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STEM Education and Workforce Policy: Its History and Politics

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“STEM” is a term that has intuitive appeal but lacks an agreed-upon definition. As such, it has become a term whose ubiquity and ambiguity allow it to be used for a range of policy and political purposes. The longstanding focus on STEM (science, technology, engineering, and mathematics) as a focal point of education and workforce policy makes it important to understand what is considered a STEM field, for what purposes the STEM designation is used, and how it has become a highly politicized term that lacks practical meaning. The use of STEM in policy historically and currently is used to support a range of policy objectives beyond improving science and engineering education or workforce development.

Keywords
STEM, science, engineering, education policy, workforce policy

Introduction

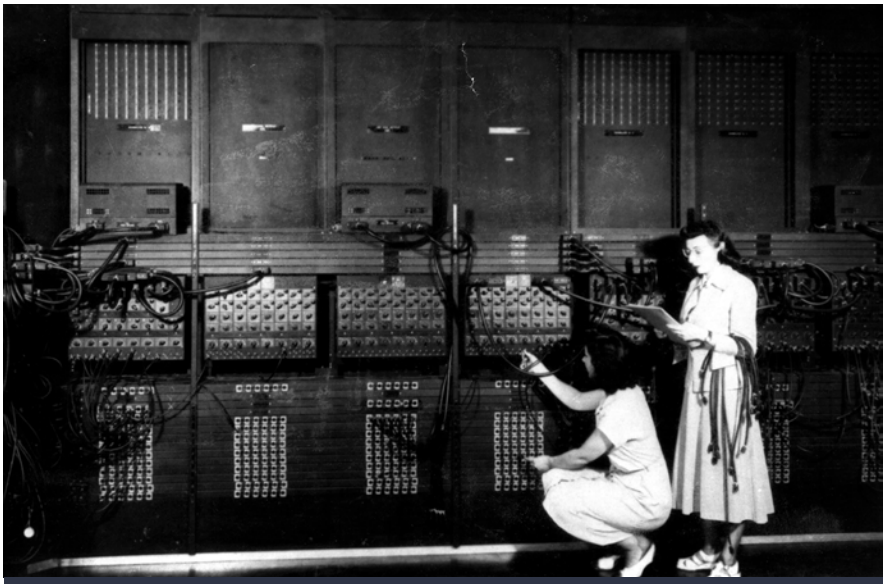
“STEM” (science, technology, engineering, and mathematics) is an acronym that has intuitive appeal but lacks an agreed-upon definition. As such, it has become a term whose ubiquity and ambiguity allow it to be used for a range of policy and political purposes. The longstanding focus on STEM in education and workforce

policy makes it important to understand what is considered a STEM field, for what purposes the STEM designation is used, and how it has become a highly politicized term that lacks practical or coherent meaning for evidence-based education or workforce policy. That is, the creation of the STEM acronym groups disciplines that have no inherently similar characteristics—the technology, mathematics, and engineering disciplines are not sciences; the sciences have neither technology nor mathematical content significantly different from many non-STEM disciplines, with the STEM/non-STEM boundary often reflecting bureaucratic and political objectives rather than coherent or substantive rationale (e.g., see Douglas & Salzman, 2020; Douglas et al., 2022, and the following discussion). In education policy, focus on STEM disciplines does not address needs in the economy or in education distinct from other fields—workforce supply is not constrained in STEM fields, nor does the overall expansion of these fields, as formally defined, serve societal purposes greater than many other, non-STEM fields such as, for example, medicine, law, public health, or a range of multidisciplinary fields.

To understand how STEM has become a term-of-art but without substance, we[1] begin with the history of STEM accounting and then consider how science and technology became considered essential to the security of the nation and to the nation's economic health. Understanding the politics historically shaping STEM policy can help us develop a better assessment of the evidence in current debates about STEM deficits and strengths.

STEM Evolution and Definition

World War II is considered the first war in which scientists, technologists, and statisticians took a prominent role in developing methods, technologies, and strategies of warfare. The strength of the science and engineering (S&E) workforce became widely recognized as a matter of military importance following the devastating impact of the atomic bomb on Japan.[2] In addition, though receiving less attention than the bomb, were other scientific and technological advances from radar and sonar to cryptography, and operations management and logistics developed by the Army Air Force's "Statistical Control" group to provide statistical and logistics analysis for the war; this statistics and management group went on to change corporate management practices after the war, becoming known as Ford Motor Company's "Whiz Kids."[3]

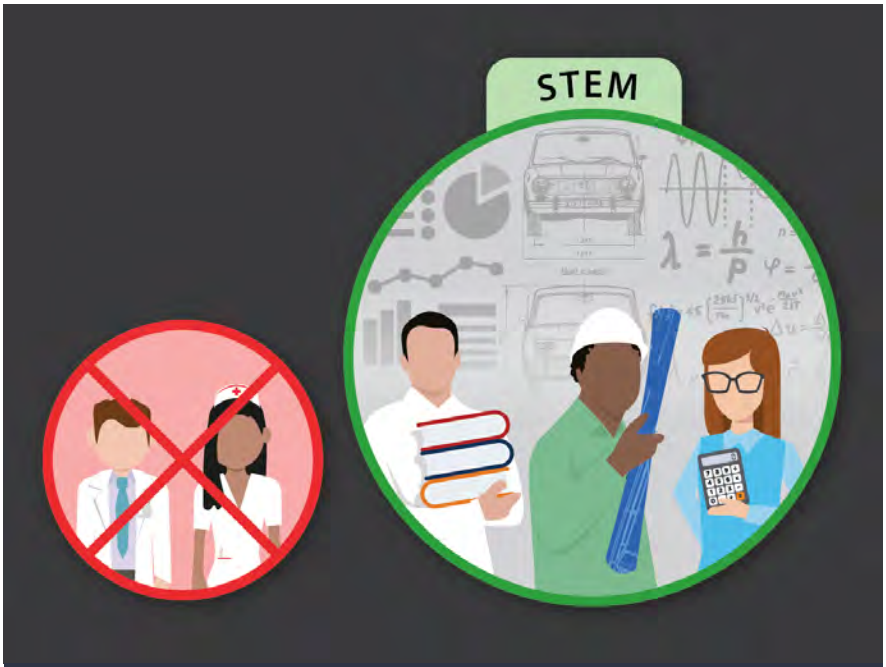


Ruth Lichterman (crouching) and Marlyn Wescoff (standing) programming the electronic numerical integrator and computer (ENIAC) in 1946. They were part of the “ENIAC 6” group of women who co-developed the programs and later software languages for the first electronic computers. They and other female programmers were overlooked and uncredited for decades until recently when Kathy Kleiman discovered and documented their stories, founding the ENIAC Programmers Project.
Public domain, courtesy of US Army/ARL Technical Library via Wikimedia Commons.

In recognition of the new technology and science of warfare, the military and national defense planners called for an assessment of the nation’s stock of scientists, engineers, and mathematicians who had returned to civilian life after the war but might be needed for future weapons development and war efforts. What began as a population census for national defense purposes soon began to reflect different organizational objectives and political purposes. Although a count of scientists and engineers (S&E, now “STEM”) would seem to be straightforward, as done for other occupational counts, in practice and in policy, neither the original S&E census nor the current STEM census has a standard definition or an enumeration that reflects a logic consistent with its use in policy or education. A brief history traces this definitional evolution and distortion.

