamoto, D.G. (2014). Redefining Race: Asian American Panethnicity and Shifting Ethnic Boundaries (Russel Sage Foundation).
2. Budiman, A., and Ruiz, N.G. (2021). Key facts about Asian Americans, a diverse and growing population (Pew Research Center). https://www.pewresearch.org/fact-tank/2021/04/29/key-facts-about-asian-americans/.
3. Teranishi, R., Lok, L., and Nguyen, B.M.D. (2013). iCount: A Data Quality Movement for Asian Americans and Pacific Islanders in Higher Education (Educational Testing Service).
4. Teves, S.N., and Arvin, M. (2018). Decolonizing API. In Asian American Feminisms and Women of Color Politics, L. Fujiwara and S. Roshanraven, eds. (University of Washington Press), pp. 107–137.
5. Wu, E.D. (2014). The Color of Success: Asian Americans and the Origins of the Model Minority (Princeton University Press).
6. Kang, C., Jo, H., Han, S.W., and Weis, L. (2023). Complexifying Asian American student pathways to STEM majors: Differences by ethnic subgroups and college selectivity. J. Divers. High. Educ. *16*, 215–225. https://doi.org/10.1037/dhe0000326.
7. Wong, F., and Halgin, R. (2006). The "model minority": Bane or blessing for Asian Americans? J. Multicult. Counsel. Dev. *34*, 38–49.
8. Wei, M., Liu, S., Ko, S.Y., Wang, C., and Du, Y. (2020). Impostor Feelings and Psychological Distress Among Asian Americans: Interpersonal Shame and Self-Compassion. Counsel. Psychol. *48*, 432–458. https://doi.org/10.1177/0011000019891992.
9. Bhatti, H.A. (2021). Toward "Inclusifying" the Underrepresented Minority in STEM Education Research. J. Microbiol. Biol. Educ. *22*. e00202–e00221. https://doi.org/10.1128/jmbe.00202-21.
10. Murray, S.A., Hinton, A., and Spencer, E.C. (2022). Developing cultural humility in immunology and STEMM mentoring. Trends Immunol. *43*, 259–261. https://doi.org/10.1016/j.it.2022.01.010.
11. Beasley, M.A., and Fischer, M.J. (2012). Why they leave: the impact of stereotype threat on the attrition of women and minorities from science, math and engineering majors. Soc. Psychol. Educ. *15*, 427–448. https://doi.org/10.1007/s11218-012-9185-3.
12. Vincent-Ruz, P., and Schunn, C.D. (2018). The nature of science identity and its role as the driver of student choices. Int. J. STEM Educ. *5*, 48. https://doi.org/10.1186/s40594-018-0140-5.
13. Schinske, J.N., Perkins, H., Snyder, A., and Wyer, M. (2016). Scientist Spotlight Homework Assignments Shift Students' Stereotypes of Scientists and Enhance Science Identity in a Diverse Introductory Science Class. LSE *15*, ar47. https://doi.org/10.1187/cbe.16-01-0002.
14. Shuler, H., Cazares, V., Marshall, A., Garza-Lopez, E., Hultman, R., Francis, T.-K., Rolle, T., Byndloss, M.X., Starbird, C.A., Hicsasmaz, I., et al. (2021). Intentional mentoring: maximizing the impact of underrepresented future scientists in the 21st century. Pathog. Dis. *79*, ftab038.