Transformation in the U.S. Higher Education System: Implications for Racial Equity

Lindsey Malcom-Piqueux
October 2020

Table of Contents

Transformation in the U.S. Higher Education System:
Implications for Racial Equity

The Current State of Racial Equity in Higher Education

Racial inequity is endemic to the U.S. Higher Education system. Since the system's founding, through its expansion and evolution, racially minoritized (i.e., Black, Latinx, and Indigenous) populations have experienced disparities in postsecondary educational access, experiences, and outcomes. These enduring inequities can be traced back to our higher education system's origin story, including the exclusion of minoritized populations and the racialized distribution of educational opportunity in the centuries following the system's founding. Inequities in higher education participation and outcomes are among the numerous vestiges of *de jure* racial discrimination that permeated nearly every aspect of the nation's past.

Currently, educational attainment among racially minoritized populations remains lower than that of whites and Asians (U.S. Census Bureau, 2020). In 2019, 19% of the Latinx population aged 25 years or older and 26% of the Black population aged 25 years or older possessed a bachelor's degree or higher, compared to 40% of the white population and 58% of the Asian population in the same age group (U.S. Census Bureau, 2020). Though racially minoritized students are more likely to attend college than they have been in prior decades, they still experience inequitable access across the higher education system. Black and Latinx students who enroll in college are more likely to attend community colleges, broad-access four-year institutions, and for-profit institutions than highly selective, highly resourced institutions (e.g., research universities). In 2018, for example, 36% of Black undergraduates and 44% of Latinx undergraduates were enrolled in community colleges and private 2-year institutions compared to 31% of white undergraduates and 32% of Asian undergraduates (Snyder, de Brey, & Dillow, 2019). In the same year, 10% of Black undergraduates were enrolled in for-profit institutions compared to 4% of white students (Snyder, de Brey, & Dillow, 2019). Within research universities, this pattern is reversed; 15% of Black undergraduates and 17% of Latinx undergraduates were enrolled in research universities compared to 24% of white students and 35% of Asian students (Snyder, de Brey, & Dillow, 2019).

These patterns of stratification are striking, and not without consequence. The pathways to STEM through the institutions in which racially minoritized students are concentrated are narrower, and fraught with barriers to completion (National Academies of Science, Engineering, & Medicine [NASEM], 2016; National Research Council & National Academy of Engineering, 2012). For example, while community colleges play a critical role in the production of the nation's STEM workforce, STEM   students at community colleges are more likely to switch out of STEM and more likely to take developmental courses before beginning college-level courses, especially in mathematics (NASEM, 2016). Community college STEM students who transfer experience a longer time to bachelor's degree completion and are, on average, less likely to complete a STEM bachelor's degree than those students who directly enroll in a four-year institution (Van Noy & Zeidenberg, 2014; Wang, 2015). Though both community colleges and 4-year minority-serving institutions (MSIs) offer a high-quality college education to a broad range of students, they are under-resourced compared to highly selective institutions (e.g., research universities, liberal arts colleges) despite educating a significantly higher proportion of the nation's college students. Given the maldistribution of resources and the resulting differences in STEM degree program breadth and research infrastructure across postsecondary sectors and institutional types, the underrepresentation of

minoritized students in research universities and other highly selective institutions equates to a form of opportunity hoarding that reinforces existing racial inequities in educational attainment and within the STEM workforce.

Racial disparities in higher education extend far beyond access. Racially minoritized students experience significant inequities across a range of postsecondary outcomes including retention, persistence, and degree completion (American Council on Education, 2019; The Education Trust, n.d.; Witham et al., 2015). Black, Latinx, and Indigenous students are also severely underrepresented among those pursuing and earning postsecondary degrees in STEM fields. In 2017, for example, 14% of the college-aged population was Black; yet, just 10% of STEM associate degrees and 8% of STEM bachelor's degrees granted that year were awarded to African Americans (National Science Foundation [NSF], 2019). Similar patterns of inequitable representation also exist for Latinx and Indigenous populations. Though the share of science and engineering undergraduate degrees earned by racially minoritized groups has increased over the past several decades, disparities remain and are particularly stark within physics, mathematics, and certain engineering sub-fields (NSF, 2019). These equity gaps are even more severe when examining the representation of racially minoritized populations among STEM master's and doctoral degree earners.

Why Focus on Racial Equity in STEM?

Decades of research on the factors that contribute to the persistent underrepresentation of Blacks, Latinx, and Indigenous populations in STEM fields reveal a complicated picture. Barriers to racial equity in STEM are numerous and interconnected, operating at the individual, interpersonal, institutional, and societal levels (NASEM, 2016). Indeed, many have long argued for a systems approach to eliminating racial inequities within STEM fields (e.g., American Association for the Advancement of Science [AAAS], 2020; Fry, 2014; Matyas & Malcom, 1991; NASEM, 2016; Posselt, 2020). These scholars note that achieving equity in STEM will require transformational change that addresses the root causes of racial disparities in access and outcomes, including the purposeful exclusion of racially minoritized populations from the U.S. higher education system for the majority of its existence. Further, efforts to redress racial inequities in STEM must also contend with structural barriers including past and ongoing denial of economic, educational, and other forms of opportunity on the basis of race.

Though it is true that STEM education faces equity challenges beyond those experienced by racially minoritized students, the struggle to advance racial equity is unique. Socially-constructed racial hierarchies, and the distribution of rights and opportunity on the basis of these hierarchies, were an organizing principle for American society including the higher education system (Center for Urban Education [CUE], 2020; Mukhopadhyay, Henze, & Moses, 2007; Wilkerson, 2020). Racially minoritized populations are the only groups to have their exclusion from higher education codified in law and enforced by federal and state governments. Current enrollment data reveal that college attendance patterns remain highly stratified on the basis of race, despite the fact that racial discrimination has long been prohibited. An examination of a range of educational indicators reveals that the opportunity to acquire the preparation needed to pursue STEM fields in college are inequitably distributed on the basis of race (Malcom-Piqueux & Malcom, 2013). K-12 schools are more segregated now than they have been since

the landmark *Brown v. Board of Education* decision, and those schools that are majority Black and Latinx are more likely to be under-resourced and staffed by less experienced teachers, and less likely to offer advanced-level math and science coursework (Frankenberg, Ee, Ayscue, & Orfield, 2019). Given the deeply entrenched nature of racial disparities in higher education broadly and within STEM specifically, it is important to consider the challenge of racial equity in STEM within the historical conditions that created it. Racial inequities in STEM are not a natural disaster that befell the U.S.; they were created intentionally and justified by white supremacist beliefs that were the cornerstone of our nation (Anderson, 1988; Butchart, 1988; Hutcheson, 2020).

For decades, educators, policy experts, and leaders within science and engineering have advocated for the elimination of racial equity gaps in access to and success within STEM fields. Efforts to realize this goal have led to measurable but uneven progress in increasing access to STEM degrees, but equity gaps remain (NSF, 2019). Further, programmatic and policy interventions intended to advance racial equity in STEM have largely left the existing structures, culture, and practices that sustain inequities intact. Racial inequities persist because attempts to redress them have been unable to target the systemic nature of their origins on a large scale (Bensimon, 2006, 2018; Dowd & Bensimon, 2015; McNair, Bensimon, & Malcom-Piqueux, 2020). This type of large-scale, system-altering change has occurred within higher education in the past; however, it has never happened with the goal of creating racial equity. To understand the potential of transformational change to dramatically shift the state of racial equity in STEM, it is instructive to examine previous transformational moments within higher education that sought to expand access to higher education broadly, and, in some instances, STEM education specifically.

The purpose of this paper is to examine several transformative moments in the formation of the U.S. higher education system and in the expansion of STEM postsecondary education to understand their implications for racial equity. While these transformational moments may have led to increased participation in higher education among racially minoritized populations, racial inequities remained firmly in place. As we look to create a more equitable and inclusive higher education system and realize racial equity in STEM, a critical examination of the past can lead to better outcomes for students and society in the future.

Viewing Transformational Moments in U.S. Higher Education through a Critical Historical Lens

Historical accounts of the American higher education system highlight several key events that fueled its expansion and massification. The Morrill Acts, the G.I. Bill, the emergence of community and technical colleges, and the Higher Education Act are among those events credited with transforming the higher education system by increasing college access and institutional diversity (Thelin, 2011). While these events led to significant growth in overall college enrollment, the primary beneficiaries were white men, not racially minoritized groups (Hutcheson, 2020). Critical historians have long pointed out the need to complicate our understanding of these transformational moments in the higher education system's formation by centering their effects on historically excluded and marginalized groups (Alridge, 2015; Villaverde, Helyar, & Kincheloe, 2006). Applying this critical historical lens brings into focus the ways in

which these transformational events, celebrated in dominant narratives of the history of American higher education for expanding access, actually furthered racial inequality.