The census of scientists and engineers was requested by Congress in the mid-1950s, and responsibility was assigned to the newly established National Science Foundation (NSF).[4] NSF was, and still is, careful not to intrude on the territory of its much larger counterpart, the National Institutes of Health (NIH), which is responsible for most medical research. Thus, nearly all applied and most basic medical researchers and practitioners are under the NIH's umbrella, while NSF funds all other sciences, including social sciences, mathematics, and engineering. Although there is some overlap between NSF's basic science that has medical applications and the NIH's work, there is a bureaucratic line that both agencies observe because a great deal of funding is at stake—in 2022, NSF's budget was $8.8 billion, and the NIH's budget was $45 billion.

The definition of "science" thus reflected NSF's domain by excluding medical practitioners and by including social scientists; the agency also had domain over the non-science fields of engineering and mathematics, and it is these fields that comprise "STEM" today. Consequently, a biology graduate who enters a health profession—physician, nurse, physical therapist—is no longer included in a census of science workers, whereas a bachelor's degree biology graduate who works as a test lab technician is included. The latter will be considered in the "STEM pipeline," whereas the former will be considered to have "left STEM." Clearly, other than reflecting bureaucratic lines, there is no intrinsic logic to this distinction based on a concept of what is and what is not science.[5]



STEM definitions include social and natural scientists, engineers, and mathematicians, while medical professionals are not considered STEM as defined by the National Science Foundation and other agencies.

The murky definitions of STEM become more opaque when we consider whether it refers to fields of study, occupations, or a body of knowledge that is applied across any number of occupations or college majors. How the health fields are classified has the largest impact on the size of the STEM fields (in education and the workforce). The undergraduate cohort of just over two million bachelor's graduates each year includes about 250,000 health majors, some of whom are preparing for medical practice, such as physicians and nurses, while others are pursuing courses of study in health administration, data management, and other health fields that do not require a significant amount of science coursework. The curriculum for pre-med students, for example, is nearly identical to that of biology majors but will be counted as a non-STEM major in education statistics; however, including all health majors would inflate the science count by including non-science health fields.

Whether a student is counted as a science graduate may depend on whether a college offers a distinct pre-med or health major or whether only biology or other science majors are offered; only a college without a distinct health major will have all of its students pursuing science-based health fields in the STEM census. Once a student enters the workforce in a health occupation of any type, they are said to have left their STEM pathway and are counted as part of the "leaking STEM

pipeline.” To say that a physician or nurse is not in a science field, but a bachelor’s-level lab technician is in a science field is an arbitrary distinction and not meaningful for policy or education purposes; rather, it reflects the legislative mandates of the agencies defining the census. Whether health is included or excluded in STEM will change the size of the STEM bachelor’s cohort by 20 percent or more and similarly affect the reported size of the STEM workforce (Oleson et al., 2014).

STEM education assessments are further affected by ambiguity about what is being measured by “STEM education.” Students in fields such as neuropsychology, physical anthropology, physical geography, and others complete a physical or life science course of study comparable to those in biology, geology, or other science majors but are excluded in STEM metrics as a consequence of the classification procedures but not for any substantive rationale. As a further bureaucratic anomaly, although a computer science major and a mathematics major are both considered STEM, an interdisciplinary computer science/math major is considered non-STEM, as are all other interdisciplinary science, technology, and math majors. At the same time, for the purposes of issuing nonresident work visas to foreign student STEM graduates, the government now considers New York University’s drama therapy, art history, and classics majors to be STEM majors, along with a host of other fields traditionally considered as fields in the humanities that became classified as “STEM” through various bureaucratic and political maneuvers.[6]

In addition to the imprecise classification of fields just discussed, students take a wide range of courses outside of their major, and in some non-STEM majors, the courses include substantial STEM content. Thus, if we are concerned about the level of STEM education among all college graduates, the count of those majoring in a STEM field does little to capture the overall extent of education in STEM subjects or STEM bodies of knowledge among those outside of traditional STEM majors.

Mathematics, in particular, is widely taught throughout the college curriculum, but only courses taught in mathematics departments are typically classified as “mathematics” in the official tabulations (those done by the Department of Education and statistical agencies). If, however, we include statistics and quantitative reasoning courses as mathematics courses, there are twice as many non-STEM students as there are STEM students who take as many or more mathematics courses than the median number taken by STEM students (Douglas & Salzman, 2020). In other words, there are more non-STEM graduates than the

number of STEM graduates with a substantial level of mathematics education. And a science graduate typically has no more math credits than a much larger number of non-STEM graduates have taken, and a mathematics graduate typically has no more science credits than a larger number of non-STEM graduates have taken. Overall, most STEM graduates do not have more course credits than a larger number of non-STEM graduates in the STEM fields outside of their major—suggesting that outside of the student's specific STEM major, high levels of STEM credits are completed among a large cohort of non-STEM graduates.

The imprecision in determining the boundaries and classification of STEM education leads to the question of why we are counting "STEM graduates" as a singular group. The usual answer is to determine whether the supply of STEM graduates is sufficient to meet labor market demand and military and national security needs. Even restricting the census of STEM graduates to those with one of the defined STEM fields, the supply of STEM graduates each year is a third to a half larger than the number hired into each of the STEM occupations. In the workforce overall, of all ages, only about a third of those with a STEM degree are in a STEM occupation (Salzman & Benderly, 2019). As the following brief history shows, concern about the supply of STEM graduates is a longstanding issue that owes its prominence and urgency to politics and policy more than to any evidence to suggest there is a weakness in the US education system.

The Politics and Policy of STEM

The focus on S&E began with the purpose of bolstering US science and technology capability for developing new military weapons and strategies along with the more general pursuit of science as an "endless frontier" to improve social welfare (Bush, 1945; Zachery, 1999). However, S&E education and workforce policies soon became an opportunity to pursue other political purposes. S&E policies were used by the military, defense contractors, cold war ideologues, and Democrats in an assault on those trying to restrain military growth and as an opportunity to attack political opponents. In the 1950s, S&E policy urgency developed in the face of declining military budgets and President Eisenhower's effort to redirect federal expenditures toward domestic development of infrastructure, education, health, and workforce training. Eisenhower, a five-star general and supreme commander of the WWII Allied forces in Europe underestimated his opponent's strength in uniting military organizations and industries against him. It was an opposition masterfully

led by Senate leader Lyndon Johnson and fueled by a powerful combination of media ideologues and agency directors within Eisenhower's own administration (Brinkley, 2010; Caro, 2002, 2012; McDougall, 1985). The battle had been brewing since the end of the Korean War in 1953, but Eisenhower's opponents found a tactical opportunity appearing in October 1957.

Although the Soviets' launch of the satellite Sputnik in 1957 is the iconic event creating awareness of a supposed science and technology crisis in America, the policy efforts to address the state of education had been building for a decade. Returning veterans eligible for the GI Bill enrolled in colleges in record numbers, at first straining the capacity to support them until colleges were able to produce and hire faculty and expand programs and facilities. As the bubble burst with the predictable decline in college enrollment after the surge of veterans graduated, the policy and education communities turned to increasing the rate of high school completion and to these students continuing on to college, in part to fill post-secondary institutions' now expanded capacity. Both efforts required a decided improvement in secondary education as well as developing other sources of support for college as fewer students were now eligible for GI educational benefits (Urban, 2010; Clowse, 1982). See Figure 1.

