STEMM OPPORTUNITY ALLIANCE

STEMM Equity & Excellence 2050

A National Strategy for Progress and Prosperity

Draft for Public Input

Public Input Period Closes
November 6, 2023
https://stemmopportunity.org/open-comment

AAAS
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

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Executive Summary

The United States has long been a global leader in science, technology, engineering, mathematics, and medicine (STEMM). The U.S. has used this leading position to strengthen national security, overcome diseases, and power an economy that sets global standards. Despite our progress, the challenges we face as we move into the future are more daunting and will require a level of human effort surpassing what we have been able to achieve up until now. Continued excellence in STEMM is essential to the nation's strategy for a winning future.

To meet the challenges that lay ahead, we must greatly expand our talent pool and achieve workforce parity in order to benefit from the brainpower and creativity of groups marginalized and excluded from STEMM education and the workforce. Achieving excellence in STEMM through equity is a national priority – one that requires a shared national strategy for driving systemic change to remove barriers and increase opportunity for all.

Improving equity is not just the right thing to do, it's the smart thing to do. Inequity in STEMM adversely affects the knowledge base and quality of scientific innovation, blunts the impact of science on society, and threatens the health of the nation's society, economy, security, and positioning on the global stage. Cultivating a diverse and sustainable STEMM community presents our best chance to overcome the challenges on the horizon.

While important progress to broaden participation in STEMM has been achieved, that progress has been uneven across groups, fields, and sectors, and simply has not been enough. To create a STEMM ecosystem that is truly equitable and excellent—everyone must be at the table, including government at all levels, industry, workforce, higher education, PreK-12, philanthropy, research and development enterprises, community organizations, and more.

In December 2022, the American Association for the Advancement of Science, in collaboration with the Doris Duke Foundation and the White House Office of Science and Technology Policy, launched the STEMM Opportunity Alliance (SOA) at the White House Summit on STEMM Equity and Excellence. SOA is designed to bring together cross-sector partners to develop a strategic plan for equity and excellence in STEMM and to garner commitments to shared goals and metrics for accountability and progress.

This document outlines that broad national strategy for building a STEMM workforce that expands opportunity and reflects national demographics by 2050. This co-constructed national strategic plan was crafted to leverage our country's talent reservoir through the addition of 10 million new STEMM professionals to the US workforce across all jobs and all sectors. This vision demands decades of concerted, coordinated action. To ensure we are on track, the strategy includes key goals and progress metrics along the way. In addition, there is an outline following the plan for the other factors necessary

to implementation. The challenge is so great, and the imperative so strong, that the nation cannot wait to act—generational change must start today.

Strategy Pillars: The national strategy has 5 key Pillars:

1. **Exposure: Sparking Curiosity in Every Child.** To bring more diverse talent into STEMM requires starting early. Exposure to STEMM throughout childhood is essential to sparking and harnessing curiosity and exploration, and opening pathways to future opportunities.

2. **Inspiration: Developing Skilled and Diverse Educators.** Exposure can open opportunity, but educators inspire. We need far more skilled math and science educators, in both in- and out-of-school learning environments, to meet demand. And we need those educators to reflect the demographics and identities of the students they teach.

3. **Discovery: Creating Opportunity for All in Higher Education.** Higher education provides students the opportunity to gain new skills, knowledge, and experience that can lead to the jobs and industries of the future. However, students from historically excluded and marginalized groups are systematically disadvantaged. We must close the opportunity gap in higher education.

4. **Innovation: Leveraging Diverse Minds in R&D.** Diversity is a catalyst for innovation. We develop new ideas when bright minds perceive problems in different ways or identify creative solutions. But gaps exist in funding and opportunities for researchers from historically excluded communities. We need to bring diverse minds into our research community, to drive innovation and solve the challenges of the future.

5. **Opportunity: Ensuring All Workers Thrive.** Equity will require that all workers have opportunities to thrive in STEMM jobs and careers and in those non-STEMM jobs that employ STEMM skills. Employers, as well as education and training institutions, must ensure that workers have relevant support to address their needs and an inclusive work environment that provides equitable opportunities to participate in and contribute to STEMM innovation throughout their careers.

Foundations for Progress: Across all actions, progress requires accountability and partnership:

- **Accountability and Partnerships: Groundwork for Collaborative Action.** Achieving long-term systems change will require (1) developing and implementing robust accountability measures to track progress and align action and (2) fostering partnerships among public and private institutions and sectors to improve pathways and break down systemic barriers.

Structures for Implementation: To drive implementation, SOA will work with partners to create:

- **New and Renewed Commitments:** Broaden and deepen the movement for change by bringing more partners to the table and collectively making new commitments aligned to the strategy;
- **Coordinating Infrastructure:** Strengthen infrastructure for coordination and action by launching working groups led by anchor partners to drive efforts on discrete workstreams; and,
- **Public-Private Partnerships:** Coordinate and align with government efforts to create the enabling environment that supports change.

As the world continues to grapple with new and unique challenges, it is essential that innovative solutions emerge. Innovation is rooted in the promotion and engagement of a wide range of ideas generated through people's creativity and the diversity of their lived experiences and backgrounds.

America has a wealth of diversity and talent to bring to bear. To propel science and rise to the challenges of tomorrow, it is imperative that committed actors collaborate across public and private sectors to foster a new era of equity and inclusion in the American STEMM ecosystem

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The Focus of this Strategy: STEMM Equity

The STEMM Opportunity Alliance is composed of organizations from across the Science, Technology, Engineering, Mathematics, and Medicine fields. Our partners include universities, nonprofit organizations, philanthropies, professional societies, and private companies representing sectors from biotechnology to finance and more.

The inclusion of medicine, the second "M" in STEMM, is particularly relevant in these efforts given the long history of inequities in the field. For example, the health disparities experienced by historically excluded and marginalized communities during the COVID-19 pandemic are the result of centuries of mistrust and misrepresentation within the medical field as well as the failure of health systems and critical technologies. Historically excluded and marginalized communities have been inordinately dehumanized and exploited in the name of the scientific enterprise. Given this history, the Alliance is committed to the full and deliberate inclusion of medicine, and the health sciences more broadly, to creating a more just society and a more excellent STEMM ecosystem.

STEMM equity is realized in two directions: by removing barriers and increasing opportunities. People can be marginalized by any number of differences such as race, ethnicity, gender, ability status, income, geography, religion, and sexual orientation. Research has greatly demonstrated the impacts of such characteristics which have affected participation in and exclusion from the scientific enterprise. Equity simply means addressing these root causes of injustice while providing the necessary support to allow everyone to fully participate within STEMM.

Introduction: Building a National Strategy for STEMM Equity and Excellence

The 21st century is proving to be one of the greatest eras of scientific and technological innovation in history--a period where such innovation is also critically needed to address global and national challenges. U.S. leadership and excellence in Science, Technology, Engineering, Mathematics, and Medicine (STEMM) promises to serve as a profound engine for progress—with the power to build a stronger and more inclusive American economy and society for the future. Yet this bright future cannot be realized under the shadow of inequity that persists across STEMM fields today, denying opportunity for excluded communities while stunting growth and progress for the nation as a whole. Improving equity in STEMM is a national priority—one that requires a shared national strategy for driving systemic change.

Both historically and currently, entrenched systemic barriers have led to morally unjust and anti-democratic inequities in STEMM fields across race, ethnicity, gender, ability status, income, geography, religion, and sexual orientation. Furthermore, barriers faced by those with intersecting identities are often only more pronounced. By nearly every measure, historically excluded and marginalized communities face less opportunity, less access, and limited outcomes.

Addressing these barriers and inequities is critical to creating better lives and a more just society, while also being essential to ensuring excellence in STEMM. Taking action can fuel innovation and growth while allowing the nation to compete on the global stage. Moreover, STEMM jobs are some of the fastest growing and highest paying occupations. Improved equity in STEMM will help broaden economic opportunity, ensure the country can meet its future talent needs, and keep pace with the rate of economic and technological change.

These challenges are not new, and past and current initiatives to establish greater equity in STEMM have driven real progress. Yet opportunity gaps persist, and the pace of progress remains far too slow to be morally or economically tenable. For too long, organizations have been acting alone, trying to break down systemic barriers that cannot be addressed by single initiatives at single institutions. The change our nation needs requires shared responsibility and coordinated action across all actors throughout the STEMM ecosystem, including government at all levels, philanthropy, industry, educational institutions, professional societies, community leaders, and others.

The current moment promises immense opportunity for change. Major government investments and focus have solidified that the American scientific enterprise is the central pillar of the nation's economic strategy to win the future. But without fundamental changes across the U.S. STEMM ecosystem, these new investments threaten to reinforce and entrench persistent inequities. Never before has the need to improve equity garnered as much interest and attention as it does today—with more and more institutions standing ready to do their part. Combined, these conditions offer great potential to remake American society and economy for the better.

This document outlines a holistic national strategy for achieving equity in STEMM with a goal of

reaching workforce parity in STEMM fields by 2050. This plan is ambitious and comprehensive, because that is what is needed to meet the scale and scope of the challenge. It includes evidenced-based approaches and action steps and offers metrics by which to track progress. Success will require not just deep cross-sector coordination, but sustained commitment and action as well.

Equity and excellence are inextricably linked. American STEMM fields need to be more equitable and inclusive in service of advancing excellence, increasing innovation, and making the nation more prosperous and secure. If achieved, a truly equitable and excellent U.S. STEMM ecosystem will ensure a brighter future for all Americans.

The stakes are high. Failure to create an equitable and excellent STEMM ecosystem will weaken U.S. economic competitiveness, exacerbate the problems plaguing our country like food insecurity and climate change, and slow scientific progress towards a safer, healthier, and more connected world. **The time is now** for an innovative, aligned, and concerted cross-sector effort to reimagine and redesign the U.S. scientific enterprise for a more prosperous future for all.

