STEM Pushout and Redirection of HMoob American College Students at a Predominantly White Institution

WCER Working Paper No. 2024-4
July 2024

Bailey B. Smolarek, Matthew Wolfgram, Chundou Her, Lena Lee, Stacey J. Lee, Geboli Long, Payeng Moua, Kong Pheng Pha, Ariana Thao, Mai See Thao, Mai Neng Vang, Susan Vang, Chee Meng Xiong, Choua Xiong, Edward Xiong, Odyssey Xiong, Pa Kou Xiong, Ying Yang Youa Xiong, Kayeng Yang, Lisa Yang, Mai Chong Yang, Scy Yang, and Steven Yang

Wisconsin Center for Education Research
University of Wisconsin–Madison
bsmolarek@wisc.edu

Suggested citation: Smolarek, B. B., Wolfgram, M., Vang, M. N., Xion, Y. Y. Y., Xiong, C. M., Lee, S. J., Xiong, P. K., Lee, L., Her, C., Pha, K. P., Xiong, C., Yang, L., Long, G., Moua, P., Thao, A., Thao, M. S., Vang, S., Xiong, E., Xiong, O., Yang, M. C., Yang, K., Yang, S., & Yang, S. (2024). *STEM pushout and redirection of HMoob American college students at a predominantly White institution* (WCER Working Paper No. 2024-4). University of Wisconsin–Madison, Wisconsin Center for Education Research.

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ABSTRACT

Asian Americans as a group are overrepresented among STEM college graduates and have the highest average college enrollment rate of any racial or ethnic category. Thus, Asian Americans are typically excluded from educational interventions directed at improving STEM education for Students of Color because they are not considered to be underrepresented minorities. However, statistics obscure the individual needs of the more than 20 ethnic subgroups that fall under the umbrella term Asian Americans. Using a participatory action research approach, this paper documents the institutional and sociocultural factors that push out HMoob (or Hmong) American college students from STEM programs at one large, predominantly White university; and the coordinate processes of gatekeeping and transactional advising that either redirect those students toward non-STEM programs or force them out of the university completely.

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Introduction

The underrepresentation of racially and ethnically minoritized populations in science, technology, engineering, and math (STEM[1]) fields spurred much-needed investigations and interventions to improve educational outcomes (Jong et al., 2020). Yet Asian Americans are typically excluded from interventions directed at improving STEM education for Students of Color because they are not considered to be "underrepresented minorities" along with Latine, Black, American Indian, or Alaska Native populations (NSF, 2019). That is because, in the aggregate, Asian Americans as a group are not only overrepresented among STEM college graduates but they also have the highest average college enrollment rate (58%) of any racial or ethnic category (NCES, 2019). However, these overgeneralized statistics obscure the individual needs of the more than 20 ethnic subgroups that fall under the umbrella term Asian Americans, thereby rendering invisible their unique experiences and creating the common assumption that all Asian Americans are succeeding in STEM (Kang et al., 2021). This paper counters this prevailing perception by documenting the institutional and sociocultural factors that push out (Kennedy et al., 2019; Tuck, 2011) HMoob (or Hmong) American college students from STEM programs at one large, predominantly White university; and the coordinate processes of gatekeeping and transactional advising that either redirect those students toward non-STEM programs or force them out of the university completely.

Because of the way data regarding Asian Americans is aggregated, we do not know how many students of the various subpopulations are pursuing STEM degrees and/or STEM careers, nor do we know if there are disparities among these subpopulations in this pursuit. Yet, traditional educational achievement measures show that Southeast Asian American populations (e.g., students of HMoob, Vietnamese, Cambodian, Lao, or Thai descent) struggle in comparison with other Asian American populations. Furthermore, studies examining the higher education experiences of HMoob American students found significant struggles and barriers that are not often discussed within the literature on Asian Americans, including a lack of campus support, feeling unwelcome (Gloria et al., 2017), and experiencing both microaggressions and overt racism (DePouw, 2012). In our own research examining the 6-year graduation rate for undergraduate students at the 13 University of Wisconsin (UW) universities, we found that only

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[1] We define STEM as including the following fields: agricultural sciences, natural sciences, life/biological sciences, physical sciences, mathematics, computer sciences (not information technology or management), engineering (all forms), kinesiology, and health professions—including nursing and psychology but not health care administration.

48% of all Southeast Asian students and 46% of HMoob students graduated within 6 years, compared with 71% of other Asian populations (Smolarek et al., 2019). These examples demonstrate the stark educational disparities between Southeast Asian students and other Asian American groups and indicate the need to better understand the experiences of overlooked Asian American populations, especially within STEM education.

This paper presents findings from an ongoing participatory action research (PAR) study that investigates the experiences of HMoob American college students in Wisconsin. The data presented were gathered during the second year of our study (2019) in which we interviewed 66 current or former UW–Madison undergraduate students who self-identified as HMoob. Our analysis found a set of institutional and sociocultural factors—such as gatekeeping processes and racial microaggressions (Smolarek et al., 2021)—that *push out* students (Kennedy et al., 2019; Tuck, 2011) from STEM programs; and transactional advising that *redirects* those students toward non-STEM programs.