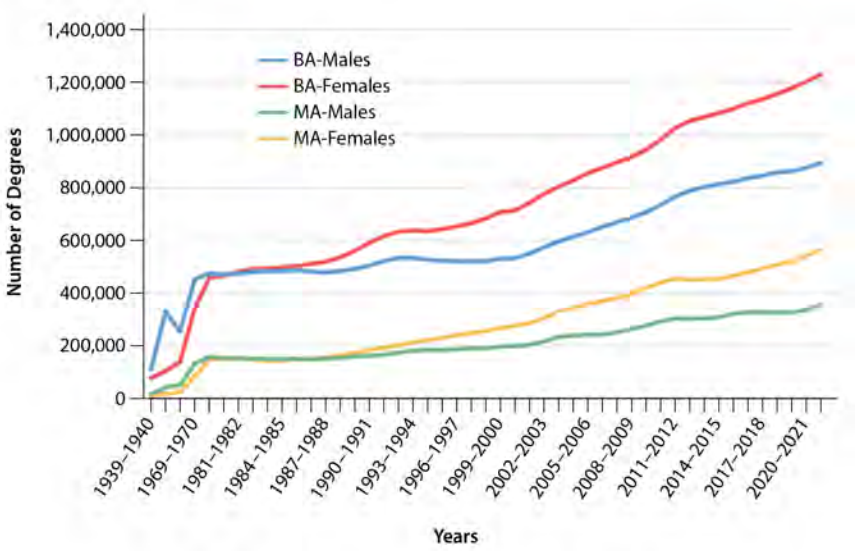


Figure 1: Degrees conferred by postsecondary institutions by level of degree and sex of student.

Source: US Department of Education, National Center for Education Statistics, Earned Degrees Conferred, 1869–1870 through 1964–1965; Higher Education General Information Survey (HEGIS), "Degrees and Other Formal Awards Conferred" surveys, 1965–1966 through 1985–1986; Integrated Postsecondary Education Data System (IPEDS), "Completions Survey" (IPEDS-C:87-99); IPEDS Fall 2000 through Fall 2020, Completions component.

During the decade preceding Sputnik, various federal education funding bills were proposed in Congress but faltered in the face of opposition to expanding the role of the federal government, and particularly southern opposition to the possibility of increasing federal government pressure to integrate schools. Thus was the education funding stalemate that became more entrenched with the 1954 Supreme Court *Brown v. Board of Education* ruling that segregated schooling was unconstitutional (Urban, 2010). This funding became a lever that civil-rights groups hoped to use by tying federal education funding to desegregation mandates through a rider attached to education bills introduced by Harlem Representative Adam Clayton Powell Jr. However, this rider inevitably guaranteed a defeat of the final bills by northern Republicans opposed to the expansion of the federal government and southern Democrats opposed to desegregation.[7] At the same

time, Eisenhower saw a need for strengthening the workforce training system, noting the strong apprenticeship training programs in Germany during the war and the low skill levels of US troops. Previously, as the university's president, he had created the Manpower Institute at Columbia University, and now, as US President, he wanted the federal government to expand its role in workforce training. Nearly a decade of political stalemate had limited the expansion of federal education and training funding.

It was into this political landscape that the Soviets launched Sputnik, neither surprising nor shocking anyone who was even moderately informed about American and Soviet rockets, science, technology, or current events. Although most narratives about this period discuss the Soviet's launch of Sputnik as demonstrating lagging US science education and capabilities to surprised policymakers, scientists, and industrialists, and a shocked public, a faithful history shows this was a narrative created for political maneuvering that also has distorted popular history ever since.

The successful launch of the Sputnik satellite in 1957 had been anticipated as part of the Soviet and US satellite programs that were intended to coincide with the International Geophysical Year (IGY). The IGY, conceived in 1950 and running from July 1957 through December 1958, was an international scientific exchange among more than seventy countries to foster cooperation and expand earth sciences research. Although both nations were in a race to develop intermediate and long-range ballistic missiles that they tried to keep out of the public eye (Sheehan, 2009), both countries announced in 1954 that each would launch a satellite as scientific and technological projects during the IGY (Kennedy, 2005; Neufeld, 2008; Ley, 1958). Though not sharing their technology secrets, which were related to the military rocket projects in both countries, satellite launch plans were generally shared, and, in the summer of 1957, the Soviets said they were close to a launch, and the Americans were on schedule to launch in the spring of 1958; the widely announced launch dates and US schedule to launch second provoked no concerns that were noted at the time.

Both nations had publicly announced plans to have their satellites collect various scientific measurements. However, seeking the public relations coup of being first-to-launch, the Soviets did so with an abbreviated scientific and technological feat that merely transmitted a radio signal for three weeks and then silently orbited for another two months before incinerating on its fall from orbit. The United States' IGY scientific satellite program launch followed a few months after Sputnik with the Jet

Propulsion Lab's Explorer 1, which had a cosmic ray detector, confirming what became known as the Van Allen radiation belt. Six weeks later, after a disastrous failed first launch attempt a few months earlier, Vanguard 1 went into orbit to transmit upper atmosphere measurements, continuing to relay information for six years and is still orbiting today.[8]

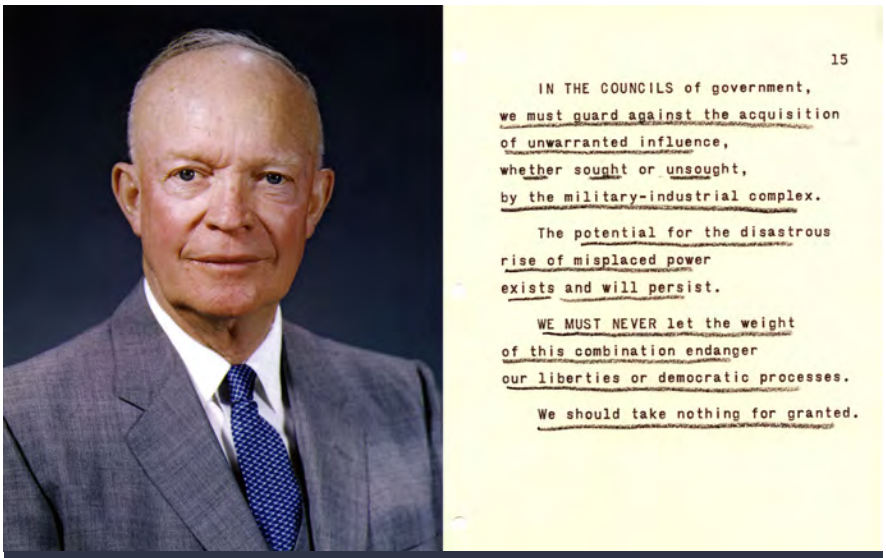
Sputnik did provide a powerful political opportunity, though less to the Soviet Union than to the Democrats looking for an opportunity to attack Eisenhower, and to the military services and industries, along with cold war ideologues all united in opposition to Eisenhower's attempts to constrain military spending and to improve relations with the Soviets (McDougall, 1985). Senate majority leader Lyndon Johnson held hearings through the spring of 1958 that Smithsonian historian Michael Neufeld (2007) describes as "…transparently designed to embarrass the administration and boost his presidential chances in 1960" (p. 317). In these hearings, the public heard Edward Teller, physicist and instrumental developer of the hydrogen bomb, speak of "a universe in which mastery of outer space meant mastery of the world…" and the real possibility that Americans "…would find [themselves] under Communist domination" (Caro, 2002, p. 1024). The Nazi's lead rocket engineer Wernher von Braun, now employed by the US Army, concurred with this assessment, along with other experts who also decried the backward state of American science and technology (Neufeld, 2008).[9]

During several months of hearings, a select group of testifying experts and politicians ignored the successful US satellite launches that, along with US military intelligence finding the Soviets were badly lagging in ballistic missile development, should have laid to rest any notion of Soviet scientific superiority (McDougall, 1985). Moreover, the hearings came on the heels of the publication of a landmark study, *The Demand and Supply of Scientific Personnel*, by National Bureau of Economic Research labor economists David Blank and George Stigler (1957), who found no cause for concern because there was no evidence of shortages. The National Science Foundation was also "skeptical of the 'manpower shortage' [claims… and] deplored the idea of crash programs that might inundate colleges and universities with students" (Clowse, 1982, p. 58).