The Imperative

Diverse and equitable STEMM fields will not just better reflect the nation's fundamental values but will produce tangible results critical to supporting key national priorities. Advancing STEMM equity will:

- **Expand Economic Growth and Opportunity:** The American economy and its people prosper most when opportunity is broadly shared. STEMM jobs are projected to grow more than other sectors, offer higher wages than non-STEMM careers, produce 69 percent of GDP, and generate over $2.3 trillion in federal tax revenue.[1] As jobs become increasingly more technical and technologically connected, the need for STEMM skills and expertise across the economy increases. Removing systemic barriers that keep historically excluded and marginalized populations out of STEMM jobs and strengthening pathways into STEMM careers will promote economic growth while expanding opportunity to meaningful and well-paying occupations.

- **Promote Global Competitiveness and National Security:** Keeping pace and exceeding global competitors in STEMM output is essential for the U.S. to ensure economic growth and national security. But the U.S. is ceding ground to its nearest competitors, particularly China, on key indicators like the rate of STEMM graduates, PhDs, and patents filed.[2] Broadening access and participation in STEMM increases the capacity of the STEMM workforce to react to unique global challenges. Equity in STEMM is critical to achieving the excellence and eminence required to expand the nation's scientific power and remain competitive.

- **Strengthen Scientific Output:** A body of research has demonstrated that diverse and inclusive teams produce the highest quality, most innovative output.[3] In contrast, homogenous teams can lead to weak and ineffective science that fails to consider different needs and perspectives—a problem which has contributed to distrust in science and produced dire consequences like disparate health outcomes and biased technologies. A more equitable and inclusive STEMM ecosystem with multiple pathways for diverse talent will enhance science's relevance, credibility, and value.

- **Develop Healthy and Resilient Communities:** Our communities and our nation face unprecedented challenges including improving access to quality education, providing cutting-edge healthcare, and reaching climate preparedness. Our ability to overcome these challenges will depend on the problem-solving capacity of the STEMM ecosystem to support local and regional innovation, especially equipping communities facing the greatest burden of these challenges to engage in and with science to produce culturally relevant solutions. STEMM research and development will improve U.S. communities' abilities to create innovative, inclusive solutions.

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[1] "STEM and the American Workforce." FTI Consulting, 2020. https://www.fticonsulting.com/~/media/Files/us-files/insights/reports/2020/march/stem-american-workforce.pdf

[2] Zwetsloot, Remcp. "Winning the Tech Talent Competition." Center for Strategic & International Studies, October 2021. https://csis-website-prod.s3.amazonaws.com/s3fs-public/publication/211028_Zwetsloot_Talent_Competition.pdf?CERH1CkKoHqhYHSLVvyn7tNJoNF0KNzw

[3] "Diversity Wins: How Inclusion Matters." McKinsey, May 2020. https://www.mckinsey.com/featured-insights/diversity-and-inclusion/diversity-wins-how-inclusion-matters

The Call to Action

At the first ever White House Summit on STEMM Equity and Excellence on December 12, 2022, the White House Office of Science and Technology Policy (OSTP) called for development of a national strategy for tearing down institutional barriers to STEMM participation and achieving America's full potential.[4] This vision included key elements for what a strategy might achieve:

- Ensure that students, educators, workers, communities, and others have adequate support to participate in and contribute to science and technology throughout their lifetimes.
- Address the STEMM teacher shortage—which disproportionately harms underrepresented students—by investing in a strong and diverse teacher pipeline.
- Close the funding gap and support researchers and communities who have been historically excluded from access to key resources.
- Scale solutions that root out bias, discrimination, and harassment in the classroom, laboratory, and workplace.
- Promote accountability across the science and technology ecosystem.

The administration's message is clear: All actors must come together towards robust, measurable, and ambitious actions that will help empower a new generation of American innovation and opportunity.

To help answer this call, the American Association for the Advancement of Science (AAAS), in collaboration with the Doris Duke Foundation (DDF) and OSTP, launched the STEMM Opportunity Alliance (SOA) to serve as the vehicle for organizing and galvanizing cross-sector alignment and action. In 2023, SOA led a yearlong co-construction process to develop a national strategy for achieving STEMM equity and excellence. The effort began with the development of an initial "strawman" framework which consolidated prevailing literature and best practices. Since then, the Alliance held 11 STEMM Equity summits across the country to solicit insights and feedback on the initial framework from more than 700 leaders from across sectors and all regions of the United States. This included events in:

- **Baltimore, Maryland** hosted by Morgan State University in February,
- **Washington, DC** at the AAAS Annual Meeting in March,
- **New York, New York** hosted by the New York Hall of Science in April,
- **Jacksonville, Florida** at the STEMM Ecosystems Learning Ecosystems Conference in STEM in May,
- **Los Angeles, California** hosted by Snap Inc. in May,
- **Boise, Idaho** hosted by Micron Technology in June,
- **St. Paul, Minnesota** hosted by 3M in August,
- **Chicago, Illinois** hosted by the Museum of Science and Industry, Chicago in August,
- **Atlanta, Georgia** hosted by Spelman College in August,
- **Dallas, Texas** co-hosted by Lyda Hill Philanthropies and the National Math and Science Initiative in October *(upcoming)*, and

[4] "Equity and Excellence: A Vision to Transform and Enhance the US STEMM Ecosystem." The White House, December 2022. https://www.whitehouse.gov/ostp/news-updates/2022/12/12/equity-and-excellence-a-vision-to-transform-and-enhance-the-u-s-stemm-ecosystem/

- **Tempe, Arizona** hosted by Arizona State University in November *(upcoming)*.

The national strategy is the product of this cross-sector national co-construction process. Feedback received in the Alliance's convenings animated the strategy, infusing on-the-ground experiences and ensuring the representation of perspectives from across all sectors.

Concurrently, OSTP has worked across agencies, via the Committee on Science, Technology, Engineering, and Math Education (CoSTEM), to develop a 5-year strategic plan for how the federal government will help advance these goals. The administration's plan will serve as an important complement to the whole-of-ecosystem approaches outlined in this document.

The Strategy: A Blueprint for Workforce Parity by 2050

This framework proposes a target of reaching parity in the STEMM workforce by 2050, by working together to help 10 million people from historically excluded and marginalized communities enter, contribute to, and thrive within STEMM. In this context, parity is defined as access to and thriving within STEMM learning opportunities, fostering a sense of inclusion and belonging in the workplace, pay equity, and much more. This goal is far in the future because it has to be given the scale of the challenge, and anything less than parity would be a failure. Yet, while our work takes a long-term strategic view on the creation of a truly excellent STEMM ecosystem, we engineer our long-term vision into yearly and decadal milestones and goals through the lens of what Dr. Martin Luther King, Jr. called the "fierce urgency of now."

This work must take a holistic approach to the populations, jobs, and sectors it comprises. It must seek to improve access and opportunity for all historically excluded and marginalized communities, including across race, ethnicity, gender, ability status, income, geography, religion, sexual orientation, and intersectional identities. It must target a wide range of occupations, from workers wearing white lab coats to those wearing steel-toed boots. Lastly, it must take a broad view of what defines STEMM sectors—including promoting equitable pathways into industries that are regionally and culturally relevant, such as agriculture and forestry.

Achieving this goal will take time and relies on concerted effort and steady progress. Like building a cathedral, the work required to construct an equitable and excellent STEMM ecosystem will be:

- **Long-Term:** This strategic plan is a blueprint, but it will take generations for the full vision to manifest. That is why this strategy begins by setting a goal for the future that remains decades away, even as work begins immediately and progress is measured each day.

- **Brick-by-Brick:** In comparison to the size of the challenge, any individual action may seem small, but immense long-term change will be achieved through the combination of many actions at once and over time. This requires sustained focus, concerted effort, methodical approach, and shared strategy.

- **A Collective Responsibility:** The scale of this change cannot be made by any single individual or institution operating alone and will require engagement from all corners of the STEMM ecosystem. This extends beyond even SOA and its hundreds of partners that are committed to the cause. Advancing equity requires all of us.

Constructing an Equitable and Excellent Ecosystem

The strategy includes two main elements: Pillars and Foundations. As the work focuses on removing barriers and increasing opportunities via more and improved pathways throughout the entire ecosystem, these Pillars target specific goals and strategies for supporting STEMM learners, educators, and practitioners throughout their lives. For this work to be more than the sum of its parts, it must be also coordinated, aligned, and sustained—requiring a Foundation built on accountability and partnership, with dedicated structures and processes.

Figure 3: Pillars of the National Strategy

The following table summarizes the Foundations and Pillars and names the goals and approaches which underpin each. A more detailed table that includes specific action steps for each approach is included in the Appendix

Table 1: National Strategy Goals, Metrics, and Approaches by Area

Strategy Area	Goals and Key Metrics	Approaches
Accountability & Partnership *Groundwork for Collaborative Action*	*(1) Develop strong systems and processes for measuring equity in STEMM to hold ourselves accountable for progress.* ***Metrics:*** *100% of SOA partners have made public commitments aligned with at least one pillar of the national strategy by 2025; SOA partners have launched a working group for each pillar with detailed metrics for public accountability for the working group's outcomes.*	• Establish data-driven accountability structures that allow interested partners to easily understand progress and hold the community responsible for action. • Improve and coordinate data collection across the STEMM ecosystem to broaden and deepen key metrics.
	(2) Establish key infrastructure for enabling coordination and collaboration across institutions and sectors, with a focus on building and strengthening partnerships. ***Metrics:*** *50% of SOA partners have engaged in new collaborations by 2035 to advance the national strategy goals; SOA has grown to a total of 500 partners by 2042 to advance the alliance's goals.*	• Facilitate knowledge sharing within and among communities of practice across all STEMM sectors. • Create and amplify opportunities for organizations to gather and discuss equity and excellence in the STEMM ecosystem.
Exposure *Sparking Curiosity in Every Child*	*(1) Ensure all schools provide rigorous, high-quality mathematics and science coursework with access to necessary learning supports.* ***Metrics:*** All students have access to, and ¾ of middle school students enroll in algebra courses by 2030*; All high school students have the opportunity to take calculus, physics, and other advanced math courses by 2040.*	• Increase the average amount of time that students spend learning STEMM subjects and the number of accessible, high-quality classes. • Ensure that all secondary school students have access to and are supported in taking STEMM Advanced Placement (AP) courses, registering for dual enrollment classes, or engaging in other rigorous academic program opportunities regardless of school district. • Provide access to modern technologies and resources free-of-charge within all PreK-12 schools and other learning spaces to address the digital divide