"School pushout" is a concept used in the secondary education literature to refer to the educational practices and policies that inhibit students' ability to successfully complete school. The term is often used as an alternative to "dropout" to remove individual blame from students and reframe the issue as structural (Fine, 1991; Tuck, 2012). School pushout can happen through a variety of mechanisms including high-stakes testing, a lack of culturally relevant and inclusive curriculum, and over-disciplinary and discriminatory schooling environments (Garcia et al., 2022; Johnston-Goodstar et al., 2022; Kennedy et al., 2019; Martin & Brooks; Nixon et al., 2022; Tuck, 2011). School pushout disproportionately affects Black, Indigenous, and other People of Color (BIPOC) and students who identify as lesbian, gay, bisexual, transgender, or queer (LGBTQ+) as these populations experience more school discipline, bullying and harassment, and inaccurate and/or negative representations in the curriculum (Burge et al., 2014; Garcia et al., 2022; Morris, 2015; Snapp et al., 2022). Dehumanizing and/or unwelcoming educational experiences lead students to being pushed out of school by creating an environment where they do not feel as though they belong and feel pressure to leave. Through their youth participatory action research work with Native youth, Johnston-Goodstar and colleagues (2022) identify four key ideas involved in school pushout:

1) School is designed for dispossession by focusing on assimilation to Eurocentric linguistic, cultural, and social norms, measuring student success in indicators that are rooted in White supremacy, and stripping BIPOC students of their ways of life, languages, stories, and knowledges.

2) Curricular harm occurs to students though inaccurate, negative, stereotypical images and/or invisibilizing or erasure of certain people and/or events from history.

3) Racialized disparities are common in school discipline as well as experiences of bullying and harassment.

4) Discriminatory macro- and microaggressions are experienced by marginalized students from school staff, teachers, and peers.

While there is a robust literature on school pushout in K–12 research, particularly in high school settings, this concept has not been applied in higher education settings. We apply the notion of school pushout to our work and argue that the underrepresented Asian American students in our study were pushed out of STEM programs through a similar process that forced countless Students of Color to leave secondary education settings.

Drawing on research examining the experiences of minoritized college students in STEM, we identify key aspects of STEM pushout of minoritized students in higher education:

1. **Racialized and exclusionary environments** on campus and in the classroom that include both macro- and microaggressions as well as a lack of cultural diversity and engagement (Lee et al., 2020; Museus, 2013).

2. **Lack of representation and/or misrepresentation** of students' backgrounds and/or cultures in the curriculum, which often plays into the racist and sexist histories of Western science (Carter et al., 2019; Grande, 2003).

3. **Meritocratic measures of success** that distribute rewards and punishments solely on individual merits without regard to broader social systems (Carter et al., 2019; Liu, 2011; Museus et al., 2011).

4. **Disciplinary processes** that rigidly apply universal classroom policies such as attendance, language varieties, and obligatory out-of-class activities without reasonable accommodations or humane flexibilities (Urrieta, 2009).

We found that the consequences of this STEM pushout included students leaving academic programs, being advised to shift programs, or stopping out of college all together. Moreover, our data indicate that HMoob students who experienced redirection to different majors often did not understand the long-term consequences of abandoning the pursuit of their desired field of study and were ultimately frustrated when they could not achieve the post-graduation job opportunities they hoped for. However, in the audit cultural accountability logic of higher education, which prioritizes student retention and persistence toward graduation at the ultimate measure of institutional success (Apple, 2013; Shore, 2008), the serious negative education and career consequences of STEM pushout and redirection are unmeasured and thus, unrecognized.

This paper focuses on the third aspect of STEM pushout—meritocratic measures of success—through an analysis of three of its key mechanisms: institutional gatekeeping, weed-out courses, and transactional advising, to demonstrate the consequences of STEM meritocracy on the academic choices, experiences, and outcomes of our participants. We suggest that these institutional logics can be disrupted by re-orienting college academic and career advising, and by providing needed resources and training to support the teaching and advising of minoritized students from an asset-oriented perspective (Gay, 1995; Ladson-Billings, 1995; Paris & Alim, 2017; Yosso, 2005). We discuss research on the racialized experiences of Asian Americans in STEM in the United States (Iftikar & Museus, 2018; Kang et al., 2021; Lee et al., 2017; Xie et al., 2015); develop a conceptual frame that draws on neoliberal, market-driven policies in higher education (Harvey, 2005; Shore et al., 2011); and discuss our research methodology. We

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conclude with a discussion of the significance of this work, our recommendations, and future aims.

The Racialization of Asian Americans in STEM in the United States

A critical, comprehensive understanding of the educational experiences of Asian American individuals and groups requires an analysis of the historical and contemporary specificity of the racializations of "Asians" in the United States (Iftikar & Museus, 2018; Museus & Iftikar, 2013)—especially the focal role of STEM in the racialization of Asians as model minorities (Chen & Buell, 2018).

Throughout the second half of the 19th and early 20th centuries, South and East Asians, and Pacific Islanders such as Filipinos, were permitted (and even encouraged) to migrate to the Western United States to meet the labor needs of agricultural and industrial production. However, after the production imperatives of U.S. capital waned, these groups were targeted for deportation. They experienced restrictive and racist immigration quotas and bans, discrimination in employment, residence, and property and business ownership, verbal and physical racist violence, and, during World War II, internment of Japanese Americans (Day, 2016; Ngai, 2014). Post-WWII, the United States transitioned away from explicitly nativist political rhetoric and policy toward a more open concept of racial liberalism, which distinguished American political culture from fascist and communist regimes as tolerant and welcoming of Asian immigrants (particularly East Asians), who were represented as having American habits and values, such as good character, stable families, hard work, and self-sufficiency (Wu, 2014).