The Equity Quadrant Framework

To facilitate the critical examination of these transformational moments in higher education and to characterize their implications for racial equity, I will use an equity quadrant as an organizing framework and analytical tool (CUE, 2020). Modeled after the Center for Urban Education's (CUE, 2020) tools for developing equity-mindedness, the framework for the current analysis is a quadrant constructed from two dimensions: (1) policy intent and (2) racial logic. The first dimension, policy intent, refers to the intended effect of a particular policy or action on postsecondary opportunity for racially minoritized populations. A policy or action that was intended to limit opportunity and access would be classified as creating *exclusion*, while one that intended to expand opportunity and access would be described as creating *inclusion*.

The second dimension, racial logic, refers to the degree to which the specific policy or action is attentive to race and the racialized nature of society in which the policy is being implemented. *Race-conscious* policies or actions pay attention to the sociopolitical, historical, and cultural realities of race within the American context. *Race-neutral* policies or actions ignore race and the way in which it has served as an organizing aspect of U.S. society (CUE, 2020). It is important to note that being race-conscious can be either positive or negative (e.g., a racist is race-conscious, but is motivated by white supremacy). This equity quadrant is depicted in the figure below.

Figure 1. Equity Quadrant as an Organizing Framework
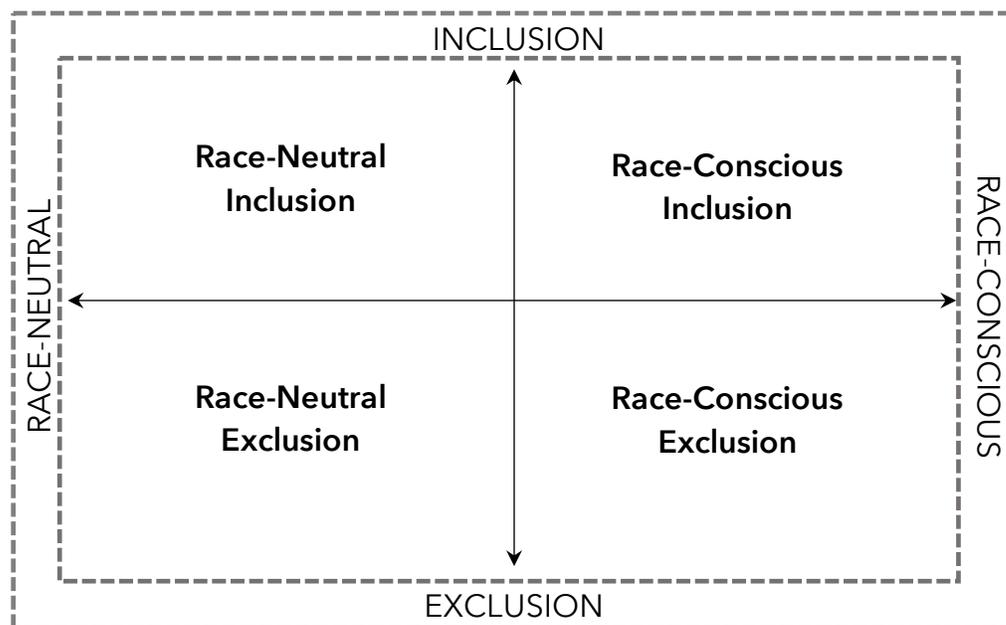
Modified from Center for Urban Education (2020).

While simple, the framework provides the means to characterize the extent to which various policies or governmental actions that led to transformations of the nation's higher education system were *equity-focused* (CUE, 2017; McNair, Bensimon & Malcom-Piqueux, 2020). Equity-focused policies or actions are inclusive and race-conscious—that is, they take active steps to eliminate disparities in educational access and outcomes for racially minoritized students while accounting for the ways in which racism has limited educational opportunity for these populations in the past. Affirmative action policies that considered race in admission decisions in order to remedy past racial discrimination serve as an example of an equity-focused policy in the history of higher education. Affirmative action was targeted to redress the inequities in access to highly selective institutions that Black, Latinx, and Indigenous populations experience. Though political backlash and legal challenges have caused a retreat from affirmative action, many studies have demonstrated that they were an effective tool for increasing racial equity (e.g., Garces, 2012, 2013; Hinrichs, 2012; Long & Bateman, 2020; Mickey-Pabello & Garces, 2018).

The equity quadrant framework illustrated in Figure 1 shows that there are multiple forms of policies and actions that are not equity-focused. A policy or action that leads to transformation in the higher education system might create *race-conscious exclusion*. Such a policy would pay attention to race but use it as the means to deny educational opportunity (e.g., segregation policies in higher education institutions). *Race-neutral inclusion* describes policies that sought to expand opportunity but using a universal, or one-size-fits-all approach. Federal financial aid policies and the G.I. Bill are examples of race-neutral inclusion. Policies that aim to create inclusion in a race-neutral manner reflect the perspective that 'a rising tide lifts all boats,' and often increase access for all groups while maintaining existing racial inequities. *Race-neutral exclusion* describes policies or actions that seek to limit the supply of or access to an opportunity without using race as an explicit means to do so. The heavy emphasis on meritocratic norms in college admissions (e.g., standardized test scores) is an example of race-neutral exclusion. In this example, seemingly neutral standards are used to exclude students from educational opportunity, rather than race. Research has shown us, however, that many of these "race-neutral" measures of merit are deeply flawed and result in the effective exclusion of racially minoritized populations (Anderson, 1993).

The organizing framework detailed above provides a tool to characterize the equity orientation of policies and practices that led to transformation within the U.S. higher education system. Examining both the intention of a higher education policy and the degree to which race was considered in policy development and implementation, provides helpful contextual information when trying to understand a transformational moment's implications for racial equity. In the following sections, I discuss three transformational moments in the history of American higher education and consider how each maintained or reduced racial inequality: (1) the Morrill Land-Grant Acts; (2) the G.I. Bill; and (3) the Space Race and the accompanying investment in science education. In accordance with the equity quadrant framework, I discuss how the policy intent and underlying racial logic of each transformational moment led to specific outcomes for racially minoritized groups.

These three transformative moments, along with many others, led to the persistent racial stratification in higher education that continues to structure educational opportunity for racially minoritized students pursuing STEM fields. Minority-serving institutions, community colleges, and for-profit institutions play a critical role in increasing racial equity in STEM for Black, Latinx, and Indigenous students. While each of these institutional types vary in the extent to which they are effective pathways to STEM degrees and

careers, it is instructive to examine whether and how equity-focused approaches employed within these institutional pathways might inform a vision for the future of undergraduate STEM education. Thus, following my discussion of the three transformational moments and their implications for racial equity, I briefly review what we know about the effectiveness of STEM education in minority-serving institutions, community colleges, and for-profit institutions to understand what ought to be preserved as we attempt to re-imagine STEM education as an equity-focused endeavor.

Transformative Moment 1: The Morrill Land-Grant College Acts

The Morrill Land-Grant Act of 1862 provided one of the first large-scale federal investments in the U.S. higher education system (Williams, 1991). The legislation led to the establishment of colleges and universities funded by the sale of public lands. In exchange for the resources used to create and develop these institutions, land-grant institutions would provide education and training in several areas aligned with federal priorities including military studies, agriculture, and mechanical arts (i.e., engineering). Thus, the first Morrill Act is one of the earliest examples of federal investment in higher education intended to fulfill a national need. Though it is true that the balance of the curricula between liberal arts and the aforementioned fields varied regionally, land-grant institutions aimed to make postsecondary training in practical areas accessible to greater numbers of the nation's population (Hutcheson, 2020). Because of these stated aims, land-grant institutions are referred to as "democracy's colleges" (Sorber & Geiger, 2014; Thelin, 2011). However, given that many populations were prohibited from attending land-grant institutions and that their very existence was made possible by the dispossession of Native lands, the term "democracy's colleges" is a bit of a misnomer (Lee & Ahtone, 2020; Nash, 2019; Stein, 2017). For racially minoritized populations, the Morrill Acts facilitated the continuation of racial segregation and intended to exclude these populations from equitable educational opportunity.