	(2) Provide children and their families with equitable access to high-quality STEMM learning experiences, including informal and technology-enabled settings. ***Metrics:*** *A national survey of out-of-school STEMM participation is developed by 2025; The participation gap for historically excluded and marginalized children is cut in half by 2035.*	• Increase access to, and participation in, high-quality informal and community-led STEMM learning opportunities, including equitable partnerships with schools and access to online learning platforms. • Provide ample opportunities for experiential learning so that theoretical and abstract concepts within curriculum are better understood, retained, and applied. • Introduce children and their parents to STEMM careers and the diversity of people in those careers across the range of preparation, from certificate to doctoral education.
Inspiration *Developing Skilled and Diverse Educators*	*(1) Diversify the STEMM educator workforce so that it reflects local and regional demographics.* ***Metrics*** *Double historically marginalized and excluded communities' participation is teacher preparation programs by 2035; Double retention of historically marginalized and excluded mathematics and science educators by 2040.*	• Strengthen incentives and support structures to attract and retain educators from a wide range of diverse and intersecting backgrounds. • Develop improved, evidence-based education norms that define excellent education as inclusive, culturally relevant, assessment-informed, and delivered utilizing the most current evidence-based teaching and learning strategies.
	(2) End the mathematics and science PreK-12 educator shortage. ***Metrics:*** *Reduce the shortfall in mathematics and science educators by one-third in Title 1 schools by 2035; Close shortage across all schools by one-third by 2035.*	• Expand on-ramps to the teaching profession, especially drawing from mid- and late-career professionals with STEMM experience in other sectors. • Create regional systems to assess and track teacher workforce gaps, retention, and representation.
Discovery *Creating Opportunity for All in Higher Education*	*(1) Ensure higher education institutions and their STEMM programs are accessible, inclusive, and designed to support the talent development of all people.* ***Metrics:*** *Cut the admissions gap in half by 2035; Cut the degree granting gap in half by 2040.*	• Ensure all STEMM programs of study are evaluated on the basis of learning effectiveness across all students and departments/colleges establish and make progress toward eradicating achievement and opportunity gaps for their students. • Update and improve student admissions and transfer processes to use legally sustainable and effective strategies to improve access and enrollment for students from historically excluded and marginalized or non-traditional backgrounds. • Connect and credit students with some postsecondary training to 4-year degrees. • Establish proactive and inclusive educational cultures and environments that include transparency, accountability, ongoing measurement and

		assessment, and support for all students, to ensure the success of students from historically excluded and marginalized populations.
	(2) Diversify STEMM faculty by educating, developing, hiring, retaining, and advancing persons from historically excluded and marginalized populations so that faculty can more closely reflect the demographics of the emerging student populations. ***Metrics:*** *All R1 institutions adopt equity and inclusion standards for STEMM graduate programs, and faculty hiring and advancement by 2030; Historically marginalized and excluded communities comprise one-third of STEMM faculty by 2045.*	• Increase efforts to prepare, hire, retain, and support diverse STEMM faculty across scientific disciplines.
Innovation *Leveraging Diverse Minds in R&D*	*(1) Ensure historically excluded and marginalized researchers receive equitable funding and support.* ***Metrics:*** *Double percentage of historically marginalized and excluded scientific review officers by 2030; Cut the funding gap for PIs from historically marginalized and excluded PIs by 2035; Quadruple the number of R1 MSIs by 2045.*	• Increase both federal and private grant funding to researchers from diverse backgrounds, targeting opportunities to build research capacity in support PIs from historically excluded and marginalized groups, including PIs of color, women, PIs with disabilities, and PIs from all sexual orientations and gender identities. • Build STEMM research capacity and infrastructure within MSIs. • Expand diversity of researchers and administrators working in scientific publishing and broader knowledge production. • Expand understanding and adoption of community-led research, education and service initiatives and community-based organizations that are crucial to engaging underserved populations in advancing STEMM.

	(2) Encourage entities in the STEMM R&D ecosystem to utilize robust plans for envisioning and implementing equity. ***Metrics:*** *Half of top 100 patent producers commit to equity and inclusion plans by 2035; All top 100 patent producers share equity and inclusion metrics by 2040.*	• Develop a process for equity reviews of government, philanthropic, and private funding for STEMM research at all decision points. • Implement processes in public and private sector research and development institutions that prioritize identifying and addressing disparities and impacts in STEMM research and development. • Expand the use of equitable and legally sustainable strategies for talent identification, recruitment, hiring, retention, and promotion.
Opportunity *Ensuring All Workers Thrive*	*(1) Identify, hire, retain, develop, and promote persons from historically excluded and marginalized communities in the workplace.* ***Metrics:*** *5 million new STEMM professionals from historically marginalized and excluded groups by 2035; 10 million new STEMM professionals from historically marginalized and excluded groups by 2050.*	• Support workforce development, entry, and re-entry along the multiple STEMM pathways. • Remove barriers that exclude STEMM innovators from historically excluded and marginalized communities in coaching, serving on boards, and when accessing capital to launch new businesses. • Uplift and resource affinity programs for historically excluded and marginalized communities in the workplace.
	(2) Ensure workplaces feel supportive of persons from historically excluded and marginalized communities. ***Metrics:*** *Three-quarters of the top 100 STEMM employers adopt equity and inclusion plans by 2045.*	• Root out bias, discrimination, and harassment in all STEMM workplaces, and support efforts to improve belonging. • Ensure all STEMM companies have robust benefits packages, including parental leave, and other family-friendly policies to support workers. • Deploy rigorous and regular employer-sponsored upskilling programs with clear paths for upward mobility in the workplace.

The below timeline summarizes key milestones tied to the pillars and goals described above:

Table 2: Key Milestones to STEMM Equity

2025	• **Exposure:** A national survey of out-of-school STEMM participation is developed. • **Accountability & Partnership:** 100% of SOA partners have made public commitments aligned with at least one pillar of the national strategy and partners have launched a working group for each pillar.
2030	• **Exposure:** All students have access to, and ¾ of middle school students enroll in algebra courses by 2030. • **Discovery:** All R1 institutions adopt equity and inclusion standards for STEMM graduate programs, and faculty hiring and advancement. • **Innovation:** Double percentage of historically marginalized and excluded scientific review officers.
2035	• **Exposure:** The participation gap for historically excluded and marginalized children is cut in half. • **Inspiration:** Double historically marginalized and excluded communities' participation is teacher preparation programs. • **Inspiration:** Reduce the shortfall in mathematics and science educators by one-third in Title 1 schools • **Inspiration:** Close shortage across all schools by one-third. • **Discovery:** Cut the admissions gap in half. • **Innovation:** Half of top 100 patent producers commit to equity and inclusion plans. • **Opportunity:** 5 million new STEMM professionals from historically marginalized and excluded groups**.** • **Accountability & Partnership:** 50% of SOA partners have engaged in new collaborations to advance the national strategy goals.
2040	• **Exposure:** All high school students have the opportunity to take calculus, physics, and other advanced math courses. • **Inspiration:** Double retention of historically marginalized and excluded mathematics and science educators. • **Discovery:** Cut the degree granting gap in half. • **Innovation:** All top 100 patent producers share equity and inclusion metrics • **Accountability & Partnership:** By 2042, SOA has grown to a total of 500 partners.
2045	• **Discovery:** Historically marginalized and excluded communities comprise one-third of STEMM faculty. • **Innovation:** Cut the funding gap for PIs from historically marginalized and excluded PIs by 2035; Quadruple number of R1 MSIs. • **Opportunity:** Three-quarters of the top 100 STEMM employers adopt equity and inclusion plans.
2050	• **Opportunity:** 10 million new STEMM professionals from historically marginalized and excluded groups.

STEMM Equity and Excellence Foundations

Long-term systemic change will be needed to achieve equity and excellence in STEMM. This transformation cannot be pursued without (1) robust accountability measures to track progress and compel action; and (2) partnerships among institutions and sectors to improve education and career pathways and break down systemic barriers.

The STEMM ecosystem lacks meaningful data and metrics practices needed to hold ourselves and each other accountable for progress. Some organizations don't track data at all, and others utilize their own metrics, leading to limited information overall and often an inability to compare across institutions and sectors. Moreover, sub-par data collection and analysis can perpetuate harmful research practices antithetical to STEMM equity.[5,6] To collectively understand the challenges and track impact, we must do a better job of measuring equity in STEMM. We must collaborate to develop structures and processes across institutions and sectors to support the development of shared education, research, and service metrics that the ecosystem collectively values and wants to improve upon.

Increased infrastructure that supports coordination and collaboration would also accelerate efforts for STEMM equity. Connections across institutions are critical to knowledge sharing, scaling of best practices, and creating more pathways. Partnerships and collaborations are especially essential to the systematic transformation that will be necessary to break down entrenched systemic barriers.

To promote accountability and partnerships in the ecosystem as the foundations of achieving STEMM equity and excellence, the STEMM Opportunity Alliance recommends targeting the following goals:

(1) Develop strong systems and processes for measuring equity in STEMM to hold ourselves accountable for progress.

(2) Establish key infrastructure for enabling coordination and collaboration across institutions and sectors, with a focus on building and strengthening partnerships.

GOAL (1) Develop strong systems and processes for measuring equity in STEMM to hold ourselves accountable for progress.

Key Progress Metrics: 100% of SOA partners have made public commitments aligned with at least one pillar of the national strategy by 2025; SOA partners have launched a working group for each pillar with detailed metrics for public accountability for the working group's outcomes.

➔ **APPROACH** Establish data-driven accountability structures that allow interested partners to easily understand progress and hold the community responsible for action.

- **Working Groups:** Establish a cross-sector working group responsible for co-creating

[5] "Data and Diagnostics to Leave No One Behind" in *Development Co-Operation Report 2018: Joining Forces to Leave No One Behind.* OECD, 2018. https://www.oecd-ilibrary.org/sites/dcr-2018-en/1/1/5/index.html?itemId=/content/publication/dcr-2018-en&_csp_=830abf7c488dcd107b07b1944a8a1cca&itemIGO=oecd&itemContentType=book#execsumm-1

[6] Palid, Olivia et al. "Inclusion in Practice: a systematic review of diversity-focused STEM programming in the United States." *International Journal of STEM Education*, 2023. https://stemeducationjournal.springeropen.com/articles/10.1186/s40594-022-00387-3#Sec21.

accountability structures and processes.