As the U.S. Cold War expanded across the second half of the 20th century, science and technical knowledge became central to the national economic, security, and military strategy (manifested by proxy in the Space Race), as well a key sign and value in anti-communist nationalist discourse (Needell, 2013). The ideologies of racial liberalism and STEM nationalism directly influenced immigration policy. The 1965 Hart-Celler Immigration and Nationality Act established preferences for immigrants with technical and scientific credentials, and the H-1B Visa permitted industry-sponsored immigration. A majority of these technical and scientific immigrants from South and East Asian countries possessed credentials from technical and scientific education institutions (Lee & Zhou, 2015; Min & Jan, 2015; Rumbaut, 2012). Excluding a pause of Asian medical professional immigration in 1976, U.S. immigration law since the 1965 Hart-Celler Act continued and increased the preference for technical and scientific immigrants from Asia (Rumbaut, 2012). At the same time, student immigration to U.S. universities for STEM education also expanded from South and East Asian countries (Dhingra, 2018). The internationalization of U.S. higher education during the Cold War was part of a geopolitical soft-power strategy to create an American Asian elite (Wang, 2010). This Asian internationalization of U.S. higher education continues today, as American universities compete for Chinese and other Asian students who can pay the high tuition (Hegarty, 2014). Thus, on account of Cold War STEM nationalism and geopolitics—manifested in South and East Asian-targeted selective immigration and higher education policies—Asian Americans have been stereotyped as model minorities (Ng et al., 2007; Poon et al., 2015) who are especially adept in STEM (Chen & Buell, 2018; Choy, 2022; Shah, 2019).

The ideological coupling of STEM with Asian model minority racialization provided scientific and technical, educational, and geopolitical contexts to re-invigorate the 19th-century discourse about an Asian threat (or "Yellow Peril"), especially with the rise of Japan and then China as scientific and economic competitors (and in the case of China, as a geopolitical adversary) with the United States (Wu, 2002). The model minority representation also obscures important socioeconomic differences within an aggregate "Asian community." This aggregation occurs in both research and the public perception (Kang et al., 2021; Xie et al., 2015), lumping together South and East Asian communities with Southeast Asian communities who resettled as refugees starting in the 1970s and who face socioeconomic and education barriers in the United States (Ngo & Lee, 2007; Lee et al., 2017). Because of this history, the experiences of minoritized Asian Americans such as HMoob and other Southeast Asians are either obscured by the aggregate Asian STEM racialization, or these groups are ideologically blackened as "delinquents" (Lee, 2001) whose culture opposes American values oriented toward educational achievement (DePouw, 2012; Ngo, 2008).

Research on the STEM experiences of minoritized Asian Americans is needed as a form of anti-institutional invisibility work (Smolarek et al., 2021) to counter the Asian model minority racialization of STEM achievement. It is important to analyze both the systemic processes that impact student experiences and how students negotiate and navigate those systems (Kennedy et al., 2019).

Conceptual Framework: Neoliberalism and STEM Meritocracy

Neoliberalism emerged in the 1980s in the United States and Western Europe as a policy approach and form of governmentality involving the radical restructuring of public institutions—from public education to health care to civic governance—based on free market principals (Harvey, 2007). Neoliberalism has become a central and often uncontested logic of governance in U.S. higher education (Saunders, 2010), and has involved the market coordination of higher education through the commodification of academic and research knowledge (Slaughter & Rhoades. 2004); state disinvestment of public higher education (Mintz, 2021); and the coordination of university programs and curricula with the labor needs of capital by focusing on "employability" and "skills" as the primary outcomes of college (Holborow, 2012). Neoliberal governance, accountability structures, and policies prioritize the producerist and instrumentalist market coordination of higher education (Chen & Buell, 2018), which contributed to the expansion of investments in STEM programs on U.S. campuses (Kleinman et al., 2012), often at the expense of the humanities (Hartman, 2017).

The promotion and expansion of STEM cultures in higher education negatively impacted the experiences of minoritized college students, including the competitive and individualistic nature of STEM disciplinary cultures (Hurtado et al., 2012; Seymour & Hewitt, 1997) and the coordinate ideologies of meritocracy, which reproduce the objective neutrality of STEM disciplinary cultures (Carter et al., 2019; Museus et al., 2011). Ideas regarding meritocracy, however, are culturally produced and reflect the interests of powerful groups (Karabel, 2005; Liu, 2011). Chen and Buell (2018) argue that "the [STEM] field itself has historically served and continues to serve as a site of reproduction for ideologies such as meritocracy and producerism

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that are fundamental to the neoliberal project and its accumulation of resources for White Americans" (p. 611). Sociologists Blair-Loy and Cech (2022) argued that "[f]ew beliefs are as sacred to scientists, engineers and mathematicians as the belief that science is a meritocracy" (p. 1). According to these perspectives, STEM fields are pure meritocracies driven by the pursuit of scientific knowledge, and are free from cultural or political influences, including commitments to diversity (Blair-Loy & Cech 2022).

Research on the culture of STEM, however, challenges this dominant perspective, pointing to cultural practices that reproduce inequalities across gender and race. Several studies highlight the way the culture of meritocracy hinders efforts to address inherent biases in the culture of STEM (Liu, 2011; Museus et al., 2011). For example, Doerr et al. (2021) described the culture of engineering as "hegemonically masculine and hegemonically White" (p. 422). In their analysis of the "professional culture of STEM," Blair-Loy and Cech (2022) identify two widely held beliefs in STEM culture—work devotion and scientific excellence—that contribute to the reproduction of inequality in STEM. The "work devotion" schema defines STEM as a "calling" that requires single-minded devotion and commitment to work in ways that disadvantage those with family responsibilities, particularly women. "Scientific excellence" is associated with those who are risk-takers and highly competitive, creating a cut-throat environment that holds women and People of Color to different standards of behavior. Significantly, Blair-Loy and Cech (2022) found that these schemas are used to explain and excuse racialized and gendered inequality in STEM.