The “bomber gap” was a fiction created by the Air Force several years before Sputnik in an effort to increase its budget; after Sputnik, Senator Johnson, and then Senator Kennedy revised it to be a "missile gap," accusing President Eisenhower and the Republicans of being soft on defense. Although the intelligence services had long before determined that the Soviets were badly lagging the US, and the US had by then launched several satellites with sophisticated scientific instrumentation, Kennedy continued to campaign on this issue. After his election, President Kennedy had to soften his missile gap claims.
Photo courtesy Keystone, Getty Images.

Undaunted, the hearings and the media first created the perception of and then stoked the fears of a panicked public. They also created a cadre of politicians worried about their political futures, who saw no benefit to challenging the effort to manufacture a crisis of confidence in the nation’s military capability (McDougall, 1985; Caro, 2002). After all, it was the military, defense industries, and the media who were promulgating the myths. Notably, the “bomber gap” slogan created by the US Air Force (which had just been established as a separate branch in the prior decade as compared to the centuries-old Army and Navy) to garner support for an increase in its budget was picked up after Sputnik as the “missile gap” by Johnson for his political sloganeering. The missile gap claim was later to be used by Senator

John F. Kennedy in his presidential campaign, falsely claiming the Soviets had outpaced the US in military capability in aerospace (McDougall, 1985). If President Eisenhower was surprised by the reaction to Sputnik, it was in his underestimation of the power of military industries to cooperate with the media in challenging the judgment of a five-star general and commander-in-chief; this was likely a factor leading Eisenhower to denounce them in his presidential farewell speech on the threats posed by the US "military-industrial complex."[10]



In his January 17, 1961, farewell address that was broadcast on all three television networks, President Dwight D. Eisenhower warned the public about the growing domestic threat to the nation, saying: "In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persist. We must never let the weight of this combination endanger our liberties or democratic processes. We should take nothing for granted. Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals, so that security and liberty may prosper together."
Public domain, courtesy of the Eisenhower Presidential Library and Museum, via Wikimedia Commons.

S&E education and supply then took center stage through a media campaign that mirrored the hyperbolic testimony and inflated claims presented in the hearings. In 1958, *Life* magazine compared the educational environments of two students, one in the United States and the other in the Soviet Union, depicting the US school system as a teenage playground with little academic rigor, especially in mathematics and the sciences. The “Crisis in Education” series was designed to raise Cold War fears, as well as shift attention from the desegregation battles about race in local schools to the space race with the Soviets.[11] *Life* magazine’s campaign revolved around distortion of the facts and, likely, a fictional student featured as the Soviet academic super achiever “Alex Kutznov of Moscow” (Bracey, 2009, p. 43).[12] This series supported *Life*’s ultraconservative publisher Henry Luce’s broader policy efforts to increase public fears about the “Red Menace” (Brinkley, 2010), and particularly to bolster his ongoing policy battles with Eisenhower and the administration. Luce, along with a substantial number of policymakers, the military, and corporate leaders, wanted to stop the President’s efforts to reduce military spending and his effort to improve diplomatic relations with the Soviets. The goal was to shift US policy to confrontation with the Soviet Union as well as constrain liberal arts education in the nation that was, Luce proclaimed, leading America’s youth to question a hardline anti-Soviet attitude and leading them toward liberal politics more generally (Bracey, 2009).

The politics and policy of Sputnik: The “Sputnik Moment” turned attention away from education and segregation toward the space—and arms—race with the Soviets.

The Soviet’s October 4, 1957, launch of Sputnik (top right), which sent radio signal “beeps” to Earth for three weeks in October, was followed by the launch of

the US Jet Propulsion Lab's Explorer satellite (top left) and the Navy's Vanguard (middle) satellites the following February and March. JPL's Explorer sent to Earth measurements of cosmic radiation, and Vanguard was the first solar-powered satellite and transmitted atmospheric measurements to Earth for three years and is still orbiting today, expected to stay in orbit for 240 years. The week that Sputnik was launched, *Life* magazine's cover, with the heading "U.S. troops take over in Arkansas," featured a picture of the National Guard in front of Little Rock Central High School as they enforced the Supreme Court's *Brown v. Board of Education* ruling that segregation was unconstitutional. Soldiers from the 101st Airborne Division escorted African American students to school (bottom). Southern Democrats' opposition to desegregation blocked federal school funding bills for a decade until that provision was removed from the 1958 education bill, renamed the NDEA.
(Left photo) Courtesy Carlos Moreno Rekondo, CC BY-SA 4.0, via Wikimedia Commons; (Right photo) courtesy NASA, public domain, via Wikimedia Commons; (Middle photo) courtesy public domain, courtesy Naval Research Laboratory via Wikimedia Commons; (Bottom photo) courtesy The US Army, CC 2.0, via Wikimedia Commons.

In 1958, Congressional education leaders, notably Alabama's Senator Lister Hill and Representative Carl Elliot, were, after a decade of failed attempts, able to broker a political compromise to steer federal funds into education systems. Relabeled the National Defense Education Act (NDEA), this legislation was a revived version of previous bills.[13] After the Democrats sidelined Democrat Representative Powell by removing him from the education committee (so he couldn't attach the "Powell Amendment" to the bills),[14] these Alabama legislators navigated a difficult legislative path providing federal funds to schools without providing another lever for federal intervention in education (Urban, 2010; Clowse, 1982).

Congressman Adam Clayton Powell during a press conference (October 11, 1956). During the 1956–1957 legislative session, Harlem Representative Powell attached the “Powell Amendment”—prohibiting school segregation—to a federal school building bill, as he had done with other education funding bills. In January 1957, he defended the amendment, knowing it would lead to Southern Democrats defeating the pending education bill, saying: "Negro people have waited many, many years for this hour of democracy to come and they are willing to wait a few more years rather than see this bill passed which will appropriate federal funds to build a dual system of Jim Crow schools in defiance of the law” (Sundquist, 1968, p. 165–166). Only when Powell was removed from the Education and Labor Committee by the Democratic leadership, because of his support for President Eisenhower’s reelection, did the longstanding education bills pass as the NDEA in 1958.
Photo courtesy public domain, courtesy United States National Archive via Wikimedia Commons.

NDEA provided funding for school buildings and programs in sciences and foreign languages. It provided federal support for higher education through loans and fellowships, and although it gave priority to sciences and foreign languages, it

supported a wide range of other fields and was used broadly. To garner the support of followers of McCarthyism who sought to quash what they considered left and liberal politics in the colleges (McCarthy having, by then, been censored by the Senate and died from alcoholism), NDEA did make funding contingent on colleges administering loyalty oaths to their students;[15] 166 colleges publicly protested this provision, with thirty-two turning down all NDEA funding (Clowse, 1982).

"Have you no sense of decency, sir?" —Army lawyer Joseph Welch listening to Sen. Joe McCarthy (standing at the map)

The end of McCarthy's career came in 1954 during televised hearings on his charges that there were communists in the US Army, when Joseph Welch, lawyer for the Army, replied to McCarthy's baseless accusations about another young lawyer, saying: "Until this moment, Senator, I think I never really gauged your cruelty or your recklessness.…You have done enough. Have you no sense of decency, sir? At long last, have you left no sense of decency?" Following this hearing the Senate censured McCarthy, and he died of alcoholism several years later. His Congressional colleagues continued his efforts, notably by requiring colleges to administer a signed loyalty oath to anyone receiving NDEA funding; objections by colleges, the president's science advisor, and many others were dismissed as the political price to pass the NDEA by appeasing McCarthy's Congressional loyalists.
Photo courtesy Getty Images.