The first Morrill Act maintained the inequitable distribution of college opportunity that had been present since the founding of the first American higher education institutions, the colonial colleges. Early land-grant institutions primarily educated white men from middle-class and wealthy families (Hutcheson, 2020). Few women were admitted; when they were, it was often done under protest. African Americans were largely prohibited from attending land-grant institutions established under the first Morrill Act, with the exception of a small number of historically Black colleges or universities (HBCUs) (e.g., Prairie View A&M University) (Davis, 1933; Hutcheson, 2020). Perhaps the most glaring (and overlooked) way that the Morrill Act of 1862 furthered inequality was that its entire passage and implementation was predicated on widespread theft and dispossession of land from Native American tribes across the country. Land-grant institutions were financed by and, in most cases, physically constructed upon land that was seized through the processes of settler colonialism (Nash, 2019; Stein, 2017). Nash's (2019) historical analysis illustrates the direct link between the dispossession of tribal land through treaty, cession, or executive order and the founding of specific land grant universities west of the Mississippi River (e.g., University of California, University of Missouri, Iowa State University). Eastern states also benefitted from the sale of dispossessed Native land in the west, as revenues generated from the sales went to fund the creation of new land-grant colleges and universities, or the expansion of existing institutions who acquired the land-grant designation (Nash, 2019).

In 1890, the second Morrill Act was passed and provided additional funding to historically white land-grant institutions established under the first Morrill Act. Unlike the 1862 land-grant legislation, the Morrill Act of 1890 included a clause specifically related to the education of Blacks. To receive funds to establish land-grant institutions, states were required to either demonstrate that race was not used as an admissions criterion *or* create a separate (i.e., racially segregated) land-grant institution designated to educate Blacks (Davis, 1933). So, while the Morrill Act of 1890 expanded educational opportunity for African Americans by supporting the establishment of Black colleges, it did so while maintaining racial segregation in colleges and universities (Hutcheson, 2020). Though the second Morrill Act explicitly called for "equitable and just division" of funds used to establish racially segregated land-grant institutions, many states systematically underfunded Black institutions in practice (Wheatle, 2019). Despite the racial clause included in the second Morrill Act, the law lacked a mechanism to enforce it (Wheatle, 2019). As a result, states, and those in the South in particular, found ways to appear to be in compliance with the racial clause, when in actuality, they were not. For example, some states would admit Black students but then assign them to a particular branch of the institution that was underfunded and lacked the curricular breadth of the flagship institution (Wheatle, 2019). This practice would allow states to comply with the requirement that race not be considered in admissions, while simultaneously providing Blacks with a lesser education in a racially segregated environment (Hutcheson, 2020). Other states that opted to comply with the racial clause of the second Morrill Act by establishing separate land-grant institutions for Black students furthered inequity by allocating only a small fraction of the funds received to these institutions and the education of Black students (Hutcheson, 2020; Wheatle, 2019). Again, this practice allowed states to comply with the letter of the law while undermining the spirit.

The Morrill Land-Grant Acts transformed the U.S. higher education system by providing the resources for its westward expansion and the establishment of degree and training programs in applied sciences. Like many of the major legislative acts related to higher education that would follow, the federal government saw colleges and universities as the means to address a national need. Greater access to practical study at the postsecondary level was undoubtedly an outcome of this transformational moment in the history of higher education. However, as many critical historians have argued, the Morrill Acts did not democratize postsecondary education for everyone. White men were the primary beneficiaries, and Indigenous tribes across the nation were irreparably harmed by the coloniallist "land-grabs" that made the Morrill Act possible (Lee & Ahtone, 2020; Nash, 2019; Stein, 2017). Though the second Morrill Act's racial clause sought to ensure that freed Blacks and their descendants had access to higher education, the exclusion of a strong enforcement mechanism ensured that states could still receive federal funds while maintaining separate and unequal institutions (Wheatle, 2019).

Transformative Moment 2: The Servicemen's Readjustment Act of 1944 (G.I. Bill)

Like the Morrill Acts, the G.I. Bill is nearly universally cited as a transformative moment in U.S. higher education (Thelin, 2011). The G.I. Bill, officially titled the Servicemen's Readjustment Act of 1944, created educational and financial benefits intended to help WWII veterans adjust back into society without disrupting the economy with an excess labor supply (Olsen, 1974; Peeps, 1984; Thelin, 2011). The law provided unemployment benefits, guaranty for home, business, and farm loans, and opportunities

for training and education. Given this paper's focus on higher education, this discussion focuses primarily on the equity implications of the G.I. Bill's educational benefits.

The G.I. Bill's educational benefits provided to returning veterans fueled rapid growth in postsecondary enrollment, which was absorbed by a mix of state colleges and universities, junior colleges, vocational and trade schools, and to a lesser extent, so-called 'elite' institutions (Hutcheson, 2020; Olsen, 1974). The government provided these funds with the hope that WWII veterans would opt to further their education before returning to the workforce. The benefits made higher education accessible to a broader swath of individuals, and millions of veterans took advantage of the opportunity. In 1949, nearly half of all college students were veterans (Hutcheson, 2020). Because the expansion and segmentation of the U.S. higher education system was already underway when the G.I. Bill was enacted, the system as a whole was able to handle this surge in enrollment. A great deal of enrollment was absorbed by community colleges, which was identified by the subsequent Truman Commission report's as a critical access point for general education during the first two years of college (Hutcheson, 2007).

Though nothing in the wording of the G.I. Bill prohibited African American veterans from participating in its programs, the racist societal context in which the bill was implemented ensured the inequitable distribution of its benefits. Implementation of the G.I. Bill, in spite of aims to facilitate and even incentivize college attendance, was stained by the racism of the U.S. in the post-WWII environment. Indeed, Black beneficiaries of the G.I. Bill returned from racially segregated military units to their racially segregated home communities to be funneled into a racially segregated higher education system. With the financial costs of higher education no longer a deterrent to participation, discriminatory admission practices at historically white institutions, the push of Black veterans into vocational training programs, and the disproportionate rates of which Black veterans were denied the benefits to which they were entitled acted as barriers to postsecondary educational opportunity (Anderson, 1993; Croco & Waite, 2007; Hutcheson, 2020; Turner & Bound, 2003). An additional barrier came in the form of inadequate educational preparation for college due to the racially segregated and systematically underfunded Black elementary and secondary schools that Black veterans had attended prior to heading off to the war. Collectively, these factors led Black beneficiaries of the G.I. Bill to enroll in HBCUs in significant numbers (Anderson, 1993; Croco & Waite, 2007; Turner & Bound, 2003).

With 95% of Black G.I. Bill beneficiaries attending HBCUs, the number of African American men attending these institutions doubled between 1940 and 1950 (Croco & Waite, 2007; Turner & Bound, 2003). However due to the longstanding, purposeful underfunding of HBCUs, these institutions could not absorb the demand and had to turn away many Black veterans who were left with no other option. Further, many of the HBCUs in southern states were unaccredited due to institutionally racist accrediting practices (Hutchenson, 2020) which, in turn, limited HBCU graduates' ability to attend graduate or professional schools. Though the G.I. Bill is often characterized as a democratizing force within higher education, the reality is more complex. The post-war societal context, including overt racism, racial segregation, structural inequalities in schooling of Blacks, and the underfunding and de-valuing of HBCUs, had severe consequences for the policy outcomes of the bill[1] (Herbold, 1995). Though college

---

[1] Similar observations have been made about the economic provisions of the G.I. Bill, which actually widened racial wealth gap due to discriminatory housing and lending practices (Katznelson, 2005; Mullen & Darity, 2020).

access increased as a result of the G.I. Bill, the massification of higher education occurred in a way that more firmly entrenched racial stratification within higher education and furthered inequality.

Transformative Moment 3: The Space Race

Both the Morrill Act and the G.I. Bill are examples of the federal government's willingness to invest in higher education to advance the national interest. As described previously, these government actions transformed the nation's higher education system and their consequences remain apparent in the current postsecondary landscape. The governmental response to the launch of *Sputnik I* and the ensuing Space Race provides another example of how higher education, when used as a vehicle to advance national priorities, underwent significant transformation.