STEM meritocratic cultures, historically amplified by the producerist ideologies and policy imperatives of the neoliberalization of U.S. higher education, marginalize the experiences of non-majoritarian students in STEM settings, with the effect of pushing out minoritized students from competitive STEM programs (Hurtado et al., 2012; McCoy et al., 2017; Russell & Russell, 2015).

Research Methodology

Our research study is firmly grounded in a critical understanding of participatory action research (PAR) as a transformational approach to research, research-informed activism, and policy change that positions the people most impacted by the phenomena as key stakeholders in all aspects of the research process. PAR typically involves engagement between academic researchers and community actors, with the aim of gaining a more grounded understanding of a given phenomenon (Appadurai, 2006; Cooke & Kothari, 2001). While social science research traditionally derived part of its authority from an opposition between the researcher and the researched, PAR complicates this paradigm by partnering academic researchers and community actors in collaborative decision making that positions community members as researchers rather than objects of the research (Anderson, 2017). We contend that PAR offers an exciting and needed approach to studying issues in higher education because it not only includes the perspectives and experiences of higher education students—those who are often excluded from policy debates—but it also positions students in a researcher role to guide the research questions, approaches, data collection, and analysis. PAR has the potential to produce conceptually

innovative, action-oriented theory that can inform activism, pedagogy, policy debates, and policy implementation (Smolarek et al., 2021).

Our PAR team began in 2018 through a partnership between a HMoob student activist group on the UW–Madison campus, the HMoob American Studies Committee (HMASC), and educational researchers at the Wisconsin Center for Education Research (who are the principal investigators of this study) to examine core research questions:

- What are the institutional and sociocultural factors influencing the college experiences of HMoob students at UW–Madison?
- How can those experiences be improved?

Since 2018, both new and continuing HMASC members have been the core of our research team. Our team has also included three PhD graduate student assistants. All undergraduate and graduate student team members self-identify as HMoob and bring a strong personal understanding of HMoob student experiences. The professional educational researchers on the team serve as lead mentors who teach and train students on the various aspects of social science research by guiding them through research design development and execution.

We involve all members in each step of the research process. Decisions regarding research design are made as a team; data collection labor is divided among the group after careful conversations regarding which team member is most appropriate to conduct each data collection step; data analysis is conducted collaboratively and involves numerous individual memos, team conversations, and partnered coding; and dissemination strategies are collaboratively made. We also review relevant literature as a group on a continuous basis and have in-depth discussions about our personal college experiences and hopes for social change on campus and beyond. These discussions serve as part of the "action" component of our PAR work in which our team enacts evidence-based policy advocacy by sharing the stories of our participants with diverse stakeholders and performing counter-invisibility work to bring attention to the needs of HMoob students (Smolarek et al., 2021). This approach encourages deep engagement by the students most affected by current, systemically racist educational structures. Therefore, our PAR team serves as a space for HMoob students to gain valuable research and academic skills; engage in critical consciousness raising (Vang et al., 2022) by learning about and sharing their own educational experiences as well as those of their HMoob peers; and advocate for social change and more equitable educational experiences for HMoob Americans and students of other marginalized backgrounds.

Research Site, Context, and Questions

University of Wisconsin–Madison is a predominantly White, land grant, research university that serves approximately 35,000 undergraduate students. About 40% of the undergraduate student population are non-residents, meaning they are not from Wisconsin or Minnesota (the state with which Wisconsin shares tuition reciprocity) and 15% receive Pell Grants. The average age of an undergraduate student is 20 years. Of the total domestic undergraduate population (31,667), about 69% are White, 11% are Asian American, 8% are Latine, 5% are more than one

race, 2% are Black, less than 1% are American Indian or Native Hawaiian, and about 4% are classified as an "unknown" race (UW–Madison data digest, 2022).

Of the 3421 Asian American students who were enrolled as UW–Madison undergraduate students in Fall 2022, only 379 were HMoob (UW System Office of Policy Analysis and Research, 2023). This is surprising because HMoob make up the largest Asian American population in Wisconsin at about 58,000 people, approximately 1% of the total state population of 5.9 million (U.S. Census Bureau, 2021). HMoob first settled in Wisconsin in the mid-1970s after they were displaced to the United States as refugees following the conclusion of the U.S. wars in Southeast Asia. During these wars, HMoob were recruited by the CIA to serve as soldiers on the Vietnam-Lao border and had to flee to refugee camps in Thailand following the communist takeover of Vietnam, Laos, and Cambodia to escape persecution (Vang, 2010). Many HMoob were eventually settled in third countries during the later decades of the 20th century. From 1990 to 2010, the U.S. HMoob population grew 175%. Today, nearly 350,000 HMoob Americans live in the United States. The largest HMoob populations are in California, Minnesota, and Wisconsin (U.S. Census Bureau, 2021).