In the decades that followed, a perpetual STEM crisis continued to be a defining feature of the policy landscape. The US was seen as constantly behind the Soviet

Union (and later Japan and now China) whenever there were economic troubles at home or to accompany the pursuit of other political objectives. In the post-Vietnam era, Americans faced a crisis of confidence: a stagnating economy accompanied by inflation, Japanese incursion into the US automobile and electronics markets, and recognition that the US military was not invincible, along with declines in defense spending following the end of an active war. Ronald Reagan came into office on the campaign promise to “make American great again.” And once again, a claimed education deficiency became the focal point not just as the reason for America’s fall from dominance but cast as an existential threat to the nation. A widely cited and still often quoted 1983 federal commission report *A Nation at Risk* identified US schools as responsible for

> …the educational foundations of our society…being eroded by a rising tide of mediocrity that threatens our very future as a Nation and a people... If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war (National Commission on Excellence in Education, 1983, p. 5).

The report coincided with President Reagan’s highly controversial arms build-up through unprecedented peacetime deficit spending and funding for outer space military technology development, which knowledgeable scientists, military leaders and strategists, and even defense industry technologists said “…did not, and could not for the foreseeable future, exist” (FitzGerald, 2000, p. 15). In fact, the proposed technology’s improbability “...appalled defense experts in and out of the administration,” with the undersecretary of defense for research and engineering referring to it as a “half-baked political travesty” (FitzGerald, 2000, p. 210). Reagan’s proposed space-based defense system, officially named the Strategic Defense Initiative, “…was immediately dubbed ‘Star Wars’ in the press” (FitzGerald, 2000, p. 22).[16] But, it did provide fuel to Cold War fears, countering growing anti-nuclear pressures to de-escalate tensions with the Soviet Union and reduce arms production and spending (Baucom, 1992).

On March 23, 1983, President Ronald Reagan introduced the American people to his Strategic Defense Initiative (SDI), which was immediately renamed “Star Wars” by the press, referring to the President’s recent speech about the Soviet “evil empire,” apparently picking up the phrase from the recent movie. Although many experts criticized the SDI program for being expensive and nonsensical, including the Pentagon’s undersecretary for defense research and engineering who said it was a “half-baked political travesty,” billions of dollars were spent in its development.
Photo courtesy public domain, White House Photographic Collection via Wikimedia Commons.

It was the tenor of the period in which fears of the Soviet Union were being stoked and used to motivate policy. The *A Nation at Risk* report parlayed that rhetorical approach to great effect, garnering widespread attention to its portrayal of educational failure as yet another American weakness in the face of Soviet prowess. But, once again, and not for the last time, a widely covered educational failure report was followed by serious but less reported studies of the evidence that found the report’s claims lacking (Berliner & Biddle, 1997). Most notably, the US Department of Energy’s Sandia Laboratories reexamination found the evidence in the report to be weak and largely in error, and the prose hyperbolic (Carson, Huelskamp, & Woodall, 1993). Nonetheless, *A Nation at Risk* successfully fueled proclamations by policymakers, business leaders, and the press of educational

failure as the pivotal explanation for the economic problems of the previous decade. It added to the general fear of the Soviet Union and turned attention to supposed failures of the education system as a central explanation for the successful economic challenges from Japanese companies who were increasing market share by outcompeting US firms.

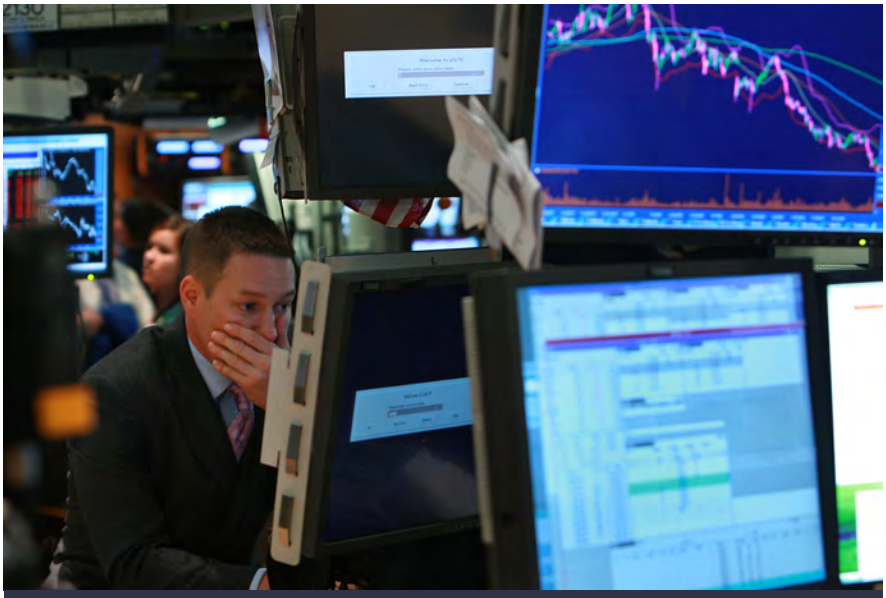
The crisis claims continued in the following decades and then during the Bush administration's efforts to expand vouchers and charter schools to privatize education (Ravitch, 2014, 2020), along with efforts to stoke public fears about the nation's military standing in the world, another commission rushed out a report that apparently intended to echo Winston Churchill's warning of *The Gathering Storm* (1948) about the Third Reich's ascendancy, but with the education system as the culprit. *Rising Above the Gathering Storm* (RAGS; National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2007), the report of the commission led by a military contractor's retired CEO, refashioned the claims of earlier reports for the current period: US schools were still failing in math and science relative to other countries, and massive investment was needed in these subjects to maintain global competitive advantage by bolstering the nation's science and technology (National Academy of Sciences, 2007).

The report echoed, and was echoed by, numerous industry association reports and policy briefs and provided support for Congress's passage of the America Competes Act in 2007 (Teitelbaum, 2014). The Act focused on funding science and technology research, increasing the NSF's budget, and expanding the supply of STEM workers. The report's recommendation of permanent expansion of guest worker visas did not make it into the final bill, so the Obama administration responded by increasing the length of one-year work permits to three years for foreign students graduating with a STEM degree. This created a large supply of guest workers—foreign students granted work permits and then eligible to apply for temporary visas, generally for employment at below-market wages (Rosenthal, 2021). And, as with so many crises claims before, careful reviews of the evidence found the claimed shortages and loss of international competitiveness—to China, rather than the Soviet Union or Japan this time—was based on a flawed analysis of the data (Salzman & Lowell, 2008; Lynn & Salzman, 2010; Lowell & Salzman, 2007).

By 2007, when the RAGS report was issued, a growing economy made the claims of impending STEM failures less urgent than they had seemed following the dot-com stock market crash and recession earlier in the decade, when the crisis and failure reports had proliferated (Teitelbaum, 2014). But a year later, the 2008 financial

crisis again raised concerns about the US economy.

In response to the financial crisis of 2008, science and industry advisers were gathered into committees to recommend policy responses. Many of the authors of the 2007 RAGS report offered in a 2010 follow-up to the original RAGS report the same argument about America's S&E declines in the face of an ascendant China that portended an imminent threat to the nation like a "Category 5 hurricane" (National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2010) The 2010 report, led again by the same retired defense contractor CEO, added further claims of an impending and unprecedented crisis, concluding that the failure to adequately respond to the 2007 report could be seen as leading to outcomes that were "second only to a weapon of mass destruction detonating in an American city…" (National Academy of Sciences, National Academy of Engineering, & Institute of Medicine, 2010, pp. 66–67).



A trader works on the floor of the New York Stock Exchange on September 15, 2008. In afternoon trading, the Dow Jones Industrial Average fell over 500 points, marking the beginning of the worst global financial crisis since the Great Depression of 1929. Although the primary causes were fraud in the housing market and other risky financial dealings, a number of business policy groups and the President's advisory council declared the impediment to recovery was a lack of STEM workers.
Photo courtesy Spencer Platt, Getty Images.