- **Shared Indicators:** Develop shared indicators of progress toward STEMM equity that include all key sectors and use benchmarks to measure success of efforts.

- **Accessible Data Collection:** Increase accessibility of public and private data collection and analysis of progress toward shared goals; Provide increased attention to sharing information with the public in a disaggregated format to determine the effectiveness of actions on all communities, especially those who have been historically excluded and marginalized in STEMM.

- **Accessible Data Analysis:** Publish and widely distribute annual reports assessing the progress made by various sectors in the STEMM ecosystem with callouts to high-impact opportunities.

➔ **APPROACH** Improve and coordinate data collection across the STEMM ecosystem to broaden and deepen key metrics.

- **Descriptive, Relevant Data:** Collect qualitative and quantitative data in a transparent and effective method with options to disaggregate for historically excluded and marginalized populations; Ensure that metrics are reviewed for relevancy and efficacy to actively inform program implementation.

- **Community Involvement:** Work with affected populations to formulate metrics and analyze data, integrating community perspectives into data collection and evaluation and reporting.

- **Impact on Historically Excluded and Marginalized Communities:** Evaluate the short- and long-term impact of STEMM equity implementation strategies on targeted communities.

GOAL (2) Establish key infrastructure for enabling coordination and collaboration across institutions and sectors, with a focus on building and strengthening partnerships.
Key Progress Metrics: 50% of SOA partners have engaged in new collaborations by 2035 to advance the national strategy goals; SOA has grown to a total of 500 partners by 2042 to advance the alliance's goals.

➔ **APPROACH** Facilitate knowledge sharing within and among communities of practice across all STEMM sectors.

- **Communities of Practice:** Regularly convene communities of practice from a variety of STEMM sectors (e.g., industry, education, research, etc.) to discuss and promote effective steps taken to improve equity.

- **Centralized Platforms:** Establish centralized platforms to facilitate knowledge sharing across the STEMM ecosystem, such as a shared database of programs implemented by SOA partners and improved national STEMM data systems.

➔ **APPROACH** Create and amplify opportunities for organizations to gather and discuss equity and excellence in the STEMM ecosystem.

- **Working Groups:** Establish cross-sector working groups that meet on a regular basis to establish, utilize, and iterate on equity action plans in different areas.

- **Leadership and Communications Training:** Provide education on effective leadership and strategic communications to leaders from all parts of the STEMM ecosystem.

STEMM Equity and Excellence Pillars

This strategy for advancing STEMM equity and excellence centers around five key Pillars: Exposure, Inspiration, Discovery, Innovation, and Opportunity.

I. **Exposure:** *Sparking Curiosity in Every Child.* To bring more diverse talent into STEMM requires starting early. Exposure to STEMM throughout childhood is essential to sparking and harnessing curiosity and exploration, and opening pathways to future opportunities. Strategies for impact include increasing time spent in STEMM learning experiences in school and out; improving access to rigorous coursework, such as those provided in AP and dual credit classes; and expanding accessible technology-based learning opportunities.

II. **Inspiration:** *Developing Skilled and Diverse Educators.* Exposure can open opportunity, but educators inspire. We need far more skilled math and science educators, in both in- and out-of-school learning environments, to meet demand. And we need those educators to reflect the demographics and identities of the students they teach. Strategies for impact include strengthening educator retention, creating opportunities for professional development, and expanding on-ramps to the teaching profession.

III. **Discovery:** *Creating Opportunity for All in Higher Education.* Higher education provides students the opportunity to gain new skills, knowledge, and experience that can lead to the jobs and industries of the future. However, students from historically excluded and marginalized groups are systematically disadvantaged. We must close the opportunity gap in higher education. Strategies for impact include reinventing enrollment practices, advancing evidence-based pedagogy to research-based active learning and experiential models – especially research- or inquiry-based and service-learning learning methods, and increasing financial support for HBCUs, HSIs, Tribal Colleges, and other MSIs.

IV. **Innovation:** *Leveraging Diverse Minds in R&D.* Diversity is a catalyst for innovation. We need to bring diverse minds into our research community, to drive innovation and solve the challenges of the future. Strategies for impact include increasing funding to researchers from diverse backgrounds, developing processes for supporting community-led research, and advancing equity in research and development—from supporting innovation infrastructure at HBCUs, HSIs, Tribal Colleges, and other MSIs and furthering diverse community engagement in research and clinical trials.

V. **Opportunity:** *Ensuring All Workers Thrive.* True equity will require that all workers have opportunities to thrive in STEMM jobs and careers and in those non-STEMM jobs that employ STEMM skills. Strategies for impact include supporting workforce entry and re-entry across STEMM pathways; elevating equity-centered entrepreneurs and businesses; and rooting out bias, discrimination, and harassment in workplaces.

Each Pillar is outlined below, with key goals, approaches for achieving them, and specific steps that could be taken. Many will require action by all institutions, and most will demand greater public, private, and philanthropic funding; the outlines provide short lists of potential key actors for each area.

I. Exposure: Sparking Curiosity in Every Child

To bring more diverse talent into STEMM requires starting early. Exposure to STEMM throughout childhood is essential to sparking curiosity and exploration, and opening pathways to future opportunities. But not all children have access to high-quality STEMM learning opportunities. Half of U.S. high schools don't offer calculus, 40 percent don't offer physics, and 35 percent lack other advanced math classes.[7] Schools with a high proportion of Black and Latino students are 10 percent less likely to offer these classes at all.[8] Access to high-quality learning experiences is similarly uneven outside of school, leading children from low-resourced communities and minority backgrounds to be less likely to participate in STEMM focused out of school activities. This lack of access is the result of systemic problems such as inequitable investment in school systems and digital infrastructure, disparities in disciplinary actions, and health challenges affecting children of color, children with disabilities, and those facing other structural disadvantages.

To spark curiosity in every child, the STEMM Opportunity Alliance recommends targeting the following goals:

> *(1) Ensure all schools provide rigorous, high-quality mathematics and science coursework and necessary learning supports.*
> *(2) Provide children with equitable access to high-quality STEMM learning experiences, including in informal and technology-enabled settings.*

Key Actors / Responsible Parties:

- State and local policymakers
- PreK-12 institutions and educators
- Community-based organizations
- Local and regional businesses
- Parents, guardians, and caregivers
- Out-of-School, afterschool, and summer learning programs

GOAL (1) Ensure all schools provide rigorous, high-quality mathematics and science coursework with access to necessary learning supports.
Key Progress Metrics: All students have access to, and ¾ of middle school students enroll in algebra courses by 2030; All high school students have the opportunity to take calculus, physics, and other advanced math courses by 2040.

➔ **APPROACH** Increase the average amount of time that students spend learning STEMM subjects and the number of accessible, high-quality classes.

- **Universal Design:** Invest in universally designed STEMM curriculums and learning spaces so that the greatest number of people can benefit.

[7] "Civil RIghts Data Collection." U.S. Department of Education, Office for Civil Rights, 2018. https://ocrdata.ed.gov/
[8] Ibid.

- **Professional Support:** Create the support needed for school districts to develop and implement inclusive curriculum for STEMM subjects, including but not limited to identifying and addressing funding, teacher quality, and culturally responsive pedagogy.

- **Resource Sharing:** Create resources for open-source learning plans on STEMM materials and support more student-led curricular development in PreK-12 schools.

➔ **APPROACH** Ensure that all secondary school students have access to and are supported in taking STEMM Advanced Placement (AP) courses, registering for dual enrollment classes, or engaging in other rigorous academic program opportunities regardless of school district.

- **Access to Advanced Courses:** Remove barriers and increase encouragement for students of color, students with disabilities, and students facing other structural obstacles to access and success in advanced STEMM courses (e.g., AP courses and dual enrollment).

➔ **APPROACH** Provide access to modern technologies and resources free-of-charge within all PreK-12 schools and other learning spaces to address the digital divide.

- **Broadband Infrastructure:** Invest in high-speed internet infrastructure to build the capacity of schools, communities, districts, and national and regional nonprofit programs to support STEMM learning.

- **Tech Equipment:** Provide students access to high-quality facilities and equipment, such as science and computer labs and in-classroom tools such as tablets and other learning technologies, as well as teach fundamental skills courses exploring how to best leverage the aforementioned equipment.

GOAL (2) Provide children and their families with equitable access to high-quality STEMM learning experiences, including informal and technology-enabled settings.
Key Progress Metrics: A national survey of out-of-school STEMM participation is developed by 2025; The participation gap for historically excluded and marginalized children is cut in half by 2035.

➔ **APPROACH** Increase access to, and participation in, high-quality informal and community-led STEMM learning opportunities, including equitable partnerships with schools and access to online learning platforms.

- **Capacity Building:** Build the capacity of community-led organizations, both grassroots and national, to provide STEMM learning experiences.

- **Asset-Based Approaches:** Invest in efforts to use the human talent and cultural assets of

communities, corporations, small businesses, and government to support a wide array of STEMM learning experiences.

- **Informal Learning Opportunities:** Identify ways to incorporate rigorous, research-based STEMM learning during childhood play and outside of formalized learning settings and support parents and guardians in affirming, creating and participating in informal STEMM learning opportunities for children.

- **Early STEMM Exposure:** Greatly expand the focus of federal investment in the Head Start Program to incorporate early childhood exposure and learning, inclusive of STEMM, that encourages discovery and socio-emotional development.

➔ **APPROACH** Provide ample opportunities for experiential learning so that theoretical and abstract concepts within curriculum are better understood, retained, and applied.

- **Innovative Pedagogy:** Study, support, and implement innovative pedagogical approaches, including work-based learning, project-based learning, and other experiential learning.

- **Experiential Learning:** Develop partnerships between local industry and educational institutions to increase access to relevant experiential learning opportunities.

➔ **APPROACH** Introduce children and their parents to STEMM careers and the diversity of people in those careers across the range of preparation, from certificate to doctoral education.