Rates of educational attainment and poverty for HMoob in Wisconsin improved significantly in the past 30 years, yet rates remain lower than the state average (Pfeifer et al., 2013). For example, while only 8% of all Wisconsin families live in poverty, 20% of HMoob families in Wisconsin live in poverty (American Community Survey, 2017). This is because most HMoob arrived in the United States with limited English, literacy, and job skills and U.S. refugee support systems did not provide sufficient financial, social, and psychological resources. As a result, HMoob are at a significant disadvantage navigating U.S. social structures (such as public schools), acquiring jobs that pay a living wage, and managing the physical and psychological trauma from war. While some of these issues common to refugees have improved as subsequent generations live in the United States, the related issues of racism and discrimination that are typically encountered by more recent immigrant groups (especially migrants of color) persist and serve as significant barriers to economic growth and social belonging.

Data Collection

Data for this analysis were collected in Year 2 of our study (2019–2020) and include semi-structured interviews with 66 participants. At that time, 36 participants were pursuing their undergraduate degrees at UW–Madison, 23 were alumni who had recently (within the previous 10 years) graduated with undergraduate degrees from UW–Madison, and seven were former students who had either stopped out or transferred from UW–Madison. All current student interviews were conducted by an undergraduate student researcher on our team, and all former student interviews were conducted by either an undergraduate or graduate student researcher. Student researchers were trained by research mentors in qualitative research methods through a series of training sessions that included topics such as epistemology, positionality, and data collection and analysis techniques, and had opportunities to practice interviewing one another before entering the field. During interviews, participants were asked about their earlier educational experiences, college decision-making process, experiences at UW–Madison, and

goals post-graduation. Alumni were also asked more about their career experiences post-graduation, and transfer and stop-out participants were asked about the circumstances and processes surrounding their exit from the university. It is important to note that all student interviews discussed in this paper were conducted between November 2019 and February 2020, before the COVID-19 pandemic began.

Participants were recruited through a combination of convenience and snowball sampling. Undergraduate and graduate student researchers recruited current and former student participants from their personal social networks. After participants had been interviewed, they were also asked if they knew of anyone else fitting the sample criteria who would be interested in participating in this study. In our weekly team meetings, we discussed participants' demographics (age, gender, academic focus, etc.) to make sure we recruited as representative a sample as possible. Regarding participants' gender identification, 41 self-identified as female, 22 self-identified as male, and three did not identify with the gender binary. Current student participants were between the ages of 18 and 24 at the time of the interview, with an average age of 20; former students ranged in age from 22 to 33. The average age was 26 years. Most of our sample (all but one person) grew up in Wisconsin. In addition to this interview corpus, we conducted 25 observational activities involving HMoob students on campus and wrote over 200 pages of research memos in the form of autoethnographic journals in which student researchers reflect on their interactions with participants in relation to their own personal experiences as HMoob college students (Vang et al., 2023).

Data Analysis

Our data analysis was an iterative process that included individual and group reflections, systematic coding, and extensive memoing. After a researcher completed an interview, they documented their initial thoughts and reflections in their autoethnographic journals (Vang et al., 2022). Then, at weekly team meetings, researchers shared insights on their recently conducted interviews and the group began to develop emerging themes and ideas for exploration. Interviews were professionally transcribed and checked by the research team; the HMoob language portions of the interviews were transcribed and translated by bilingual research team members. Transcripts were uploaded into MAXQDA coding software, and the research team collectively developed first round codes to segment the data into more manageable chunks such as "encounters with racism" or "advising experiences." In pairs or small groups, our team then developed sub-codes for first round codes based on emerging themes and discussions.

The research team traced the major pathways for each participant in an Excel spreadsheet by listing intended majors, first major, subsequent major changes, and reasons for these changes to help identify participants who experienced program shifts. Through this analytic procedure, we began to see patterns of pushout within STEM and examined the sub-set of participants who had either intended to study a STEM field or began to study STEM but ended up switching majors. The patterns that we found in their experiences make up the core aspects of our findings discussed below.

Limitation of the Research

We recognize the limitations associated with our research. First, our sample is only a portion of the HMoob students who attend UW–Madison and cannot be generalized to all cases. Second, our purposeful and snowball sampling techniques may result in some unintended sampling bias as our participants were part of our researchers' social networks.

Findings – Role of Meritocratic Measures of Success in STEM Pushout

We focus on role of meritocratic measures of success in STEM pushout and redirection, which includes phenomena such as weed-out courses, grading on a curve, emphasis on standardized testing, competitive and individualistic classroom environment, selective enrollment processes, and transactional advising. We argue that these forms of teaching and learning are subtractive (Valenzuela, 1999) in nature because they take a deficit-oriented perception of students that devalues their home knowledges; opposes culturally responsive and sustaining teaching (Gay, 2018; Ladson-Billings, 1995; Paris & Alim, 2017) and feminist pedagogies (Crabtree et al., 2009); and lacks student-centered ideologies, multiculturalism, and compassion.

Our investigation found that of our 66 HMoob American college student participants, 28 experienced college STEM pushout through one or more of three key STEM meritocracy mechanisms: 16 experienced institutional gatekeeping, 20 experienced challenges in weed-out courses, and nine experienced transactional advising. Moreover, 20 of these 28 participants reported experiencing a combination of two or all three of these pushout mechanisms. Table 1 provides a list of participants who experienced pushout, along with the pushout mechanism(s) they experienced. In the following sections we review each of these mechanisms in depth and provide examples of their manifestation in our participants' schooling experiences. While we argue that each of these processes is unique in its appearance, either together or individually they led to a consequence of pushout in which participants were indirectly forced out of their programs or were greatly deterred from enrolling in the first place.