Responding to this presumed threat, President Barack Obama assigned his President's Council of Advisors on Science and Technology (PCAST) the task of examining the future STEM needs in the economy. To bolster PCAST's mission, Obama assembled two dozen industry executives and one labor representative in an ad hoc President's Council on Jobs and Competitiveness, appointing General Electric's CEO Jeff Immelt as chair. Assigned to formulate policies addressing the causes of, and remedies to, the economic crisis and slow recovery, the solution both councils identified was an increase in the number of STEM graduates: the President's Council on Jobs and Competitiveness called for ten thousand more engineers each year (2011), and President's Council of Advisors on Science and Technology called for one million more STEM graduates over a decade (2012). Both proposals came shortly after Apple's co-founder Steve Jobs told Obama that Apple would have located its vast low-cost manufacturing operation, with 700,000 jobs, in the United States instead of China if only the company had been able to find enough US engineers to support its operations (even though moving manufacturing to the US would have increased its wage costs by $26 billion annually, an amount slightly more than its net profit that year; Salzman, 2013).

Steve Jobs at dinner with President Obama—later telling the President that Apple might bring some manufacturing work back to the US if the government trained more engineers. Not discussed at dinner was how the US would be competitive with Apple's manufacturing operations in China, where employees work twelve hour shifts, six days a week, live in company barracks, and earn less than $17 a day (2012 wages). (*New York Times*, January 21, 2012).
Photo: The White House from Washington, DC, Public domain, via Wikimedia Commons.

These reports all followed Obama's speeches during the prior year that America's "Sputnik moment" had arrived again. The nation's economic recovery, he said, would come from producing more STEM workers. Disregarding the evidence showing a longstanding, and growing, number of STEM graduates without STEM jobs, Obama, policymakers, the media, and industry all joined in a chorus proclaiming imminent STEM shortages. These proclamations and proposed policy solutions seemingly ignored the evidence that the 2008 financial crisis was sparked by widespread fraud in the mortgage markets and their deregulation in the previous decade, and more generally, the restructuring of the financial system over the prior decades (Stiglitz, 2010; Tooze, 2018). Once again, these corporate leaders said the nation's ills were to be cured by expanding the STEM workforce, along with reducing corporate taxes, thus refocusing attention to alleged failures of the education system rather than of the financial system.[17] The policy prescriptions advanced longstanding political and industry goals to redirect public education

funds to charter schools and private religious schools (Ravitch, 2014, 2020), as well as renewing calls for increases in lower-paid guest workers for the politically powerful technology industries (Teitelbaum, 2014; Salzman, 2013). There was no dramatic increase in STEM graduates or the STEM workforce, and although the economy did recover and the stock market hit new highs, the claims of an ongoing, decades-long crisis of STEM have continued unabated.

Conclusion

STEM education and workforce development policy has consistently been motivated by political objectives far removed from the realities of the education system, the labor market, or the economy. Through the decades, report after report points to STEM deficiencies as the root cause of whatever problem is thought to be ailing the nation (see Table 1). And they all conclude with policy prescriptions to address a “STEM crisis” that has been remarkably consistent throughout the decades as the key problem accounting for the military and economic ascendancy of other nations, the economic declines in the US, and a myriad of other problems.

Years	Milestones
1939–1945	World War II innovations and advances in nuclear weaponry, radar, sonar, cryptography, computers, operations, and logistics (1945) Presidential science adviser Vannevar Bush calls for expanded government support for science and creation of the National Science Foundation (NSF) in *The Endless Frontier* report
1950	National Science Foundation established
1954	Supreme Court rules school segregation unconstitutional in *Brown v. Board of Education of Topeka*
1957	International Geophysical Year: launch of Sputnik, Explorer 1, and Vanguard 1 satellites National Bureau of Economic Research report, *Demand and Supply of Scientific Personnel*, finds no evidence of S&E shortage in the US
1958	Senate hearings on alleged Soviet scientific superiority *Life* magazine publishes "Crisis in Education" series National Defense Education Act (NDEA) directs federal funding to schools and colleges but removes desegregation requirements in previous, defeated education bills and adds requirement for loyalty oaths to be administered by colleges; 166 colleges protest and 32 colleges refuse NDEA funding in objection to the loyalty oath
1960	Democratic Senator John F. Kennedy campaigns for President, claiming a "missile gap" that he blames on Republicans who are weak on defense
1961	President Eisenhower's farewell speech warns the nation about the military-industrial complex, which he believed was diverting funds from domestic needs such as education
Mid-1970s	Stagnation and decline in college graduates
1983	*A Nation at Risk* report claims an education crisis US Department of Energy's Sandia Laboratories finds the evidence in the report to be weak and largely in error President Ronald Reagan's Evil Empire speech and launch of the Star Wars program over the opposition of the Administration's science and military advisors
2007	*Rising Above the Gathering Storm* (RAGS) report released by the National Academy of Sciences Urban Institutes "Into the Eye of the Storm" study finds RAGS and other reports to be in error, based on faulty data and unsupported conclusions America Competes Act passed by Congress
2008	Global financial crisis Obama administration extends optional practical training (OPT) guestworker permits for foreign STEM graduates to 29 months
2010	RAGS follow-up report claims US education worsening, posing a threat to the nation equal to a Category 5 hurricane and second only to that of a weapon of mass destruction detonating
2011–2012	Obama's President's Council on Jobs and Competitiveness and his President's Council of Advisors on Science and Technology call for increasing the number of STEM graduates AFL-CIO President Trumka, a member of Obama's Jobs Council, issues a dissent to the report President's Council of Advisors on Science and Technology
2016	Obama administration extends optional practical training (OPT) guestworker permits for foreign STEM graduates to 3 years

Table 1: Milestones in the politicized history of STEM.

Although science and engineering play an increasingly important role in the prosperity and military standing of modern nations, proposed STEM policies recycle the same prescriptions of prior years and have few substantive solutions to offer for addressing the specific problems of each era. Because “STEM” is a term that only loosely describes the actual education content or the workforce occupations that are implied in its use, various metrics and policy proposals about STEM also have little correspondence to their stated objectives. Proposed STEM policies would increase the number of civil engineers and lab technicians, but would that improve the economy or society more than increasing the number of physicians and nurses (the latter not being considered STEM workers)? Does expanding the number of STEM visas and increasing the supply of lower-cost workers, including drama therapists and graduates in Classics literature, advance national prosperity? Would Steve Jobs have moved 700,000 manufacturing jobs to the US—increasing Apple’s annual wage costs by $26 billion—if American colleges graduated another five thousand or ten thousand engineers? The vagueness in defining and counting “STEM” graduates and workers does provide a policy purpose, even if not for its ostensible goals of strengthening the economy, national defense, or society.

As this brief history shows, STEM policies invariably become encumbered with other political and policy objectives. Under the banner of addressing a STEM crisis, policymakers can attract widespread support for policies that are easily commandeered for other purposes—whether to provide the justification for restructuring education (some of which supports education but also achieves other purposes, from constraining school integration to privatizing public education) or to redirect attention away from global challenges undermining a broad-based prosperity or the direct causes of national economic crises. As discussed in this review of the noted STEM crisis reports of the past three-quarters of a century, each time major reports on the STEM crisis have been issued, they have been found not to reflect reliable evidence. To believe these reports, the US has suffered seventy-five years of ongoing and unresolved STEM crises, yet the US has not suffered the devastating political or economic fates each of these reports has proclaimed as imminent, or as equivalent to “an act of war,” or a “weapon of mass destruction.”