- **Career Exposure:** Expand and strengthen career fairs, in-class presentations, and work-based learning opportunities to build applied knowledge and professional networks.

- **Uplifting Historically Excluded and Marginalized Professionals:** Support specific efforts to highlight professionals from historically excluded and marginalized groups, to redefine norms around who belongs in STEMM.

- **Connect to Regional Economies:** Support specific efforts to highlight professionals from local areas, tying culturally relevant relationships from a community's educational institutions to local economies.

- **Inclusive STEMM Narratives:** Support efforts to expand STEMM narratives, ensuring trade, agriculture, and other critical occupations are seen and uplifted as valued and viable STEMM career pathways open to all.

II. Inspiration: Developing Skilled and Diverse Educators

Exposure can open opportunity, but educators inspire. We need far more skilled math and science educators, in both in- and out-of-school learning environments, to meet demand. And we need those educators to reflect the demographics and identities of the students they teach. Educator biases and lack of access to diverse educators sway many historically excluded and marginalized students from taking advanced courses. Transforming PreK-12 STEMM education requires developing diverse educators who can represent and inspire children from communities that have been historically excluded from STEMM. We must set these educators up for success by providing them the tools needed to nurture young talent.

To develop skilled and diverse educators, the STEMM Opportunity Alliance recommends targeting the following goals:

> *(1) Diversify the STEMM educator workforce so that it reflects local and regional demographics.*
> *(2) End the mathematics and science PreK-12 educator shortage.*

Key Actors / Responsible Parties:

- State and local policymakers
- Local school districts
- Teaching professionals
- Teaching licensers

GOAL (1) Diversify the STEMM educator workforce so that it reflects local and regional demographics.

Key Progress Metrics: Double historically marginalized and excluded communities' participation is teacher preparation programs by 2035; Double retention of historically marginalized and excluded mathematics and science educators by 2040.

➔ **APPROACH** Strengthen incentives and support structures to attract and retain educators from a wide range of diverse and intersecting backgrounds.

- **Pre-Service Teacher Preparation:** Provide access to affordable, comprehensive, evidence-based pre-service teacher preparation programs.
- **Debt Relief:** Support student loan forgiveness initiatives.
- **Economic Support:** Stabilize funding for public schools.
- **Public Support for Teaching:** Increase positive public support for the teaching profession, including recognition through improved salaries and enhanced valuing of the roles of these professionals in society.

➔ **APPROACH** Develop improved, evidence-based education norms that define excellent education as inclusive, culturally relevant, assessment-informed, and delivered utilizing the most current evidence-based teaching and learning strategies.

- **Healthy Teaching Environments:** Provide students and educators with the services needed to promote and protect their total well-being, including mental health, and to support safe, inclusive, and equitable learning and teaching environments. Implement widely accepted credentials for social emotional learning (SEL) and anti-bias teaching.

- **Collaborative Professional Development:** Create opportunities for professional learning, and leadership along with the opportunity to work collaboratively within and across schools and community led organizations.

- **STEMM Specialization:** Support advanced STEMM certification and advanced credentials for educators.

- **Education-Employer Dialogues:** Creates local, regional, and national forums and channels for employers to connect to educators to inform both curricula and employee expectations.

GOAL (2) End the mathematics and science PreK-12 educator shortage.
Key Progress Metrics: Reduce the shortfall in mathematics and science educators by one-third in Title 1 schools by 2035; Close shortage across all schools by one-third by 2035.

➔ **APPROACH** Expand on-ramps to the teaching profession, especially drawing from mid- and late-career professionals with STEMM experience in other sectors.

- **Expanded Teacher Licensing:** Advocate for and implement policies which increase the flexibility of teacher licensing while maintaining quality standards.

- **Teaching Apprenticeships:** Scale programs for teaching apprenticeships, especially supporting candidates to stay within the profession.

➔ **APPROACH** Create regional systems to assess and track teacher workforce gaps, retention, and representation.

- **Measuring Teacher Shortages:** Create guidance for assessing, tracking, and addressing teacher shortages and representation.

- **Clear Teaching Trajectories:** Create pathways for teacher career advancement and salary increases throughout the STEMM teacher career trajectory, including opportunities for externships to enable educators to gain STEMM industry experience.

III. Discovery: Creating Opportunity for All in Higher Education

Higher education provides students the opportunity to gain new skills, knowledge, and experience that can lead to the jobs and industries of the future. However, students from historically excluded and marginalized groups are systematically disadvantaged.[9,10,11] We must close the opportunity gap for students in higher education. The recent Supreme Court decision striking down affirmative action policies, combined with recent legislative action in several states to limit DEI initiatives at the collegiate level, makes it more difficult for institutions to create equitable pathways for all students.

To create opportunity for all in higher education, the STEMM Opportunity Alliance recommends targeting the following goals:

> *(1) Ensure higher education institutions and their STEMM programs are accessible, inclusive, and designed to support the talent development of all people.*
> *(2) Diversify STEMM faculty by educating, developing, hiring, retaining, and advancing persons from historically excluded and marginalized populations so that faculty can more closely reflect the demographics of the emerging student populations.*

Key Actors / Responsible Parties:

- Postsecondary institutions
- Local officials
- Community organizations
- Professional societies
- Funding agencies

GOAL (1) Ensure higher education institutions and their STEMM programs are accessible, inclusive, and designed to support the talent development of all people.
Key Progress Metrics: Cut the admissions gap in half by 2035; Cut the degree granting gap in half by 2040.

➔ **APPROACH** Ensure all STEMM programs of study are evaluated on the basis of learning effectiveness across all students and departments/colleges establish and make progress toward eradicating achievement and opportunity gaps for their students.

[9] Li, Jing and Scott-Clayton, Judith. "Black-white disparity in student loan debt more than triples after graduation." Brookings Institution, 20 October 2016. https://www.brookings.edu/research/black-white-disparity-in-student-loan-debt-more-than-triples-after-graduation/

[10] Penner, Andrew and Sanabria, Tanya. "Weeded Out? Gendered Responses to Failing Calculus." Social Sciences 6:2, 10 May 2017. https://www.mdpi.com/2076-0760/6/2/47

[11] Thompson, Marissa E. "Who's getting pulled in weed-out courses for STEM majors?" Brookings Institution, 26 July 2021. https://www.brookings.edu/blog/brown-center-chalkboard/2021/07/26/whos-getting-pulled-in-weed-out-courses-for-stem-majors/

- **Systemic Improvement Plans:** Ensure all higher education institutions utilize evidence-based systemic improvement plans to improve outcomes for all, especially focusing on the systemic barriers that have blocked access and success for persons from historically excluded and marginalized communities.

➔ **APPROACH** Update and improve student admissions and transfer processes to use legally sustainable and effective strategies to improve access and enrollment for students from historically excluded and marginalized or non-traditional backgrounds.

- **Audit Enrollment Practices:** Audit student recruitment practices for separate enrollment processes into STEMM degree programs.

- **Holistic Review Enrollment:** Emphasize holistic review including reconsidering the use of historical merit measurements like standardized test scores in the application process (e.g., school exams, ACT/SATs, GREs, MCATs).

- **Partnerships for Student Support:** Build the capacity of community-led organizations to authentically partner in equitable relationships with institutions of higher education to support increased access to STEMM degrees for students from historically excluded and marginalized communities while engaging in research that mutually benefits students, community organizations, and institutions of higher education.

➔ **APPROACH** Connect and credit students with some postsecondary training to 4-year degrees.

- **Seamless Student Transfer:** Create a nationwide system of articulation agreements that allow students to easily transfer in order to find effective STEMM degree pathways.

- **2-year to 4-year Transfers:** Strengthen transitions from 2-year and associate programs into 4-year college degree programs.

- **Military Credit Programs:** Bolster and scale programs that translate military service and training into academic credits at 4-year institutions.

➔ **APPROACH** Establish proactive and inclusive educational cultures and environments that include transparency, accountability, ongoing measurement and assessment, and support for all students, to ensure the success of students from historically excluded and marginalized populations.

- **School and Career Navigation:** Support students with robust 1:1 counseling to decide majors, identify academic supports, and consider career pathways.

- **Suspend Exclusionary Courses:** Replace exclusionary "weed-out" courses with successful research-based approaches that foster STEMM learning at multiple learning levels.

- **Expanded Academic Engagement:** Broaden availability of curricular and co-curricular engagements including corequisite remediation, internships, mentor and sponsorship, peer support groups, undergraduate research opportunities, and more.

- **Effective Reporting Structures and Consequences:** Create safe and reliable reporting structures, and institute appropriate consequences for incidents of bias, discrimination, and harassment.

- **Equity-Centered Professional Development:** Provide instructors with opportunities to learn skills that contribute to creating more inclusive learning environments and value and reward culturally responsive and effective mentorship.

GOAL (2) Diversify STEMM faculty by educating, developing, hiring, retaining, and advancing persons from historically excluded and marginalized populations so that faculty can more closely reflect the demographics of the emerging student populations.

Key Progress Metrics: All R1 institutions adopt equity and inclusion standards for STEMM graduate programs, and faculty hiring and advancement by 2030; Historically marginalized and excluded communities comprise one-third of STEMM faculty by 2045.

➔ **APPROACH** Increase efforts to hire, retain, and support diverse STEMM faculty across scientific disciplines.

- **Pathways into Advanced Education:** Develop tailored and legally sustainable programs to increase diversity among graduate students and postdoctoral fellows by preparing students for success, introducing them to networks, and providing early opportunities for grants.

- **Increased Tenure Pathways:** Provide increased pathways to tenure for faculty from diverse backgrounds, including addressing inequities and barriers in graduate training and postdoctoral programs, especially finance and debt accumulation.

- **Early-Career Supports:** Expand opportunities for early-career funding and holistic support for junior faculty and support them in establishing their research agendas, teaching practice, and university service while advancing their careers in academic science.

- **Vibrant and Inclusive Professional Organizations:** Strengthen professional and affinity organizations to enhance support for tenure and non-tenured faculty across all ranks.