Institutional Gatekeeping

We define institutional gatekeeping as including competitive programs with high grade point average requirements that typically take more than 4 years to complete or require additional unpaid commitments (e.g., internships or practicums); these sorts of programs place an additional burden on first-generation, low-income, and minoritized students. Sixteen participants described the mechanisms of institutional gatekeeping that hindered them from pursuing their intended STEM field. The following table provides illustrative examples of institutional gatekeeping by sharing the participants' intended academic major, gatekeeping experience, and pushout consequence.

Table 1. **Institutional Gatekeeping**

Participant and Original or Intended Major	Student Experience	Consequences
Kazoua: Declared major in communication sciences and disorders to research more about hearing loss. Wanted to apply to the School of Engineering to learn how to develop and improve hearing technology.	"Engineering school is very competitive, very hard to get in. You have to maintain a 3.5... And because I'm more focused on communication science and disorders, like, as much as I want to learn about hearing technology... I'm still equally passionate about the research on hearing loss... I'm just going to stick with communication science and disorders... Engineering academic advisors are very harsh. Like, they'll just look at, like, your math placement... And, like, if you don't meet their expectations, they'll just turn you down."	Due to competition and rigid requirements, Kazoua did not apply to the School of Engineering.
Mina: Was accepted into the School of Engineering and declared a major in biomedical engineering.	"I also see that, as an Asian woman and a person of color coming into UW–Madison, doing science engineering, and—you know, those classes, it's— it's a very competitive place that is very toxic, and it doesn't nurture a lot of people who aren't in these spaces. You have to really fight for it and advocate for yourself and catch up with a lot of courses so that you could be—so that you just don't fail. You have to make sure you either do a lot of tutoring, or when you're in those group projects, advocate for yourself so you get a good role, and it's a lot of mental and physical draining that they don't tell you about…honestly, they just see you as a statistic that you graduate here and make money for them and they pretend that their school is welcoming to people of color."	Constrained by institutional barriers, Mina couldn't realize her career aspirations, leading her to feel incapable of achieving her dreams and struggling academically without guidance, resulting in an incomplete degree and feelings of disappointment. She stopped out of college after her sophomore year and is presently working as a babysitter in a series of jobs to support herself and her family.
Npauj Npaim: Intended to apply to the School of Nursing to become a nurse and help people access resources.	"I was rejected from nursing school last year, and I immediately followed up with my advisor to discuss planning. So, I told her that I wanted to maybe take physiology, which would boost my GPA the most... It was primarily because I realized that the school of nursing is a little more competitive than the social work school is. I thought it would be because I'm a fourth year already that it would be more beneficial if I were to go toward something that is easier to get in. And that would also… allow me to achieve one of my goals, wanting to help people access resources."	Pressured to maintain high GPA, Npauj Npaim switched from pre-nursing to a social welfare major because the nursing requirements were competitive and she could graduate sooner with the social welfare major.

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| **Tim:** Declared in biology with the intentions of a pre-dental track. Aspires to be a dentist. | "My GPA wasn't as great. And my grades, you know, weren't that amazing... my goal, my dream [to be a dentist] it was dead. But then I went to go talk to the coordinator and co-coordinator of the bacteriology department here at UW–Madison… they understood my situation and you know, I told them that I didn't want to give up my dreams... they said that if I worked another semester and I did good, that they would be references to get into the graduate program here. And so, that's what I'm currently working on is prerequisites." | Because of needing to retake prerequisite courses for better grades, Tim is spending more time in school catching up to get into dental school even after graduating with their Bachelor's degree; resulting in a protracted time to get into dental pathway. |

The examples in Table 1 demonstrate the variety of ways that institutional gatekeeping pushes students either away from or out of STEM programs, including highly competitive and individualist environments, strict GPA requirements, and rigid academic pathways. These gatekeeping tools are held up as meritocratic ideals that proport to be "fair" and "objective" for all. In reality, the tools privilege particular ways of learning and types of knowledge that emphasize individualism, memorization, and lack of outside responsibilities, and do not equate to intelligence or expertise within a particular field.

Weed-out Courses

We define weed-out courses as large lectures with a high ratio of students to professors, curved-based gradings, and a high number of students receiving very low grades. Twenty students in our sample described the impact of weed-out courses on their access to STEM pathways. Weed-out courses are designed to exacerbate educational inequalities by creating obstacles that result in high failure rates, redirection, and/or college exit rates (Weston et al., 2019). These are prominent in foundational courses for STEM majors that students need to do well in to advance to the next levels.

Table 2 illustrates the role of weed-out courses as a process of STEM pushout with examples from four student participants, including experiences with weed-out courses and educational consequences.

Table 2: **The Impact of Weed-out Courses on STEM Pathways**

Participant and Original or Intended Major	Student Experience	Consequences
Kia: Declared in biology with a pre-med track. Intended to get into medical school.	"[The] first semester of O-Chem, I like mentally, like died. I feel like that really destroyed me... And it changed my thoughts about school... I stop looking towards medical school..."	Switched major to nutrition and dietetics.
Tuam: computer engineering.	"I feel like it's how competitive it is here... I've failed many courses here and like I've retaken them so many times and I just keep failing them, so like if I stay and if I just keep failing them, I feel like I'd rather just transfer and maybe do better and get through it."	Developed low self-esteem and low confidence due to weed-out courses. Had to retake multiple courses. Resulted in protracted time at UW to 5 years. Ultimately transferred to a different university.
Amy: Intended for a biology major with pre-med track.	"I did really, really bad... I think it was surprising for me because I excelled in these classes in high school. And I think that part of that was because of my imposter syndrome because I was feeling, like, oh I'm at this school with, like, the smartest people in the in the state. And perhaps I'm not as smart, or something..."	Developed imposter syndrome. Received academic probation. Switched major to anthropology.
Vaj: Declared in chemistry with a pre-med track and intended to become a pharmacist.	"I really liked chemistry... I felt like it was fun, but as the questions got more advanced, I felt like it was... just having to memorize things rather than really trying to understand it... But I took organic chemistry. There was talk that that was a class to weed out people... it discourages people... I wanted to go into the medical field... like pharmacy. But, yeah, that changed."	Switched major to English. Protracted time at the UW to 7 years. Changed career plans from the medical field to community developmental field working with youth.