Decades of STEM policy have followed the playbook written on the narrative of weakness and failure that emerged from the Sputnik episode. As with the Sputnik era, the claimed threat from other nations or weaknesses within the country prove to be transitory and overplayed by politicians and the media. Nonetheless, the STEM myths based on these fears have a more important role than does evidence in shaping US policies. Whatever threat the Soviet Union posed to America, it was not countered by increasing the supply of scientists and engineers. Nor was the 2008 financial crisis resolved by increasing the supply of STEM graduates that would have far exceeded demand for them. Along with the implausibility of decades-long shortages of STEM workers, the US economy has endured boom-and-bust cycles and financial crises that have little relationship to the supply of STEM workers or to presumed weaknesses in education. Global “threats,” whether economic or military, go far beyond the state of STEM education or labor supply. Effective STEM policy requires first disentangling the role of STEM education and work in the US economy from other political or business goals.

Notes

1. This material is based upon work supported by the Alfred P. Sloan Foundation, Grant Nos. 2012-6-13 and G-2016-7310; and the National Science Foundation, Grant No. NSF-DGE-1561687. It also draws on work conducted in collaboration with Daniel Douglas and Leonard Lynn. Two anonymous reviewers provided detailed and helpful suggestions and edits.
2. It is important to note that large-scale death and destruction had been achieved through other military tactics and technology, such as the firebombing of Dresden and Tokyo, which killed a large number of their residents and destroyed an extensive area of those cities—25,000 and 100,000, respectively, compared to 130,000 to 225,000 killed in Hiroshima and Nagasaki and similar-sized areas destroyed—but those required about 1,200 and 340 bombers, respectively, compared to two planes to drop the atomic bombs.
3. The statistical and logistics approach to military strategy came to dominate US war strategy following WWII, notably as directed by former “Whiz Kid” and Secretary of Defense Robert McNamara in Vietnam, after he had developed and improved this approach as a management executive at Ford (Halberstam, 1986).

4. Under contract to the NSF, the census was conducted by the National Academies of Science. Currently, the NSF's National Center for Science and Engineering Statistics prepares its reports on S&E education and workforce, including its longstanding Science and Engineering Indicators, which provide the S&E statistics widely used, along with the National Center for Education Statistics and the US Bureau of the Census, which use the NSF definitions. Nearly all reports on STEM education and the workforce derive their statistics from these sources and use their classifications.
5. Logic would dictate the inclusion of all majors that have substantially similar science credits and thus would include all health and pre-professional fields such as pre-med, nursing, pharmacy, etc., but would exclude other health majors such as health administration. (For a detailed discussion, see Douglas et al., 2022; Salzman & Douglas, 2022.)
6. In a rather remarkable justification, New York University appears to have classified a version of art history and classics majors as falling under Archeology, which is an established STEM major. The university says those majors can be classified as a field of archeology because the former majors, similar to archeology, also "[i]nclude instruction in…conservation and museum studies…and the study of specific selected past cultures," as long as the student also took several "classical archeology" courses in addition to their standard art history or classics courses to qualify. Individual schools assign the instructional classification code for each major (CIP), and, according to the DHS, that classification is accepted by the DHS with minimal review or oversight. The Department of Education's National Center for Educational Statistics, which administers the development of the CIP codes and data collection, does not review these types of classification decisions by universities; moreover, NCES uses the DHS STEM designation list for determining majors to be classified as "STEM" in NCES's datasets and STEM tabulations (e.g., in the national datasets of the BPS and B&B; Grassley, 2022; Lugo, 2022; also see Douglas et al., 2022).
7. In the byzantine world of Congressional policymaking, "Republicans and Northern Democrats teamed up to write the Powell Amendment into the bill. But then [those same] Republicans and southern Democrats joined forces to defeat the whole measure" (Bauman, 1956; Munger & Fenno, 1962; Loftus, 1965). Republicans who were opposed to any federal funding for schools would support Powell's rider, knowing that they could then join southern Democrats—who wanted education funding but not integration required by the Powell Amendment—to defeat the entire bill.

8. The mythology of the Soviet “surprise” launch and its significance has become so compelling in the political history of science and technology that the actual history is nearly erased in the narratives that dominate the retelling of this event. Both the US and Soviet Union had publicly announced plans to develop a satellite, and both committed to a launch during IGY. For example, on December 21, 1954, the US Department of Defense announced that it was continuing studies in its Earth satellite vehicle program; on January 10, 1955, the Soviets announced that satellite flight was possible in the near future and, on April 26th, announced it had an active satellite development program; on July 29th of the same year, the US National Academy of Sciences and the National Science Foundation announced the US was planning to launch a satellite as part of IGY; this was followed the next day by the Soviet’s announcement they would orbit a satellite “like that of the United States.” American scientists reported that the “Russians had worked on this problem [of launching a satellite] as long as scientists in the United States.” On August 2nd, the chair of the USSR Academy of Sciences interplanetary communication committee publicly announced the Soviets would launch a satellite within the next two years (within the timeframe of IGY). In the US, on October 7th, contracts were awarded to the Martin Company and GE to build the launch vehicle (rocket) and motors for the satellite. In January of 1956, a London newspaper reported the Soviets were likely to launch a satellite six months before the expected US launch; on March 6th, Radio Moscow reported its satellite would be “small, spherical, and weigh about 50 kilograms.” On September 15th, an IGY committee, which included the US and USSR, recommended standard instruments for tracking both the US and USSR satellites and that both release technical information. On May 19, 1957, the US Vanguard satellite program announced a delay for the launch until spring 1958 because the satellite tracking network would not be completed until April 1958 (this was the global network that would be used to track both US and USSR satellites). On June 2, 1957, Pravda published an article announcing the USSR had completed its satellite rocket and instruments and planned a launch in the coming months. On June 10th, the Soviets sent a formal announcement to the IGY committee that it planned to launch a satellite in the coming months. The IGY held a press conference at its headquarters in Belgium, announcing “The Soviet Union plans to send satellites around the earth in the next few months” (Special to the New York Times, 1957, June 23) following a Soviet press conference on June 18th and a statement by Soviet scientists that they would launch a satellite before the end of 1957. On June 27th the Soviets published an article describing the satellite radio transmitters that would

operate at 20 and 40 megacycles and provided other technical information (These events are listed in a chronology compiled by the House Committee on Science and Astronautics [US GPO, March 8, 1961], and were reported as they occurred in the media as, for example: “Satellite Set To Launch, Reds Claim” [1957]; “Russia Says Her Satellite Will ‘Look like a Star’” [1957]; “Russians May Reveal Better Space Satellite” [Diamond, 1957]; “Soviets To Launch First ‘Moon’ In '58” [Frankel, 1957]; “Earth Satellite Marks Man’s First Step Into Space” [Laurence, 1957] with a full page article and illustrations; and “As International Geophysical Year Opens—The Over-All Picture” [Sullivan, 1957, June 30] also a full page with illustrations). On the July 1, 1957 opening of IGY, the US and USSR programs to each launch a satellite during the coming year were widely reported (e.g., Sullivan, 1957, July 1) along with a speech from President Eisenhower Special to the *New York Times* and a special hour-long BBC show hosted by Prince Philip, also discussing the satellite programs, both airing on June 30th, the night before the IGY opening. A month before, President Eisenhower had requested a supplemental appropriation of an additional $34.2 million, adding to the $35.8 million already in the budget for the satellite program (Construction fund asked for satellite, 1957). The IGY program called for launch and tracking coordination with the US and USSR and the scientific objective of collecting measurements; the Soviet Union announced its intentions of launching a satellite that would gather information but also said it would not announce its launch until the satellite was successfully in orbit. The Soviet Union did not coordinate the launch with the US or IGY committee but, instead, decided to launch a satellite with no scientific instrumentation using an ICBM as the launch vehicle (Neufeld, 2020) and was thus unable to provide the information collection that was intended by the IGY satellite program; this abbreviated scientific mission (rather than a delay to complete the scientific instrumentation announced earlier) appears to have been done so it could claim a “first-to-launch” publicity achievement.