IV. Innovation: Leveraging Diverse Minds in R&D

Diversity is a catalyst for innovation. We develop new ideas when a bright mind perceives a problem in a different way or identifies a creative solution. We need to bring diverse minds into our research community to drive innovation and solve the challenges of the future. However, there are significant inequities in the distribution of research funding. Women, Black and Hispanic individuals, and people with disabilities are exceedingly underrepresented in federally funded research.[12,13] And the colleges and universities that overwhelmingly support historically excluded and marginalized communities have far less funding and infrastructure than do white-serving institutions. For instance, minority-serving institutions (MSIs), emerging institutions, and community colleges receive only a small fraction of all the STEMM research and development funds available each year.[14]

To make sure that post-secondary research institutions, employers, and workforce development programs alike continue to offer pathways for people from historically excluded and marginalized communities to contribute to technological and scientific advancement, these funding gaps must be closed. Overall, there must also be a commitment to ensuring that all entities in the STEMM research and development ecosystem have robust and sustainable diversity, equity, inclusion, and accessibility goals and an achievable plan for meeting them.

To leverage diverse minds in research and development, the STEMM Opportunity Alliance recommends targeting the following goals:

> *(1) Ensure historically excluded and marginalized researchers receive equitable funding and support.*
> *(2) Encourage entities in the STEMM R&D ecosystem to utilize robust plans for envisioning and implementing equity.*

Key Actors / Responsible Parties:

- Public research funders
- Private research funders
- Postsecondary institutions
- State and federal government agencies

GOAL (1) Ensure historically excluded and marginalized researchers receive equitable funding and support.

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[12] Bernard, Marie and Lauer, Mike. "Research Project Grant Funding Rates and Principal Investigator Race and Ethnicity." National Institutes of Health, 15 June 2022. https://diversity.nih.gov/blog/2022-06-15-research-project-grant-funding-rates-and-principal-investigator-race-and-ethnicity

[13] "NIH Shares Data on Investigators with Disabilities/" National Institutes of Health, 1 February 2023. https://www.niaid.nih.gov/grants-contracts/nih-shares-data-investigators-disabilities

[14] Pece, Christopher. "Growth in Federal S&E Support to HBCUs Continues to Lag Behind Increases to All Institutions in FY 2019." National Science Foundation, National Center for Science and Engineering Statistics, 15 July 2021. https://ncses.nsf.gov/pubs/nsf21332

Key Progress Metrics: Double percentage of historically marginalized and excluded scientific review officers by 2030; Cut the funding gap for PIs from historically marginalized and excluded PIs by 2035; Quadruple number of R1 MSIs by 2045.

➔ **APPROACH** Increase both federal and private grant funding to researchers from diverse backgrounds, targeting opportunities to build research capacity in support PIs from historically excluded and marginalized groups, including PIs of color, women, PIs with disabilities, and PIs from all sexual orientations and gender identities.

- **Diversify Leadership:** Include diverse voices in agency leadership positions and, redefine agency agendas in ways that reflect needs and issues across diverse communities; pursue diverse voices to drive innovation and provide opportunities to a wider array of scientists to explore topics, have greater success in success funding, publications, and patenting and creating start-ups.

- **MSI Research Infrastructure:** Invest in the research and innovation infrastructure of HBCUs, TCUs, and other MSIs and research centers.

- **Incubate Nascent Programs:** Provide resources to emerging research institutions, minority-serving institutions, and community-based organizations that offer models and pathways for success, including entrepreneurial success.

➔ **APPROACH** Build STEMM research capacity and infrastructure within MSIs.

- **Government Funding Assistance:** Increase federal and state funding to Historically Black Colleges & Universities (HBCUs), Tribal Colleges & Universities (TCUs), and other Minority-Serving and 2-year Institutions with the aim of increasing these institutions' degree production of STEMM student majors from historically excluded and marginalized populations.

- **Eased Financial Responsibilities:** Reduce the financial burden on students and their families through scholarships, grants, loan forgiveness, and relevant work-study, internship and co-op opportunities. Rally conversation on student loan relief, especially with industry partners reliant on highly skilled workers.

- **Increased Infrastructure for MSIs:** Ensure that MSIs have sufficient capacity and infrastructure, such as experienced grant writers, to make them more competitive for various public and private funding streams and more effective in providing students with research experiences directly and through partnerships.

➔ **APPROACH** Expand diversity of researchers and administrators working in scientific publishing and broader knowledge production.

- **Create Enabling Institutions:** Incentivize and scale successful institutional strategies for supporting students and practitioners from diverse populations to fully participate in STEMM research and development.

- **Support Emerging Diverse Leadership:** Incentivize the inclusion of diverse perspectives among the leadership of academic research institutions, professional STEMM organizations, and scientific journals.

- **Responsive and Inclusive Administration:** Increase diversity among scientific review administrators while simultaneously providing cultural competence education to all scientific reviewers and program officers.

- **Incentivize Board Diversity:** Address the need for diversity among scientific advisors and boards of university-funded start-ups. Incentivize such diversity through investment policies.

➔ **APPROACH** Expand understanding and adoption of community-led research, education and service initiatives and community-based organizations that are crucial to engaging underserved populations in advancing STEMM.

- **Uplift Community Organizations:** Incentivize investment in diverse and inclusive community organizations and scale up successful community-led initiatives focused on supporting STEMM pathways and the overall research enterprise.

- **Resource Community Scientists:** Create opportunities for community scientists to learn about and apply for funding solicitations and grants.

- **Connect Researchers and Communities:** Increase funding for programs and initiatives that facilitate connections and public engagement between researchers and communities through citizen science, crowdsourcing, prize competitions, challenges, clinical trials, and university-community research partnerships.

GOAL (2) Encourage entities in the STEMM R&D ecosystem to utilize robust plans for envisioning and implementing equity.

Key Progress Metrics: Half of top 100 patent producers commit to equity and inclusion plans by 2035; All top 100 patent producers share equity and inclusion metrics by 2040.

➔ **APPROACH** Develop a process for equity reviews of government, philanthropic, and private funding for STEMM research at all decision points.

- **Funding Sustainability:** Ensure the long-term durability of funding and program maintenance, investing in culture change over time, with a focus on retention and continuous improvement, building on opportunities to confront and respond to emerging challenges and to scale successful efforts.

➔ **APPROACH** Implement processes in public and private sector research and development institutions that prioritize identifying and addressing disparities and impacts in STEMM research and development.

- **Working Groups for Equity:** Establish a working group to develop processes to advance equity in research and development, including agenda setting, needs assessments, resource allocation, and the implementation of equity checks and reviews.

- **Equity-Centered Research Oversight:** Support institutions that vet academic and industry research practices, especially adding capacity to educate organizations about equity-centered research practices and organizations holding themselves accountable when they fall short of their goals or fail to comply.

➔ **APPROACH** Expand the use of equitable and legally sustainable strategies for talent identification, recruitment, hiring, retention, and promotion.

- **Legally Sustainable Hiring:** Connect legal experts to organizational leaders and recruiters for training and consultations on equitable talent identification, hiring and retention and advancement.

- **Share Legal Guidance:** Provide opportunities to learn legal strategies that can support equitable talent pathways.

V. Opportunity: Ensuring All Workers Thrive

True equity will require that all workers have opportunities to thrive in STEMM jobs and careers. Yet individuals from various gender, sexual orientation, racial, ethnic, and disability backgrounds are often locked out of high-quality jobs not just due to gaps in opportunity, but also inequitable treatment, bias, and discrimination. For example, studies show that women and Black Americans both report higher rates of discrimination in STEMM workplaces than in non-STEMM.[15] To address these disparities, employers as well as education and training institutions must ensure that employees have relevant support to attend to their needs as well as equal opportunities to participate in and contribute to STEMM innovation throughout their careers.

To ensure all workers thrive, the STEMM Opportunity Alliance recommends targeting the following goals:

> *(1) Identify, hire, retain, develop, and promote persons from historically excluded and marginalized communities in the workplace.*
> *(2) Ensure workplaces act supportively of persons from historically excluded and marginalized communities.*

Key Actors / Responsible Parties:

- Public and private employers
- State and local policymakers
- Regional workforce boards
- Worker advocates and unions
- Community organizations

GOAL (1) Identify, hire, retain, develop, and promote persons from historically excluded and marginalized communities in the workplace.
Key Progress Metrics: 5 million new STEMM professionals from historically marginalized and excluded groups by 2035; 10 million new STEMM professionals from historically marginalized and excluded groups by 2050.

➔ **APPROACH** Support workforce development, entry, and re-entry along the multiple STEMM pathways.

- **Common Sense Standards:** Adopt and implement shared definitions for terms, data collection, and data sharing across employers and industries.

[15] Funk, Cary and Parker, Kim. "Women and Men in STEM Often at Odds Over Workplace Equity." Pew Research Center, 9 January 2018. https://www.pewresearch.org/social-trends/2018/01/09/blacks-in-stem-jobs-are-especially-concerned-about-diversity-and-discrimination-in-the-workplace/

- **Company-Wide Diverse Hiring:** Implement hiring of candidates from diverse populations at all company levels, so that company diversity is reflected in all levels of leadership.

- **Skills-Based Hiring:** Scale skills-based hiring practices and similar routines that demonstrate proficiency as part of evaluating candidates for employment.

- **Support Untraditional Backgrounds:** Encourage employers to hire candidates without traditional educational or previous work experience, and to provide on-the-job training to orient workers to new job skills and responsibilities.

- **Expand Company Mentorship:** Introduce or scale up mentorship programs for all employees, particularly those from historically excluded and marginalized backgrounds.

- **Employer-Sponsored Upskilling:** Encourage employers to sponsor employee's continued education or upskilling.

- **Expand Professional Specialization:** Increase access to STEMM 2-year and certificate/technical programs to upskill America's workforce as well as support for graduate credentialing.

➔ **APPROACH** Remove barriers that exclude STEMM innovators from historically excluded and marginalized communities from coaching, serving on boards, and when accessing capital to launch new businesses.

- **Equity-Centered Accelerators:** Expand start-up, incubator, and accelerator programs, especially ones aimed at expanding and financially supporting entrepreneurship in service of historically excluded and marginalized communities.