Many of the HMoob students from our sample entered the university hoping to pursue STEM majors with linear career trajectories such as nursing, engineering, and other medical fields. However, our findings suggest that HMoob students are one of the student groups who have been inequitably pushed out of STEM by weed-out courses. By design, such courses are not fair and filter students inequitably because privileged students can perform with less preparation, opportunities, and resources.

The long-term consequences of being weeded out include a mental and emotional toll and the financial burden of taking longer to complete school and having to devise alternative plans. At the introductory levels, students were already discouraged by classes that were not conducive to their learning and success. HMoob students who did not perform well in weed-out courses perceived themselves as undeserving and unfit to continue STEM or their intended programs.

They typically experienced destructive feelings of imposter syndrome, low self-esteem and low confidence, and loss of motivation to continue their original academic plans.

Transactional Advising

We define transactional advising as brief interactions with advisors that are prescriptive and focused on efficiency in order to provide quick solutions for students' academic problems without addressing the root issue. This type of advising often results in the student being redirected to a different program. Transactional advising approaches are built to reflect the structures of the university and its programs, in which advising priorities are related to course enrollment and program requirements for major selection without centering both curricular and non-curricular experiences of the students. Ten participants in our sample experienced transactional advising.

Table 3 highlights a selection of four students out of the 12 who shared their transactional advising experiences and educational consequences. Their stories illustrate the role of transactional advising as a process of STEM pushout by gatekeeping and redirection, as well as, enforce audit culture in higher education that further renders the invisibility of STEM pushout among HMoob students.

Table 3: **Redirection Through Advising**

Participant and Original or Intended Major	Student Experience	Consequences
Peter: Declared in kinesiology with the intent to become a physical therapist.	"One major thing that made me change from [kinesiology] was that I went to go talk to my advisor about what courses should I take. And, he legit said, '[It] looks like you got a C in chemistry, you should think about changing to rehab psych...' You know, just because I didn't pass that doesn't mean I can't become a great physical therapist... But, because he did say that, it did change my way of thinking, maybe I don't fit in this role."	Switched majors into communication arts. Developed low self-esteem.
Sherry: Pre-med track	"My dreams [of becoming a doctor] were crushed. Because like the lady was like... talking about my GPA and like my grades for math, mainly the science courses... And then I think she also maybe dug a little bit deeper with like the why piece, like, 'why do you want to go to med school?... if you have, um, what's the word, if you have grit, you should be, you should be able to do it. But that's up to you...' And maybe that's why I was so disappointed... you probably won't be able to go to med school."	Switched from a pre-med track to human development and family studies. Developed low self-esteem. Protracted time to get into the health field.
Karissa: Intended plan was to apply into the School	"Pre-nursing advisors are not good... they didn't really answer my questions because I don't really know what nurses do. And she just made it seemed like I would clean people's butt all day... I wanted to	Switched major to biology with emphasis on genetics and cytology. Developed advising skepticism.

of Nursing to become a nurse.	be a genetic counselor. But my advisor didn't really help me. So, I guess that's why I didn't do genetic counseling... I think [my advisor] was sick and tired of me like not knowing what I wanted. And so, she pushed me off onto another advisor... and she is like the worst advisor ever... She just doesn't check up on me at all... I emailed her and she's like, 'Okay, we can meet at this time.' I went to see her, and she's busy with another student. I had a class at 11 so I left, and she never followed up with me. And she just never really like supports me."	Enrolled in master's program for nursing education after a period of working in the cytology field. Protracted time of getting to their desired career pathway.
Austin: Intended to major in biomedical engineering in the College of Engineering.	"My academic [College of Engineering] advisor, I think he was the—the one who kind of was really harsh ... he spoke a lot of truth, and he had his reasons, too ... he was basically going off of statistics and seeing my grades. ... But it's something that I feel like, 'Man, dude, why can't you have a little bit of hope in you or something.' ... I think an advisor like that who never encourages or never brings you up was really difficult for me...I never felt that there was nothing there to guide you academically, mentally or spiritually ... I almost feel as if it was my responsibility ... because everything that I would [need to know], I always had to [take the initiative to] look into it or ask about it, so I always felt like if I wanted something, then I needed to do it myself for it. ... I wish I had a mentor ... I guess I never knew where to go to get a mentor. I guess that was kind of my fault for not networking..."	Experienced both weed-out courses and institutional gatekeeping through selective enrollment applications. Was not accepted to the College of Engineering and was advised to switch programs to Biological Systems Engineering in the College of Agriculture and Life Sciences. Graduated with a degree that he did not want and is presently working as a salesperson.