The 1957 launch of *Sputnik I* created a tremendous sense of urgency among the nation's leaders to strengthen U.S. scientific and technological capabilities. That the Soviet Union surpassed the U.S. in the race to launch an artificial satellite was seen as a failure of the higher education system, and of research universities in particular (Gibson, 2020; Douglass, 2000; Urban, 2010). Suddenly, increasing research and development activities within higher education and increasing the scientific and technical workforce were matters of national security. Policymakers realized that these goals could only be achieved through the improvement of science education at the elementary, secondary, and postsecondary levels and used multiple vehicles to do so (Gibson, 2020; Whissehr, Barrow, & Concannon, 2011).

The federal government relied on existing agencies and the passage of legislation to achieve its goals related to science research, education, and the workforce. Since its founding in 1950, the National Science Foundation (NSF) had been charged with supporting basic research and education in the sciences. As those goals became essential to maintaining the nation's global prominence and prevailing in the Cold War, Congress significantly increased NSF's budget given the agency's central role in science education and training efforts and supporting basic research (Gibson, 2020). On the legislative side, Congress passed the National Defense Education Act (NDEA) in 1958. The NDEA provided funds to states to strengthen science education by hiring teachers, supporting curriculum development in science, math, and foreign languages, equipping science labs in schools, and constructing facilities related to delivering science education (Gibson, 2020; Wissehr, Barrow, & Concannon, 2011). Federal actions taken to prevail in the Space Race provided significant resources for postsecondary science education and training; however, given the segregated context in which these actions took place, racially minoritized populations did not enjoy equitable access to the resulting improvements in higher education research infrastructure and science education.

Research universities were primary beneficiaries of the infusion of federal support to higher education in the post-*Sputnik* era. Between 1955 and 1965, federal R&D funding increased by 200% (Douglass, 2000; Urban, 2010). A relatively small number of research universities received the lion's share of federal support for R&D in science, engineering, and technology, exacerbating stratification within the U.S. higher education system. For example, in 1963, 20 universities received 80% of all federal R&D funds awarded to higher education institutions (Douglass, 2000). These universities that received the majority of federal research dollars were able to expand their research programs and strengthen their STEM research

facilities, equipment, and other infrastructure. The maldistribution of research dollars further advantaged these already resource-rich institutions, which enrolled small numbers of racially minoritized students. During this era, Black students were still heavily concentrated in HBCUs, few of which were able to compete for research funding awarded by NSF. While HBCUs and other schools that enrolled significant numbers of racially minoritized students were awarded training grants from NSF, the size of these awards were relatively small compared to research dollars (e.g., NSF, 1957, 1958, 1959).

Recognizing that research grants were primarily awarded to the nation's top research universities, NSF attempted to improve the quality of science education across the country through its teacher training institutes (Gibson, 2020). The institutes provided college, secondary school, and elementary school STEM teachers with instructional training to improve the quality of science education in their home institutions. Universities awarded institute grants would host the teachers on campus, providing a living-learning experience for participants. Though NSF wished to provide significant training to teachers in southern schools given the region's needs and the desire to provide access to quality science education to Blacks, ongoing racial segregation complicated these efforts (Gibson, 2020). Initially, foundation leaders required grantees to commit to integrating all aspects of the teacher training institutes due to their strong belief that training institutes would not be as effective for participants in a racially segregated setting. However, after being discouraged against continuing this practice by the Eisenhower administration, the NSF reversed its prior policy and began awarding training grants to segregated and integrated institutions alike (Gibson, 2020). Thus, while part of the NSF's response to the Space Race sought to prioritize aspects of racial equity, the social and political realities of American society forced the agency to set these priorities aside.

The NDEA also sought to ensure access to quality science education across the country. However, limitations of this legislation restricted its ability to reduce inequity. For example, though the NDEA provided federal aid to undergraduates, the aid came in the form of student loans, not scholarships as originally intended (Urban, 2010). Loans are a less desirable form of aid, particularly for individuals who might be risk averse due to uncertainty around their chances of completing a college degree or the likelihood of securing stable employment in an era where racial discrimination in hiring was rampant. Additionally, language in the NDEA about testing and guidance to identify potential students to participate in science, engineering, and technological education programs emphasized the "able" student using narrow definitions of merit rather than a standard of expanding opportunity (Urban, 2010).

The transformation of STEM education and research infrastructure in the post-*Sputnik* era was driven by the nation's need to regain its competitive edge in science and technology. Expanding access and enhancing quality were the primary policy goals, while racial equity was not a large consideration. Though there were efforts to hold onto equitable ideals by NSF, these attempts were foiled by the social and political context in which the Space Race took place.

Learning from the Present: What MSIs and Community Colleges Can Teach Us

The transformative moments discussed above, along with many others, shaped the formation and expansion of the U.S. higher education system. In the case of the Morrill Acts, the G.I. Bill, and the Space

Race, federal policy was used as a means to increase college enrollment and to establish new types of institutions that could advance the nation's priorities. As this examination demonstrates, racial inequality was often exacerbated by large-scale policy efforts due to their policy intent, racial logic, and the societal conditions in which each was implemented. Even when policies were crafted to increase access, a failure to prioritize racial equity or consider the racialized conditions of implementation ensured that inequities in access would persist. The cumulative result is what we have always observed and what persists today: severe racial stratification within American higher education.

Given their deeply entrenched nature, overcoming racial inequities in undergraduate STEM education will require systemic change and equity-focused approaches that aim to create inclusion while disrupting the policies, practices and norms that sustain racial disparities within STEM. Fortunately, some institutions and programmatic interventions offer guidance on what equity-focused undergraduate STEM education might entail. Many MSIs and community colleges, for example, have been able to remove common barriers on the pathway to STEM credentials and careers for racially minoritized students, as evidenced by the disproportionately high share of Black, Latinx, and Indigenous STEM degree earners educated by these institutions. Though these institutions continue to face significant challenges related to their role as STEM pathways for racially minoritized students (NASEM, 2019), examining their contributions provides valuable lessons to inform the future of undergraduate STEM education.

Mission-Based Minority-Serving Institutions

Founded with the express purpose of educating African Americans, HBCUs were the primary educational pathway available to Black students with college aspirations for well over a century. HBCUs continued to education the majority of Black undergraduates until the late 1970s (Anderson, 2002; Hill, 1984). Though the proportion of Black college students enrolled in HBCUs has declined in the post-*Brown* era, they continue to produce a disproportionate share of Black STEM bachelor's degree earners and are also among the top baccalaureate origin institutions of Black STEM doctorate earners (NSF, 2019). HBCUs consistently achieve these outcomes despite being underfunded, less selective, and enrolling more low-income and first-generation students than many historically white institutions (NASEM, 2019). In fact, after controlling for relevant student characteristics, Black students at HBCUs who aspire to earn a STEM degree are more likely to complete a STEM degree than their counterparts at historically white institutions (Eagan et al., 2014). The success of HBCUs has been attributed to many factors including their inclusive environments, supportive campus cultures, academic support structures, close student-faculty relationships, and strong mission orientation among faculty (Allen, Epps, & Haniff, 1991; Fries-Britt & Turner, 2002; NASEM, 2019).

Like HBCUs, Tribal Colleges were founded for the express purpose of educating Indigenous students, many of whom reside in geographically isolated areas (American Indian Higher Education Consortium [AIHEC], 1999; Brown, 2003; Warner & Gipp, 2009). The first Tribal College was founded in 1968, and more than 30 others were chartered by tribes over the next 30 years. These institutions were created to ensure that Indigenous students would have access to higher education opportunity. Historically white institutions had not succeeded in providing adequate access to Native students and were largely unresponsive to this population's educational needs (Martin, 2005). At Tribal Colleges, curricula are

informed by and reflect the cultures and languages of the communities that they serve, and instructional and assessment practices employ culturally relevant approaches (Martin, 2005; Ortiz & Boyer, 2003; Parker & Cunningham, 1998). Tribal Colleges possess a much higher proportion of Indigenous faculty than historically white institutions (AIHEC, 1999; Pavel, Inglebret, & Banks, 2001). The contributions of Tribal Colleges to the educational attainment of the nation's Indigenous populations are evident from their institutional outcomes. Six of the top 20 institutions awarding STEM-related associate degrees to American Indians and Alaska Natives between 2012-16 were Tribal Colleges (NSF, 2019). Additionally, the educational approaches used within Tribal Colleges are among those demonstrated to facilitate student success in STEM (AIHEC, n.d.).