- **Demystify Financial Supports:** Enhance education regarding pathways to accessing venture capital and establish programs to connect innovators from historically excluded and marginalized communities with start-up incubators and accelerators. Additionally, monitor program participants to ensure those benefiting from such programs are the intended audience.

➔ **APPROACH** Uplift and resource affinity programs for historically excluded and marginalized communities in the workplace.

- **Authentic Leadership Buy-In:** Garner and demonstrate organizational leadership buy-in and responsiveness to affinity programs.

- **Concretizing Affinity Connections:** Compensate and recognize leadership and attendees for time spent building and participating in affinity and service programs.

GOAL (2) Ensure workplaces feel supportive of persons from historically excluded and marginalized communities.

Key Progress Metrics: Three-quarters of the top 100 STEMM employers commit to transparent job descriptions and career mobility plans by 2030; Three-quarters of the top 100 STEMM employers adopt robust equity and inclusion plans by 2045.

➔ **APPROACH** Root out bias, discrimination, and harassment in all STEMM workplaces, and support efforts to improve belonging.

- **Just Job Descriptions:** Include salary ranges and remove gendered, ableist and ageist language from job descriptions and advertisements to recruit a broader range of applicants.

- **Just Career Mobility:** Mitigate bias in performance evaluations, promotion decisions, and award and recognition selection to promote equitable career advancement and access to leadership positions.

- **Proactive Anti-Harassment:** Establish proactive and inclusive anti-harassment structures that promote transparency, accountability, ongoing measurement and assessment, and support for individuals who have been targets of harassment. Implement consequences for perpetrators of harassment and discrimination while supporting those who've demonstrated allyship.

➔ **APPROACH** Ensure all STEMM companies have robust benefits packages, including parental leave, and other family-friendly policies to support workers.

- **Total Employee Well-Being:** Provide support for critical life events that can occur through the course of a career, such as caregiving, chronic illness, disability and accessibility services, mental health, and pandemic recovery. Offer comprehensive wraparound services to employees juggling multiple responsibilities and/or challenges.

- **Protections from Technological Advances:** Outline protections and plans for employees for job security and dignity from AI and machine learning technologies.

➔ **APPROACH** Deploy rigorous and regular employer-sponsored upskilling programs with clear paths for upward mobility in the workplace.

- **Options for Career Advancement:** Implement regular training during work hours for employees interested in upskilling programs.

- **Clear Job Pathways:** Document and publicize pathways and requirements for career growth in the workplace. Moreover, assess how a diverse set of employees progresses through such pathways.

Implementing the National Strategy

To create the national strategy, the STEMM Opportunity Alliance methodically engaged people from all across the country with diverse backgrounds, giving them the opportunity to share their perspectives on how to best drive equity in STEMM. Partners from a multitude of sectors and communities have signed onto the Alliance and are committed to driving STEMM equity in their respective fields. Those stories and ideas have been carefully accounted for and synthesized into this broader document, pointing to ways that barriers can be removed and opportunities can be made for historically excluded and marginalized communities.

However, none of these efforts and commitments matter if SOA and its partners do not turn these ideas into strategic action. To fully implement the strategy, the STEMM Opportunity Alliance will need:

- **New and Renewed Commitments:** While hundreds of organizations have pledged nearly $2 billion towards advancing STEMM equity, new and current SOA partners must ensure that their contribution matches the strategic priorities and sequencing of actions established in the national strategy. SOA's main purpose is to drive alignment of existing work and funding across the ecosystem, growing the base by generating new and expanded contributions from engaged actors, and by compelling more partners and actors to the table.

- **Coordinating Infrastructure:** Transforming the entire system will surely require everyone to change, but a core set of nonprofits, businesses, philanthropies, educational institutions, and others will need to be assembled to lead coordinated progress towards the specific goals. To drive progress on the strategy's Foundations and on each of the five Pillars, SOA will work with leading organizations in different regions and sectors to launch working groups and partnerships that will serve as organizing infrastructure for deeper planning and action on each workstream. Moreover, existing STEMM equity working groups will be invited into SOA's network to bolster and align efforts. With help from SOA's Advisory Council, these working groups can drive action while tracking and reporting on progress against this plan's key goals and action steps.

- **Public-Private Partnerships:** Government, especially federal entities, must play a central role in efforts in order for success to be feasible. Policies and supports at the federal, state, regional, and local levels are essential prerequisites for action in many areas, while alignment and coordination between public and private efforts are critical for us all to achieve greater shared impact. This plan was developed to work in synergy with the federal government's CoSTEM strategic plan to help build this alignment from the outset. But this coordination must endure across decades, demanding it rise above politics or the priorities of current leaders.

When SOA, its partners and working groups, the government, and the STEMM ecosystem at-large work in tandem, action can be taken comprehensively and at a large enough scale to effect change and achieve STEMM equity and excellence.

Conclusion: Realizing a More Perfect STEMM Ecosystem

Equity and excellence in STEMM are inextricably linked. As science and technology rapidly advance, continued leadership in STEMM promises to serve as a powerful driver of prosperity and progress for the American economy and society for generations to come. But innovation is borne of diverse minds, as different thinkers see the problems with different lenses and offer a range of solutions. America's globally distinct and sustainable competitive advantage is the diversity of its people. Only by leveraging this advantage—centering equity not just as a goal, but as a core strategy for driving excellence and growth—can the country truly reach its full potential.

The bright future STEMM equity offers cannot be attained without coordinated collective action. To meet the ambitious goals laid out in this strategy demands everyone be at the table, including government, philanthropy, industry, educational institutions, communities, and more. Across the STEMM Equity and Excellence Pillars outlined in this document are myriad opportunities for change; all these demand action, and more measures must be considered as well. Actions must be bold and immediate, but also sustained and strategic. Organizations must advance initiatives within their own structures while also seeking partnerships across institutions and sectors. And STEMM equity leaders must serve as evangelists, bringing ever more actors to the movement for change.

Efforts to advance equity in STEMM have for too long been sidelined as a nice to have at the organization level, rather than a need to have across the ecosystem. Today, we must embrace equity as *essential* to achieving shared national priorities.

Appendix

Key Terminology

1. **Diversity**: The act of including individuals from a wide range of social, ethnic, and other backgrounds. Diversity includes members from various races, abilities, incomes, geographies, sexual orientations, genders, and other backgrounds.

2. **Equity**: Eliminating barriers and facilitating the advancement of historically excluded and marginalized groups to achieve success on par with that of historically prioritized groups.

3. **Historically Excluded and Marginalized Community**: Individuals or groups of individuals belonging to backgrounds that have experienced disproportionate discrimination or unfair treatment resulting in unbalanced outcomes in education, opportunity, employment, representation, and more.

4. **Learning Spaces:** Locations where learning takes place – including schools, museums, community organizations, libraries, etc.

5. **Parity**: The status of equality – whether in pay, status, access to opportunities, representation, or other factors. In this context, parity is defined as access to and thriving within STEMM learning opportunities, fostering a sense of inclusion and belonging in the workplace, pay equity, and much more.

6. **Scientific Enterprise:** All economic activities are based in the scientific process, including both academic and commercial processes.

7. **STEMM Ecosystem**: The broad collection of networks, organizations, and individuals committed to the advancement of science, technology, engineering, mathematics, and medicine.

Table 3: Strategy Summary

Strategy Area	Goals and Metrics	Approaches	Steps
Accountability and Partnership *Groundwork for Collaborative Action*	*(1) Develop strong systems and processes for measuring equity in STEMM to hold ourselves accountable for progress.* ***Metrics:** 100% of SOA partners have made public commitments aligned with at least one pillar of the national strategy by 2025; SOA partners have launched a working group for each pillar with detailed metrics for public accountability for the working group's outcomes.*	Establish data-driven accountability structures that allow interested partners to easily understand progress and hold the ecosystem responsible for action.	**Working Groups:** Establish a cross-sector working group responsible for co-creating accountability structures and processes.
			Shared Indicators: Develop shared indicators of progress toward STEMM equity that include all key sectors and use benchmarks to measure success of efforts.
			Accessible Data Collection: Increase accessibility of public and private data collection and analysis of progress toward shared goals; Provide increased attention to sharing information with the public in a disaggregated format to determine the effectiveness of actions on all communities, especially those who have been historically excluded and marginalized in STEMM.
			Accessible Data Analysis: Publish and widely distribute annual reports assessing the progress made by various sectors in the STEMM ecosystem with callouts to high-impact opportunities.
		Improve and coordinate data collection across the STEMM ecosystem to broaden and deepen key metrics.	**Descriptive, Relevant Data:** Collect qualitative and quantitative data in a transparent and effective method with options to disaggregate for historically excluded and marginalized populations; Ensure that metrics are reviewed for relevancy and efficacy to actively inform program implementation.
			Community Involvement: Work with impacted populations to formulate metrics and analyze data, integrating community and indigenous perspectives into data collection and evaluation.
			Impact on Historically Excluded and Marginalized Communities: Evaluate the short- and long-term impact of STEMM equity implementation strategies on targeted communities.

	(2) Establish key infrastructure for enabling coordination and collaboration across institutions and sectors, with a focus on building and strengthening partnerships. ***Metrics:*** *50% of SOA partners have engaged in new collaborations by 2035 to advance the national strategy goals; SOA has grown to a total of 500 partners by 2042 to advance the alliance's goals.*	Facilitate knowledge sharing within and among communities of practice across all STEMM sectors.	**Communities of Practice:** Regularly convene communities of practice from a variety of STEMM sectors (i.e., industry, education, research, etc.) to discuss effective steps taken to improve equity.
			Centralized Platforms: Establish centralized platforms to facilitate knowledge sharing across the STEMM ecosystem, such as a shared database of programs implemented by SOA partners and improved national STEMM data systems.
		Create and amplify opportunities for organizations to gather and discuss equity and excellence in the STEMM ecosystem.	**Working Groups:** Establish cross-sector working groups that meet on a regular basis to establish, utilize, and iterate on equity action plans in different areas.
			Leadership and Communications Training: Provide education on effective leadership and strategic communications to leaders from all parts of the STEMM ecosystem.
Exposure *Sparking Curiosity in Every Child*	*(1) Ensure all schools provide rigorous, high-quality mathematics and science coursework with access to necessary learning supports.* ***Metrics:*** All students have access to, and ¾ of middle school students enroll in algebra courses by	Increase both the average amount of time that students spend learning STEMM subjects and the number of accessible, high-quality classes.	**Universal Design:** Invest in universally designed STEMM curriculums and learning spaces so that the greatest number of people can benefit.
			Professional Support: Create the support needed for school districts to develop and implement inclusive curriculum for STEMM subjects, including but not limited to identifying and addressing funding, teacher quality, and assignment disparities.
			Resource Sharing: Create resources for open-source learning plans on STEMM materials and support more student-led curricular development in PreK-12 schools.
		Ensure that all secondary school students have access to and are supported in taking STEMM Advanced Placement (AP)	**Access to Advanced Courses:** Remove barriers for students of color, students with disabilities, and students facing other structural obstacles to access and success in advanced STEMM courses (e.g., AP courses and dual enrollment).