While academic advising is constrained by the structure of the university, advising approaches have a strong influence on students' self-perceptions. From our data on transactional advising, advisors were mainly focused on academic metrics such as a student's GPA, final grades, and major requirements. Students from our sample felt discouraged by their advisors when the conversations centered around low performance metrics as a reason to divert plans when many of them were impacted by weed-out courses. When students are redirected from their original majors, it sends a message that they are unfit for the field, and does not recognize that the major and its structures were designed inequitably for the student. Due to dismissive academic advising experiences and the lack of relationships between advisors and advisees, students developed skepticism about advising and felt dissuaded to seek advising resources for their academic and nonacademic needs.

In a sense, advisors perceived that redirecting students to an "easier" major or field of study might enable students to graduate "on time." Graduation and retention rates are one of the many accountability metrics in higher education. The consequences of switching majors are rarely discussed yet can significantly affect what a student is able to do after they graduate. Often, students who were redirected were not made aware of the consequences and how their decisions may impact their career pathways and require them to return for an additional degree.

Discussion

Narratives of STEM achievement play a central role in model minority representations of Asian Americans (Chen & Buell, 2018; Choy, 2022; Shah, 2019). Such representations obscure important socioeconomic differences by lumping the experiences of minoritized Asian Americans within an aggregate "Asian community" (Kang et al., 2021; Xie et al., 2015). This narrative erases the experiences of minoritized Asian Americans such as HMoob and other Southeast Asians who resettled as refugees starting in the 1970s. Our research indicates that HMoob college students are highly motivated toward STEM achievement, yet they experience systematic pushout from STEM programs—a form of institutional racism structured and amplified by neoliberal policies of U.S. higher education and by the meritocratic ideologies of STEM disciplinary cultures. More research is needed to document the experiences of minoritized Asian Americans in STEM and to theorize the forms of racial minoritization that are obscured and/or produced by Asian American model minority STEM achievement ideologies.

Drawing on the secondary education literature on school pushout that examines the educational practices and policies that inhibit students' ability to successfully complete school (Garcia et al., 2022; Johnston-Goodstar et al., 2022; Kennedy et al., 2019; Martin & Brooks; Nixon et al., 2022; Tuck, 2011), we argue that a similar process is taking place in STEM higher education contexts—where students experience a series of unwelcoming, discriminatory, and/or biased policies or practices that result in them leaving STEM fields and switching to more welcoming, non-STEM majors, or leaving higher education completely. STEM pushout and redirection for minoritized students is amplified by STEM culture and STEM education policies that prioritized meritocratic measures of success—which impact the experiences of HMoob students through institutional gatekeeping such as application and screening for selective STEM programs, required STEM weed-out courses, and transactional advising, which students find discouraging and which often serves to redirect students away from STEM programs.

The prevalence of STEM meritocratic ideologies—and their impacts on HMoob and other minoritized STEM students—is amplified and institutionalized by the expansion of neoliberal governmentality in U.S. higher education. In consequence, institutional gatekeeping, weed-out courses, and transactional advising operate within a neoliberal context that rewards merit and punishes inefficiency, and which drives the competitive culture of STEM fields (Hurtado et al., 2012; Seymour & Hewitt, 1997). The operation of the market then ensures that everyone gets what they "deserve," disregarding the advantages and disadvantages of student backgrounds (Carter et al., 2019; Museus et al., 2011). Thus, neoliberal governmentality in U.S. higher education produces real consequences that a) push out minoritized students into a field of study that does not align with their career choices, b) extend students' time to graduation and obstruct them from pursuing their intended career field; or, in extreme cases, c) cause students to leave the university. In addition to the impacts of meritocratic measures of success, research literature on how minoritized college students experience STEM education (Hurtado et al., 2012; Seymour & Hewitt, 1997; Carter et al., 2019; Liu, 2011) indicates that other institutional and sociocultural mechanisms may be relevant to the process of STEM pushout, such as racialized and excluding environments; a lack of representation and/or misrepresentation in the curriculum; and inflexible

and discriminatory disciplinary processes. This suggests that more research is needed to study the process of STEM pushout for minoritized students in higher education.

Conclusion

In her acclaimed 1994 book *Teaching to Transgress,* bell hooks claimed academia's biases "uphold and maintain" the lying and denial of oppressive social structures through the superficial recognition of cultural diversity that many academics see as a threat to their "authority." hooks asserts that truly embracing multiculturalism would require a "rethinking of ways of knowing, a deconstruction of old epistemologies, and the concomitant demand that there be a transformation in our classes, in how we teach and what we teach" (p. 30). Even though hooks' work was published 30 years ago, these same issues persist today. And while academia may acknowledge the existence of racism, sexism, classism, etc., academics do not necessarily see themselves and their teaching practices as a part of those continued injustices. In STEM, professors can cling to notions of meritocracy and objectivity as mechanisms of truth that bypass forms of injustice, instead of realizing that meritocracy in it of itself is a particular form of knowledge and way of understanding the world. By claiming that STEM disciplines are politically neutral, one can justify failure as due to an individual's deficiencies rather than structural prejudices. Yet, when looking at the picture as a whole and considering who is consistently underrepresented in STEM fields, it is hard to deny that the racist and sexist biases that run rampant in STEM.

Our data on HMoob students showed that STEM pushout contributes significantly to the underrepresentation of minoritized students in STEM. While there is considerable interest in the cultural and institutional factors that may encourage minoritized college students to persist in STEM programs (Museus et al., 2011; Lee et al., 2020), we assert that a comprehensive and critical theory of STEM pushout is needed to (a) identify the key factors that may be modified to counter pushout and (b) critique the larger social, cultural, and political contexts of U.S. higher education that obstruct needed institutional change. We aim to continue this investigation through our work and encourage our peers to delve into these critical issues.

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