Despite their varying origin stories, HBCUs and Tribal Colleges are effective vehicles to increase educational equity for their target populations. Though the vast majority of HBCUs and Tribal Colleges lack the research infrastructure present in larger universities, they have been successful in building the environment necessary to promote student success in STEM. For HBCUs and Tribal Colleges, their mission is often integral to their institutional identity and shapes institutional culture, policies, and practices in highly intentional ways (Gasman, Nguyen, & Conrad, 2015; NASEM, 2019). Though there are multiple factors to which the success of HBCUs and Tribal College in providing STEM education and workforce preparation can be attributed, the culturally responsive, inclusive educational approaches and supportive institutional cultures warrant close attention. These strategies provide a model of how equity-focused (i.e., race-conscious and inclusive) practices can yield successful outcomes for racially minoritized groups.

Enrollment-Based Minority-Serving Institutions

In contrast to HBCUs and Tribal Colleges, the vast majority of Hispanic-Serving Institutions (HSIs) were not founded with the express mission of educating Latinx students (Garcia, 2019; Laden, 2004). Instead, the designation is based on enrollment (i.e., at least 25% of undergraduate FTE must be Latinx) and is granted by the U.S. Department of Education (ED). Latinx college students are concentrated in HSIs, nearly half of which are two-year institutions. Many Latinx students at HSIs continue to experience equity gaps in terms of retention, degree completion, and granting degrees in high-demand fields of study (e.g., STEM). There is a great deal of diversity among HSIs, and studies of the institutional cultures and educational practices at these institutions have shown that some are slow to incorporate the 'Hispanic-Serving' label into their mission and adapt to their changing student populations (Garcia, 2019; Garcia & Okhido, 2015; Marin, 2019). HSIs can be designated as such without making an explicit commitment to educating Latinx students (Gasman, Nguyen, & Conrad, 2015). Some HSIs are very successful in preparing significant proportions of Latinx STEM degree holders; however, at others, Latinx students remain underrepresented in these fields. While HSIs have reduced inequality for Latinx students in many respects, the potential of HSIs to advance racial equity in STEM has yet to be fully realized (NASEM, 2019).

Asian American and Native American Pacific Islander Serving Institutions (AANAPISIs) are also designated based on enrollment criteria. Institutions at which at least 10% of the undergraduate enrollment is Asian American and Native American Pacific Islander students and at which at least 50% of

all degree-seeking students are low-income are eligible to apply for AANAPISI grants from ED (Teranishi, 2011). More than half of AANAPISIs are community colleges and serve high concentrations of low-income Asian American and Native American Pacific Islander (AAPI) students. These institutions award nearly half of associate degrees earned by AAPI students. Given the relatively recent emergence of the AANAPISI designation, researchers are still beginning to understand what educational approaches these institutions take to meet the mission implied by the designation (Gasman, Nguyen, & Conrad, 2015; Park & Teranishi, 2008; Teranishi et al. 2014). Studies of how AANAPISIs have utilized federal funds through the ED grant program suggest that these institutions concentrate on creating academic and student support services and improving the efficacy of developmental education at their institutions (National Commission on AAPI Research in Education, 2013; Teranishi, Alcantar, Martin, & Nguyen, 2015).

As enrollment-based minority-serving institutions, HSIs and AANAPISIs have had to evolve their practices to meet the needs of a demographically changing student population. Institutions have followed differing trajectories in response to their MSI designation, and researchers continue to document these institutional responses by way of conducting in-depth studies to determine which approaches are effective in what contexts, and why. HSIs and AANAPISIs can provide models of how to spur the institutional change required to adequately respond when an institution's mission and students' needs evolve. As we think about what equity-focused transformation in undergraduate STEM education might look like, the responsiveness and willingness to adapt to better serve racially minoritized students are worth emulating.

De-Facto Minority-Serving Institutions

Given the rates at which racially minoritized students enroll at community colleges and for-profit institutions, these higher education sectors can be described as *de facto* minority-serving (Malcom-Piqueux, 2018). As with the institutional types discussed above, the concentration of racially minoritized students within community colleges and for-profit institutions is not happenstance. Rather, this racial stratification within higher education is a consequence of specific policy decisions and the sociohistorical context in which these institutions developed.

The comprehensive community college of today resulted from the union of technical colleges, which emphasized vocational education and preparation for the workforce, and junior colleges that originally had a more academic focus (Brint & Karabel, 1989). The Truman Commission Report's (President's Commission on Higher Education, 1947) recommendation to create an expansive network of low-cost, accessible, community-focused institutions in order to extend educational opportunity to a broader swath of the population cemented the crucial role that community colleges continue to play in the American higher education landscape. Due in part to the educational benefits available through the G.I. Bill, enrollment in junior colleges accelerated in the mid-20th century (Hutcheson, 2007). These institutions renamed themselves community colleges and vocationalized the curriculum to respond to the demand for practical and workforce training while also maintaining academic programs (Brint & Karabel, 1989). Given their open-access mission, lower costs, and geographical accessibility, community colleges have been the primary access point for students seeking career preparation as well as students who have bachelor's degree aspirations but require additional academic preparation before beginning college-level work. As four-year institutions reduced their developmental course offerings and further restricted

admissions in response to criticism from policymakers (e.g., *A Nation at Risk*, 1983), community colleges minded this gap by educating an increasingly racially and socioeconomically diverse group of students (Cohen, Brawer, & Kisker, 2014; Gilbert & Heller, 2013).

Currently, 44% of Latinx undergraduates and 36% of Black undergraduates attend community colleges (Snyder, de Brey, & Dillow, 2019). Thus, the potential for community colleges to advance equity in educational and economic attainment of racially minorized populations is great. To some extent, community colleges have been fulfilling this potential. However, examinations of student outcome data reveal that racial inequities in retention, completion rates, and transfer rates to 4-year institutions persist. Due in large part to the structural inequalities in K-12 schooling, racially minoritized students in the community college sector are more likely to be placed into developmental education courses (math in particular), less likely to transition to college-level math, and less likely to attain a credential from a community college than white students (Bailey, Jeong, & Cho, 2010; Mejia, Rodriguez, & Johnson, 2016; Porchea, Allen, Robbins, & Phelps, 2010; Turk, 2017). A number of national initiatives have been put in place to improve completion rates at community colleges, but these have been neither race-conscious, nor have they centered the goal of achieving racial equity in outcomes (Bensimon, 2017).

Despite these challenges, community colleges are a critical component of any effort to increase racial equity in STEM fields. The existence of STEM occupational programs and STEM academic programs within community colleges provide multiple paths to the STEM workforce for racially minoritized students (NASEM, 2016; National Research Council & National Academy of Engineering, 2012; Van Noy & Zeidenberg, 2014). These pathways, particularly those that emphasize workforce preparation, have been constructed in consultation with external partners (e.g., business and industry, local employers, four-year institutions) so that the education and training that students receive within the community college is relevant to their goals, careers, and lives. The growing emphasis on transfer pathways from the community college to STEM bachelor's degree programs has highlighted the need for strong articulation agreements and curricular alignment. Though articulation and alignment are critical to facilitating vertical transfer to any bachelor's degree program, these considerations are even more important in STEM fields given the sequential nature of undergraduate STEM curricula (NASEM, 2016). Recognizing the need to provide support to students as they navigate and make informed choices about credential programs and transfer, community colleges have begun to adopt innovations like guided pathways and accelerated developmental education programs—structural and curricular reforms that are not prevalent in four-year institutions. The willingness among community colleges to examine institutional structures and curricula in order to improve student success is noteworthy as we consider what transformation of undergraduate STEM education ought to entail. However, in order to be *equity-focused*, structural or curricular reform efforts must include a critical examination of how race and racism affect how existing and proposed structures, policies and practices serve (or fail to serve) racially minoritized students.

Like community colleges, the for-profit sector of higher education enrolls a disproportionate share of racially minoritized college students. Enrollment rates in for-profit institutions are highest among African Americans (Snyder, de Brey, & Dillow, 2019). For-profit institutions have been viewed with skepticism due to what some describe as predatory recruitment and marketing practices (Deming, Goldin & Katz, 2012). Though there is a great deal of intra-sector diversity among for-profit institutions, on average, students enrolled in these institutions, particularly Black and Latinx students, experience poor degree and

labor market outcomes (Lang & Weinstein, 2012; Lynch, Engle & Cruz, 2012). Students in for-profit institutions are more likely to accrue student loan debt and more likely to default on those loans than their counterparts at other institutions (Armona, Chakrabarti, & Lovenheim, 2017; Hillman, 2014; Kelchen & Li, 2017). For-profit institutions do award significant numbers of credentials in the health-related fields, engineering technology, and computer and information sciences, with 70 percent of these being sub-baccalaureate degrees and certificates (Kinser, 2014). While some structural aspects of for-profit institutions facilitate access (e.g., geographical concentration in urban and suburban population centers, widespread use of online education and other innovative instructional models, credential programs aligned with labor market needs), other characteristics of the for-profit sector (e.g., lack of transfer pathways to non-profit four-year institutions, low completion rates, high tuition-high debt model) have the potential to undercut their ability to serve as vehicles for racial equity within STEM and beyond.