9. As the Smithsonian’s foremost space historian Michael Neufeld writes (2007), during “Johnson’s Inquiry into Satellite and Missile Programs, which opened on 25 November 1957,” von Braun testified that whoever controlled space would “control the planet…[making] statements that Johnson and the Democrats could use against the administration…launch[ing] von Braun on a long career as a popular congressional witness” (pp. 317–318). Wernher von Braun was also upset that his rocket project, under the aegis of the Army, had not been selected as the satellite launch vehicle but instead, the Navy’s project was selected with the rocket being built by Martin Companies and GE. Johnson’s plans to run for president in 1960 were eclipsed by Senator John Kennedy,

though Kennedy did build on Johnson's efforts to create a perception of missile inferiority to the Soviets.

10. In his last speech as president on January 17, 1961, Eisenhower, a five-star general who commanded the allied forces in Europe to victory in World War II, gave a stunning warning to the country about the influence of military contractors along with those in the military bureaucracy and command: on a national TV broadcast he explained to the public that this coalition of the military and industry was exerting pressure to expand their budgets and influence the direction of foreign policy, posing a threat to democracy. Eisenhower said: "Our military organization today bears little relation to that known by any of my predecessors in peacetime, or indeed by the fighting men of World War II or Korea…The total influence—economic, political, even spiritual—is felt in every city, every State house, every office of the Federal government. …In the councils of government, we must guard against the acquisition of unwarranted influence, whether sought or unsought, by the military-industrial complex. The potential for the disastrous rise of misplaced power exists and will persis. "We must never let the weight of this combination endanger our liberties or democratic processes. We should take nothing for granted. Only an alert and knowledgeable citizenry can compel the proper meshing of the huge industrial and military machinery of defense with our peaceful methods and goals, so that security and liberty may prosper together" (Eisenhower, 1961, pp. 13–16). An excellent discussion of this speech, its history, and its impact is the documentary film *Why We Fight* by the filmmaker Eugene Jarecki. Previously the sociologist C. Wright Mills—a Columbia University sociology professor when Eisenhower was the university's president—had discussed the growing influence of the military and the defense industry in his noted book *The Power Elite* (1956; also see Domhoff & Ballard, 1970).
11. President Eisenhower had just ordered federal troops to Little Rock, Arkansas, to stop local white segregationists from preventing and attacking the first African American children to attend the high school as mandated by the Supreme Court ruling. *Life* magazine's October 7, 1957, cover showed federal troops in front of Little Rock Central High School, captioned: "U.S. Troops Take Over in Arkansas."
12. The distortions and political purposes were noted by a number of analysts, educators, and policymakers, observing that, as Clowse (1982) writes: "…that media attacks were leading to a contrived consensus…United States Ambassador to the USSR Llewelyn E. Thompson told the cabinet on February 7 that the Russian educational system was not as good as 'the exaggerated

stories appearing in our press.'" (Clowse, 1982, p. 108). Clowse (1982) notes that "some Americans continued to object to the heavy-handed rhetoric and admiration of Russian schooling […] creating illusions. The Soviets, after all, had educational problems. Overcrowding existed in schools there just as in the United States. Instruction was often poor, and young Russians did not always have an opportunity to use their schooling. Considering in toto the educational achievements of the United States, where a high percentage of the population remained through high school, accusations of failure seemed unjustified" (p. 123).

13. Throughout the 1940s and 1950s, there had been various attempts to permanently expand federal funding of education, school construction, and vocational training. These bills were regularly defeated by a coalition of southern Democrats fearing it would also allow federal requirements for desegregation, along with Republicans who opposed the expansion of the federal government; the effect of Powell's introduction of an amendment prohibiting federal aid to segregated schools assured the defeat of the bills introduced throughout this period (Clowse, 1982; Munger & Fenno, 1962; Bauman, 1956). The various bills previously had addressed one part or another of education funding, such as "Federal Aid to States for School Construction" (1955) and the 1953 predecessor to the NDEA titled: "A Bill to assist in the provision of facilities for free public education required in connection with the national defense" (Urban, 2010).
14. Democratic Representative Powell was removed from the committee by the Democrats for having supported Republican President Eisenhower's reelection bid in 1956; later, in 1960, after reconciling with the Democrats over this earlier endorsement of Eisenhower, Powell became chairman of the education and labor committee, and his amendment became part of the 1964 Civil Rights Act.
15. Requirements that government employees sign oaths stating they did not belong to subversive organizations (which could include any number of organizations, such as the NAACP, ACLU, and other civil rights groups) were enacted in the late 1940s and early 1950s as part of the "Red Scare" and "witch hunts" that came to be known as McCarthyism. A loyalty oath for federal employees was first enacted by President Truman's executive order in 1947, and then, led by Nevada Sen. Pat McCarran, more draconian legislation for monitoring and prosecuting "subversives" passed in 1950 over Truman's veto (Ybarra, 2015). A number of states required state employees to sign similar loyalty oaths. Most notably, California enacted loyalty oath laws in the Levering Act, with only one objecting vote by State Senator George Miller,

which then led to the University of California instituting its own loyalty oath policy. At the University of California, thirty-one faculty refused, arguing it infringed on principles of academic freedom, and they were fired in 1950—not because of any specific organizational affiliation or political sympathies of the faculty but because of their refusal to sign the loyalty oath on principle (California Federation of Teachers, n.d.). The faculty challenged the University's policy, and the Supreme Court ruled the policy unconstitutional in 1952. (Finacom, 2003). By the mid-1950s, many of these loyalty oath policies had been challenged, and Senator Joe McCarthy was censured by the Senate in 1954, but there was still a large group of McCarthyism supporters who saw the NDEA as an opportunity to enact loyalty oaths as a federal requirement. Instituting loyalty oaths in colleges was a particular objective because of fears that liberal professors were indoctrinating America's youth.

16. The announcement of the "Star Wars" program had followed an earlier speech in which Reagan labeled the Soviet Union "the evil empire" and was referred to as his "Darth Vader speech," leading journalists to imply the President was unclear about the distinction between reality and the movies (FitzGerald, 2000, p. 22). Reagan's biographer, Lou Cannon, wrote: "Reagan totally believed in the science fiction solution he had proposed without consultation with his secretary of state or his secretary of defense…" (quoted in FitzGerald, 2000, p. 206). As Fitzgerald further explains, "The Joint Chiefs were stunned by the precipitous action and the sweeping language. The chief technical experts in the Pentagon were furious….the undersecretary of defense for research and engineering 'went ballistic' and asked how nuclear policy could be the subject of such a 'half-baked political travesty'" (2000, p. 210).
17. AFL-CIO President Richard Trumka was the sole labor representative and "…filed a stinging 1635-word dissent to the 'Road Map to Renewal' adopted by the President's Council on Jobs and Competitiveness. Trumka also charged that the 27-member panel Obama appointed, which is dominated by business and finance leaders, isn't diverse enough to be making 'balanced' policy proposals to the president" (Gerstein, 2012). In his dissent, Trumka wrote: "I believe that the Jobs Council's education recommendations begin and end in the wrong place: focusing on providing businesses with an endless supply of workers—as opposed to supporting, improving and sustaining a strong public education system….Some of the policies advocated in the report would move us further from the goal of providing all Americans with a great education that prepares them for life, college and careers (Trumka, 2012, p. 3)."

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