Despite the rightful trepidation with which some may approach a for-profit institutional pathway to the STEM workforce, their willingness to engage adult learners and other populations underserved by higher education by offering online education and certificates with immediate value in the labor market are of note. However, transforming undergraduate STEM education in an equity-focused manner would necessitate that for-profit institutions reform practices that may have a disproportionately negative impact on racially minoritized students.

Envisioning Equity-Focused Transformation in STEM Undergraduate Education

Racial inequity is an architectural element of American higher education. As I argue in this paper, widely recognized transformative moments that fueled the expansion and segmentation of the higher education system also increased racial inequality. In some instances, the denial of equal opportunity on the basis of race was explicit in the policy actions that transformed the system (e.g., Morrill Acts). Even when a policy purported to be a race-neutral mechanism to increase educational access broadly (e.g., G.I. Bill) or within STEM fields specifically (e.g., federal investments in science education during the Space Race), the societal context in which these transformative moments occurred constrain their effectiveness in advancing racial equity. The failure to prioritize racial equity during these transformational moments resulted in the severe racial stratification within the higher education system that remains apparent today.

With racially minoritized students concentrated in minority-serving institutions, community colleges, and for-profit institutions, these institutions are considerably important to current efforts to reduce inequality. The level of commitment with which these institutions engage, support, and respond to racially minoritized students' needs have profound implications on their ability to advance equity through higher education practice. Institutions that have been effective in promoting minoritized student success and reducing racial inequalities in outcomes employ equity-focused policies and practices (CUE, 2017). Equity-focused policies and practices center the need to eliminate the persistent disparities in educational access and outcomes experienced by racially minoritized populations. Equity-focused policies and practices are attentive to systemic racism and its relationship to the structural barriers at the root of existing inequalities (CUE, 2017; Malcom-Piqueux & Bensimon, 2017). Being equity-focused involves interrogating existing policies and practices to understand why they are not serving racially minoritized students well, rather than attributing failures of policy and practice to the deficits of students (Bensimon,

2006, 2017; Dowd & Bensimon, 2015; McNair, Bensimon, & Malcom-Piqueux, 2020). Finally, equity-focused policies and practices use minoritized student success and the elimination of racial inequities as the primary standards against which their effectiveness is measured.

Given the equity challenges that persist within it, it is clear that the entirety of the nation's undergraduate STEM education system is in need of transformation. Though offering a specific vision of what undergraduate STEM education might look like in 2040 is beyond the scope of this paper, adhering to the following principles can help to ensure that the coming transformation maintains an equity focus.

- *Maintaining an equity focus requires **being race-conscious.*** As I have argued throughout this paper, race, though socially constructed, remains a social reality for minoritized populations. Racism continues to structure educational opportunity for Black, Latinx, and Indigenous students from early childhood education through college. Ignoring race and the racialized nature of society does not remove the many barriers erected by racism. Instead, doing so inhibits our ability to critically reflect on existing policies and practices that may have a disproportionately negative impact on Black, Latinx, and Indigenous students.

- *Maintaining an equity focus requires **reconsidering traditional measures of merit.*** Though deeply embedded in the culture of STEM fields, the belief that opportunity is distributed on the basis of merit alone is problematic when the measures of merit are flawed and institutionally racist. For example, the stated reasons for relying on standardized tests in admissions decisions or for only looking to a small group of top institutions when recruiting prospective students or faculty in STEM might be to identify "best" candidates, but the end result is the further exclusion of minoritized populations from programs and institutions in which they are capable of succeeding. Developing new, more equitable ways of identifying talent and potential is necessary to ensuring racial equity. Taking such steps is not about lowering standards; rather, it is about questioning how and why routine practices in admissions and hiring result in the reproduction of existing racial inequities.

- *Maintaining an equity focus requires **adopting racial equity as a primary measure of success.*** At first glance, the transformational moments discussed in this paper seem to have been successful. The land-grant institutions born of the Morrill Act continue to exist today, millions of students are enrolled in the nation's colleges and universities, and research universities continue to be centers of STEM research and innovation. When using racial equity as a measure of success, however, it is evident that these transformational moments and the subsequent events in higher education have fallen short. Establishing racial equity as a central goal of a transformed undergraduate STEM education system and using it as a primary measure of system, institutional, and program effectiveness ensures that policies and practices that are counterproductive to achieving equity are quickly identified and remediated.

Transforming undergraduate STEM education requires that we think beyond what currently exists and reimagine what is possible (Malcom, 2020). As we engage in that collaborative process it is critical that we be equity-focused so that history does not repeat itself.

References

Allen, W. R., Epps, E. G., & Haniff, N. Z. (1991). *College in Black and White: African American students in predominantly White and in historically Black public universities*. SUNY Press.

Alridge, D. P. (2015). The ideas and craft of the critical historian of education. In A. M. Martinez-Aleman, B. Pusser, & E. M. Bensimon (Eds.), *Critical approaches to the student of higher education: A practical introduction* (pp. 103-129). Johns Hopkins University Press.

American Association for the Advancement of Science. (2020). *Sea Change: Guiding principles*. https://seachange.aaas.org/about/principles

American Indian Higher Education Consortium. (n.d.). *Living science: Strengthening and sharing Native knowledge at TCUs.* http://www.aihec.org/our-stories/docs/reports/stem-livingscience.pdf

American Indian Higher Education Consortium. (1999). *Tribal colleges: An introduction.* http://www.aihec.org/who-we-serve/docs/TCU_intro.pdf

Anderson, J. D. (1988). *The education of blacks in the South, 1860-1935*. University of North Carolina Press.

Anderson, J. D. (1993). Race. Meritocracy and the American academy during the immediate post-World War II era. *History of Education Quarterly, 33*(2), 151-175.

Anderson, J. D. (2002). Race in American higher education: Historical perspective on current conditions. In W. A. Smith, P. G. Altbach & K. Lomotey (Eds.), *The racial crisis in American higher education: Continuing challenges for the twenty-first century* (pp. 3-21). SUNY Press.

Armona, L., Chakrabarti, R., & Lovenheim, M. (2020). *Student debt and default: The role of for-profit colleges*. Federal Reserve Bank of New York Staff Report No. 811. Available at SSRN: https://ssrn.com/abstract=2958120

Bailey, T., Jeong, D. W., & Cho, S. W. (2010). Referral, enrollment, and completion in developmental education sequences in community colleges. *Economics of Education Review*, *29*(2), 255-270.

Bensimon, E. M. (2006). Learning equity-mindedness: Equality in educational outcomes. *The Academic Workplace, 1*(17), 2-21.

Bensimon, E. M. (2017). *Making American higher education just* [AERA Social Justice Award Recipient Lecture]. Center for Urban Education, Rossier School of Education, University of Southern California. https://cue.usc.edu/files/2017/06/Bensimon_Making-American-Higher-Education-Just_AERA-SJ-Award-Lecture.pdf

Bensimon, E. M. (2018). Reclaiming racial justice in equity. *Change: The Magazine of Higher Learning*, *50*(3), 95-98. https://doi.org/10.1080/00091383.2018.1509623

Brint, S., & Karabel, J. (1989). *The diverted dream: Community colleges and the promise of educational opportunity in America, 1900-1985*. Oxford University Press.

Brown, D. (2003). Tribal Colleges: Playing a key role in the transition from secondary to postsecondary education for American Indian students. *Journal of American Indian Education*, *42*(1), 36-44.

Butchart, R. (1988). "Outthinking and outflanking the owners of the world": A historiography of the African American struggle for education. *History of Education Quarterly, 28*(3), 333-66.

Center for Urban Education. (2017). *Improving postsecondary attainment: Overcoming common challenges to an equity agenda in state policy*. Rossier School of Education, University of Southern California. https://cue.usc.edu/files/2017/02/Overcoming-Challenges_Final_Online.pdf

Center for Urban Education. (2020). *Laying the groundwork: Concepts and activities for racial equity work*. Rossier School of Education, University of Southern California. https://www.cue-tools.usc.edu/s/Concepts-and-Tools-for-Racial-Equity-Work_Summer2020.pdf

Cohen, A. M., Brawer, F. B., & Kisker, C. B. (2014). *The American community college*. Jossey-Bass.

Croco, M. S. & Waite, C. L. (2007). Education and marginality: Race and gender in higher education: 1940-1955. *History of Education Quarterly*, *47*(1), 69-91.

Darity Jr., W. A., & Mullen, A. K. (2020). *From here to equality: Reparations for Black Americans in the twenty-first century*. University of North Carolina Press Books.

Davis, J. W. (1933). The Negro land-grant college. *Journal of Negro Education*, *2*(3), 312-328.

Deming, D. L., Goldin, C., & Katz, L. F. (2012). The for-profit postsecondary school sector: Nimble critters or agile predators? *Journal of Economic Perspectives*, *26*(1), 139–164.

Douglass, J.A. (2000). A certain future: Sputnik, American higher education, and the survival of a nation. In R. D. Lanius, J. M. Logsdon, & R. W. Smith (Eds.), *Reconsidering Sputnik: Forty years since the Soviet satellite* (pp. 327-363). Routledge.

Dowd, A. C. & Bensimon, E. M. (2015). *Engaging the "race question": Accountability and equity in U.S. higher education*. Teachers College Press.

Eagan, K., Hurtado, S., Figueroa, T., & Hughes, B. (2014). *Examining STEM pathways among students who begin college at four-year institutions*. Commissioned paper prepared for the Committee on Barriers and Opportunities in Completing 2-Year and 4-Year STEM Degrees, National Academy of Sciences. https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_088834.pdf

Frankenberg, E., Ee, J., Ayscue, J. B., & Orfield, G. (2019). *Harming our common future: America's segregated schools 65 years after Brown*. UCLA Civil Rights Project, University of California, Los Angeles. https://www.civilrightsproject.ucla.edu/research/k-12-education/integration-and-diversity/harming-our-common-future-americas-segregated-schools-65-years-after-brown/Brown-65-050919v4-final.pdf

Fries-Britt, S. & Turner, B. (2002). Uneven stories: Successful Black collegians at a Black and a White campus. *Review of Higher Education*, *25*(3), 315-330. https://doi.org/10.1353/rhe.2002.0012

Fry, C. L. (Ed.). (2014). *Achieving systemic change: A sourcebook for advancing and funding undergraduate STEM education*. Association of American Colleges and Universities.

Garces, L.M. (2012). Racial diversity, legitimacy, and the citizenry: The impact of affirmative action bans on graduate school enrollment. *The Review of Higher Education 36*(1), 93-132.

Garces, L. M. (2013). Understanding the impact of affirmative action bans in different graduate fields of study. *American Educational Research Journal*, *50*(2), 251-284.

Garcia, G. (2019). *Becoming Hispanic-serving institutions: Opportunities for colleges and universities*. Johns Hopkins University Press.

Garcia, G. A., & Okhidoi, O. (2015). Culturally relevant practices that "serve" students at a Hispanic Serving Institution. *Innovative Higher Education*, 40, 345-357.

Gasman, M., Nguyen, T. H., & Conrad, C. F. (2015). Lives intertwined: A primer on the history and emergence of minority serving institutions. *Journal of Diversity in Higher Education*, *8*(2), 120-138. https://doi.org/10.1037/a0038386

Gibson, E. K. (2020). Strengthening scientific manpower: The National Science Foundation's postwar science education programs and the limitations of federal desegregation policy. *Federal History Journal*, *12*, 53-74.

Gilbert, C. K., & Heller, D. E. (2013). Access, equity, and community colleges: The Truman Commission and federal higher education policy from 1947 to 2011. *The Journal of Higher Education, 84*(3), 417-443. doi:10.1353/jhe.2013.0019

Herbold, H. (1995). Never a level playing field: Blacks and the GI Bill. *The Journal of Blacks in Higher Education*, *6*, 104–108.

Hill, S. T. (1984). *The traditionally Black institutions of higher education: 1862 to 1982* (NCES 84-308X). National Center for Education Statistics, U.S. Department of Education.

Hillman, N. W. (2014). College on credit: A multilevel analysis of student loan default. *The Review of Higher Education*, *37*(2), 169-195. https://doi.org/10.1353/rhe.2014.0011

Hinrichs, P. (2012). The effects of affirmative action bans on college enrollment, educational attainment, and the demographic composition of universities. *Review of Economics and Statistics*, *94*(3), 712-722.

Hutcheson, P. A. (2007, Fall). The Truman Commission's vision of the future. *Thought & Action*, *23*, 107-115.

Hutcheson, P. A. (2020). *A people's history of American higher education*. Routledge.

Katznelson, I. (2005). *When affirmative action was white: An untold history of racial inequality in twentieth-century America*. W.W. Norton & Company.

Kelchen, R. & Li, A. Y. (2017). Institutional accountability: A comparison of the predictors of student loan repayment and default rates. *The ANNALS of the American Academic of Political and Social Science*, *671*(1), 202-223. https://doi.org/10.1177/0002716217701681

Kinser, K. (2014). *For-profit pathways into STEM*. Commission paper prepared for the Committee on Barriers and Opportunities in Completing 2-Year and 4-Year STEM Degrees, National Academy of Sciences. https://sites.nationalacademies.org/cs/groups/dbassesite/documents/webpage/dbasse_088833.pdf

Laden, B. V. (2004). Hispanic-serving institutions: What are they? Where are they? *Community College Journal of Research and Practice*, *28*(3), 181-198. https://doi.org/10.1080/10668920490256381

Lang, K. & Weinstein, R. (2012). Evaluating student outcomes at for-profit colleges. NBER Working Paper No. 18201. National Bureau of Economic Research. https://www.nber.org/papers/w18201

Lee, R., & Ahtone, T. (2020, March 30). Land-grab universities: Expropriated Indigenous land is the foundation of the land-grant system. *High Country News*. https://www.hcn.org/issues/52.4/indigenous-affairs-education-land-grab-universities

Long, M.C. & Bateman, N.A. (2020). Long-run changes in underrepresentation after affirmative action bans in public universities. *Educational Evaluation and Policy Analysis*, *42*(2), 188-207.

Lynch, M., Engle, J., & Cruz, J. L. (2012). *Subprime opportunity: The unfulfilled promise of for-profit colleges and universities*. The Education Trust. https://edtrust.org/resource/subprime-opportunity-the-unfulfilled-promise-of-for-profit-colleges-and-universities/

Malcom, S. M. (2020). Reimagining colleges and universities to make them more equitable. *Scientific American*. https://www.scientificamerican.com/article/reimagining-colleges-and-universities-to-make-them-more-equitable/

Malcom-Piqueux, L. E. (2018). Student diversity in community colleges: Examining trends and understanding the equity challenge. In S. Kater & J. Levin (Eds.), *Understanding community colleges* (2nd edition) (pp. 37-58). Routledge.

Malcom-Piqueux, L. E., & Bensimon, E. M. (2017). Taking Equity-Minded Action to Close Equity Gaps, *Peer Review, 19*(2), 5-8.

Malcom-Piqueux, L. E., & Malcom, S. M. (2013). Engineering diversity: Fixing the educational system to promote equity. *The Bridge*, *43*(1), 24–34.

Marin, P. (2019). Is "business as usual" enough to be Hispanic-serving? Becoming a Hispanic-serving research institution. *Journal of Hispanic Higher Education*, *18*(2), 165-181.

Martin, R. G. (2005). Serving American Indian students in Tribal Colleges: Lessons for mainstream colleges. *New Directors for Student Services, 109*, 79-86.

Matyas, M. L. & Malcom, S. M. (1991). *Investing in human potential: Science and engineering at the crossroads*. American Association for the Advancement of Science. https://www.aaas.org/sites/default/files/s3fs-public/reports/Investing%2520in%2520Human%2520Potential_Science%2520and%2520Engineering%2520at%2520the%2520Crossroads%25201.pdf

McNair, T., Bensimon, E. M., & Malcom-Piqueux, L. E. (2020). *From equity walk to equity talk: Expanding practitioner knowledge for racial justice in higher education.* Jossey-Bass.

Mejia, M. C., Rodriguez, O., & Johnson, H. (2016). *Preparing students for success in California's community colleges*. Public Policy Institute of California. https://www.ppic.org/content/pubs/report/R_1116MMR.pdf

Mickey-Pabello, D. & Garces, L. M. (2018). Addressing racial health inequities: Understanding the impact of affirmative action bans on applications and admissions in medical schools. *American Journal of Education*, *125*(1), 79-108.

Mukhopadhyay, C. C., Henze, R., & Moses, Y. T. (2007). Race and inequality: Race as a social invention to achieve certain goals (pp. 119-143). *How real is race? A sourcebook on race, culture, and biology*. Rowman & Littlefield.

Nash, M. A. (2019). Entangled pasts: Land-grant colleges and American Indian dispossession. *History of Education Quarterly, 59*(4), 437-467. doi:10.1017/heq.2019.31

National Academies of Science, Engineering, and Medicine. (2016). *Barriers and opportunities for 2-year and 4-year STEM degrees: Systemic change to support students' diverse pathways*. The National Academies Press. https://doi.org/10.17226/21739

National Academies of Science, Engineering, and Medicine. (2019). *Minority serving institutions: America's underutilized resource for strengthening the STEM workforce*. The National Academies Press. https://doi.org/10.17226/25257

National Commission on AAPI Research in Education (2013). *Partnership for equity in education through research (PEER): Findings from the first year of research on AANAPISIs*. http://care.gseis.ucla.edu/wp-content/uploads/2015/08/2013_CARE_Report.pdf

National Research Council and National Academy of Engineering. (2012). *Community colleges in the evolving STEM education landscape: Summary of a summit*. The National Academies Press. https://doi.org/10.17226/13399

National Science Foundation. (1957). *The seventh annual report of the National Science Foundation*. https://www.nsf.gov/pubs/1957/annualreports/ar_1957.pdf

National Science Foundation. (1958). *The eighth annual report of the National Science Foundation*. https://www.nsf.gov/pubs/1958/annualreports/ar_1958.pdf

National Science Foundation. (1959). *The ninth annual report of the National Science Foundation*. https://www.nsf.gov/pubs/1959/annualreports/ar_1959.pdf

National Science Foundation. (2019). *Women, minorities, and persons with disabilities in science and engineering: 2019* (NSF 19-304). National Center for Science and Engineering Statistics, National Science Foundation. https://www.nsf.gov/statistics/wmpd

Olson, K. (1974). *The GI Bill, the veterans and the colleges*. The University Press of Kentucky.

Ortiz, A. M., Boyer, P. (2003). Student assessment in Tribal colleges. *New Directions for Institutional Research*, *118*, 41-49.

Park, J. J., & Teranishi, R. T. (2008). Asian American and Pacific Islander serving institutions: Historical perspectives and future prospects. In M. Gasman, Baez, B., & Turner, C. S. V. (Ed.), *Understanding minority-serving institutions* (pp. 111-126): SUNY Press.

Parker, C., & Cunningham, A.F. (1998). Tribal colleges as community institutions and resources. *New Directions for Higher Education*, *102*, 45-56.

Pavel, D. M., Inglebret, E., Banks, S. R. (2001). Tribal colleges and universities in an era of dynamic development. *Peabody Journal of Education*, *76*(1), 50-72. https://doi.org/10.1207/S15327930PJE7601_04

Peeps, J.M.S. (1984). A B.A. for the G.I.…why? *History of Education Quarterly*, *24*(4), 513-525.

Porchea, S. F., Allen, J., Robbins, S., & Phelps, R. P. (2010). Predictors of long-term enrollment and degree outcomes for community college students: Integrating academic, psychosocial, socio-demographic, and situational factors. *The Journal of Higher Education*, *81*(6), 680-708. https://doi.org/10.1080/00221546.2010.11779077

Posselt, J. (2020). *Equity in science: Representation, culture, and the dynamics of change in graduate education.* Stanford University Press.

President's Commission on Higher Education. (1947). *Higher education for American democracy.* Harper & Brothers Publishers.

Snyder, T. D., de Brey, C., & Dillow, S. A. (2019). *Digest of Education Statistics 2018* (NCES 2020-009). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. https://nces.ed.gov/pubs2020/2020009.pdf

Sorber, N. M. & Geiger, R. L. (2014). The welding of opposite views: Land-grant historiography at 150 years. *Higher Education: Handbook of Theory and Research, 27*, 385-422.

Stein, S. (2017). A colonial history of the higher education present: rethinking land-grant institutions through processes of accumulation and relations of conquest. *Critical Studies in Higher Education, 20*(2), 218-222.

Teranishi, R.T. (2011). Asian American and Native American Pacific Islander-Serving Institutions: Areas of growth, innovation, and collaboration. *AAPI Nexus: Policy, Practice and Community*, 9(1-2), 151-155.

Teranishi, R. T., Alcantar, C. M., Martin, M., Nguyen, B. M. (2015). *The return on investment for an AANAPISI-funded program: Outcomes for Asian American and Pacific Islander community college students*. Penn Center for Minority Serving Institutions. https://cmsi.gse.rutgers.edu/sites/default/files/AANAPISI%20paper%20final.pdf

Teranishi, R., Martin, M., Bordoloi Pazich, L., Alcantar, C. M., & Nguyen, T. L. K. (2014). *Measuring the impact of MSI-funded programs on student success: Findings from the evaluation of Asian American and Native American Pacific-Islander-serving institutions*. Retrieved from http://care.gseis.ucla.edu/assets/2014_peer_report.pdf

The Education Trust. (n.d.). *The state of higher education equity*. https://edtrust.org/the-state-of-higher-education-equity/

Thelin, J. R. (2011). *A history of American higher education*. Johns Hopkins Univeristy Press.

Turk, J. M. (2017). *Identifying predictors of credential completion among beginning community college students*. American Council on Education. https://www.acenet.edu/Documents/Identifying-Predictors-of-Credential-Completion-Among-Beginning-Community-College-Students.pdf

Turner, S., & Bound, J. (2003). Closing the gap or widening the divide: The effects of the G.I. Bill and World War II on the educational outcomes of black Americans. *The Journal of Economic History*, *63*, 145–177.

Urban, W. J. (2010). *More than science and Sputnik: The National Defense Education Act of 1958*. University of Alabama Press.

U.S. Census Bureau (2020). *Current Population Survey, 2019 Annual Social and Economic Supplement*. https://www.census.gov/content/census/en/data/tables/2019/demo/educational-attainment/cps-detailed-tables.html

Van Noy, M. & Zeidenberg, M. (2014). *Hidden STEM producers: Community colleges' multiple contributions to STEM education and workforce development*. Commissioned paper prepared for the Committee on Barriers and Opportunities in Completing 2-Year and 4-Year STEM Degrees, National Academy of Sciences. http://sites.nationalacademies.org/dbasse/cs/groups/dbassesite/documents/webpage/dbasse_088831.pdf

Villaverde, L., Helyar, F., & Kincheloe, J. L. (2006). Historical research in education. In K. Tobin & J. Kincheloe (Eds.), *Doing educational research: A handbook* (pp. 311-346). Sense Publishers.

Wang, X. (2015). Pathway to a baccalaureate in STEM fields: Are community colleges a viable route and does early STEM momentum matter? *Educational Evaluation and Policy Analysis*, *37*(3), 376-393. https://doi.org/10.3102/0162373714552561

Warner, L. S. & Gipp, G. E. (Eds.). (2009). *Tradition and culture in the millennium: Tribal colleges and universities*. Information Age Publishing.

Wheatle, K. I. E. (2019). Neither just not equitable: Race in the Congressional debate of the Second Morrill Act of 1890. *American Educational History Journal*, *46*(2), 1-20.

Wilkerson, I. (2020). *Caste: The origin of our discontents*. Random House.

Williams, R. L. (1991). *The origins of federal support for higher education: George W. Atherton and the land-grant movement*. The Pennsylvania State University Press.

Wissehr, C., Barrow, L. H., & Concannon, J. (2011). Looking back at the Sputnik era and its impact on science education. *School Science and Mathematics*, *111,* 368-375.

Witham, K., Malcom-Piqueux, L. E., Dowd, A. C., & Bensimon, E. M. (2015). *America's unmet promise: The imperative for equity in higher education*. Association of American Colleges & Universities.