	2030; All high school students have the opportunity to take calculus, physics, and other advanced math courses by 2040.	courses, registering for dual enrollment classes, or engaging in other rigorous academic program opportunities regardless of school district.	
		Provide access to modern technologies and resources free-of-charge within all PreK-12 schools and other learning spaces to address the digital divide.	**Broadband Infrastructure:** Invest in high-speed internet infrastructure to build the capacity of schools, communities, districts, and national and regional nonprofit programs to support STEMM learning.
			Tech Equipment: Provide students access to high-quality facilities and equipment, such as science and computer labs and in-classroom tools such as tablets and other learning technologies, as well as teach fundamental skills courses exploring how to best leverage the aforementioned equipment.
	(2) Provide children and their families with equitable access to high-quality STEMM learning experiences, including informal and technology-enabled settings. ***Metrics:*** A national survey of out-of-school STEMM participation is developed by 2025; The participation gap for historically excluded and marginalized children is cut in half by 2035.	Increase access to, and participation in, high-quality informal and community-led STEMM learning opportunities, including equitable partnerships with schools and access to online learning platforms.	**Capacity Building:** Build the capacity of community-led organizations, both grassroots and national, to provide STEMM learning experiences.
			Asset-Based Approaches: Invest in efforts to use the human talent and cultural assets of communities, corporations, small businesses, and government to support a wide array of STEMM learning experiences.
			Informal Learning Opportunities: Identify ways to incorporate rigorous, research-based STEMM learning during childhood play and outside of formalized learning settings and support parents and guardians in affirming, creating and participating in informal STEMM learning opportunities for children.
			Early STEMM Exposure: Greatly expand the focus of federal investment in the Head Start Program to incorporate early childhood exposure and learning, inclusive of STEMM, that encourages discovery and socio-emotional development.
		Provide ample opportunities for experiential learning so that theoretical and abstract	**Innovative Pedagogy:** Study, support, and implement innovative pedagogical approaches, including work-based learning, project-based learning, and experiential learning.

		concepts within curriculum are better understood, retained, and applied.	**Experiential Learning:** Develop partnerships between local industry and educational institutions to bring students to facilitate experiential learning.
		Introduce children and their families to STEMM careers and the diversity of people in those careers across the range of preparation, from certificates and vocational programs to doctoral education.	**Career Exposure:** Expand and strengthen career fairs, in-class presentations, and work-based learning opportunities to build applied knowledge and professional networks.
			Uplifting Historically Excluded and Marginalized Professionals: Support specific efforts to highlight professionals from historically excluded and marginalized groups, to redefine norms around who belongs in STEMM.
			Connect to Regional Economies: Support specific efforts to highlight professionals from local areas, tying culturally relevant relationships from a community's educational institutions to local economies.
			Inclusive STEMM Narratives: Support efforts to expand STEMM narratives, ensuring trade, agriculture, and other critical occupations are seen and uplifted as valued STEMM career pathways open to all.
Inspiration *Developing Skilled and Diverse Educators*	*(1) Diversify the STEMM educator workforce so that it reflects local and regional demographics.* ***Metrics:*** Double historically marginalized and excluded communities' participation is teacher preparation programs by 2035; Double retention of	Strengthen incentives and support structures to attract and retain educators from a wide range of diverse and intersecting backgrounds.	**Pre-Service Teacher Preparation:** Provide access to affordable, comprehensive, evidence-based pre-service teacher preparation programs.
			Debt Relief: Support student loan forgiveness initiatives.
			Economic Support: Stabilize funding for public schools.
			Public Support for Teaching: Increase positive public support for the teaching profession, including recognition through improved salaries and enhanced valuing of the roles of these professionals in society.
		Develop improved, evidence-based education norms that	**Healthy Teaching Environments:** Provide students and educators with the services needed to promote and protect their holistic health, including mental health, and to support safe,

	historically marginalized and excluded mathematics and science educators by 2040.	define excellent education as inclusive, culturally relevant, assessment-informed, and delivered utilizing the most current evidence-based teaching and learning strategies.	inclusive, and equitable learning and teaching environments. Implement widely accepted credentials for social emotional learning (SEL) and anti-bias teaching.
			Collaborative Professional Development: Create opportunities for professional learning, and leadership along with the opportunity to work collaboratively within and across schools and community lead organizations.
			STEMM Specialization: Support advanced STEMM certification and advanced credentials for educators.
			Education-Employer Dialogues: Creates local, regional, and national forums and channels for employers to connect to educators to inform both curricula and employee expectations.
	(2) End the mathematics and science PreK-12 educator shortage. ***Metrics:*** Reduce the shortfall in mathematics and science educators by one-third in Title 1 schools by 2035; Close shortage across all schools by one-third by 2035.	Expand on-ramps to the teaching profession, especially drawing from mid- and late-career professionals with STEMM experience in other sectors.	**Expanded Teacher Licensing:** Advocate for and implement policies which increase the flexibility of teacher licensing while maintaining quality standards.
			Teaching Apprenticeships: Scale programs for teaching apprenticeships, especially supporting candidates to stay within the profession.
		Create regional systems to assess and track teacher workforce gaps, retention, and representation.	**Measuring Teacher Shortages:** Create guidance for assessing, tracking, and addressing teacher shortages and representation.
			Clear Teaching Trajectories: Create pathways for teacher career advancement and salary increases throughout the STEMM teacher career trajectory, including opportunities for externships to enable educators to gain STEMM industry experience.
Discovery *Creating Opportunity for All in Higher*	*(1) Ensure higher education institutions and their STEMM programs are accessible, inclusive, and designed to*	Ensure all STEMM programs of study are evaluated on the basis of learning effectiveness across all students and departments/colleges establish and make progress toward eradicating achievement and	**Systemic Improvement Plans:** Ensure all higher education institutions utilize evidence-based systemic improvement plans to improve outcomes for all, especially focusing on the systemic barriers that have blocked access and success for persons from historically excluded and marginalized communities.

Education	*support the talent development of all people.* ***Metrics:*** Cut the admissions gap in half by 2035; Cut the degree granting gap in half by 2040.	opportunity gaps for their students.	
		Update and improve student admissions and transfer processes to use legally sustainable and effective strategies to improve access and enrollment for students from historically excluded and marginalized or non-traditional backgrounds.	**Audit Enrollment Practices:** Audit student recruitment practices for separate enrollment processes into STEMM degree programs.
			Holistic Review Enrollment: Emphasize holistic review including reconsidering the use of historical merit measurements like standardized test scores in the application process (e.g., school exams, ACT/SATs, GREs, MCATs).
			Partnerships for Student Support: Build the capacity of community-led organizations to authentically partner in equitable relationships with institutions of higher education to support increased access to STEMM degrees for students from historically excluded and marginalized communities while engaging in research that mutually benefits students, community organizations, and institutions of higher education.
		Connect and credit students with some postsecondary training to 4-year degrees.	**Seamless Student Transfer:** Create a nationwide system of articulation agreements that allow students to easily transfer in order to find effective STEMM degree pathways.
			2 year - 4-year Transfers: Strengthen transitions from 2-year and associate programs into 4-year college degree programs.
			Military Credit Programs: Bolster and scale programs that translate military service and training into academic credits at 4-year institutions.
		Establish proactive and inclusive educational cultures and environments that include transparency, accountability, ongoing measurement and assessment, and support for all	**School and Career Navigation:** Support students with robust 1:1 counseling to decide majors, identify academic supports, and consider career pathways.
			Suspend Exclusionary Courses: Replace exclusionary “weed-out” courses with successful research-based approaches that foster STEMM learning at multiple learning levels.

		students, to ensure the success of students from historically excluded and marginalized populations.	**Expanded Academic Engagement:** Broaden availability of curricular and co-curricular engagements including corequisite remediation, internships, mentor and sponsorship, peer support groups, undergraduate research opportunities, and more.
			Effective Reporting Structures: Create safe and reliable reporting structures, and institute appropriate consequences for incidents of bias, discrimination, and harassment.
			Equity-Centered Professional Development: Provide instructors with opportunities to learn skills that contribute to creating more inclusive learning environments and value and reward culturally responsive and effective mentorship.
	(2) Diversify STEMM faculty by educating, developing, hiring, retaining, and advancing persons from historically excluded and marginalized populations so that faculty can more closely reflect the demographics of the emerging student populations. ***Metrics:*** All R1 institutions adopt equity and inclusion standards for STEMM graduate programs, and faculty hiring and advancement by 2030; Historically marginalized and excluded	Increase efforts to prepare, hire, retain, and support diverse STEMM faculty across scientific disciplines.	**Pathways into Advanced Education:** Develop tailored and legally sustainable programs to increase diversity among graduate students and postdoctoral fellows by preparing students for success, introducing them to networks, and providing early opportunities for grants.
			Increased Tenure Pathways: Provide increased pathways to tenure for faculty from diverse backgrounds, including addressing inequities and barriers in graduate training and postdoctoral programs, especially finance and debt accumulation.
			Early-Career Supports: Expand opportunities for early-career funding and holistic support for junior faculty and support them in establishing their research agendas, teaching practice, and university service while advancing their careers in academic science.
			Vibrant and Inclusive Professional Organizations: Strengthen professional and affinity organizations to enhance support for tenure and non-tenured faculty across all ranks.

	communities comprise one-third of STEMM faculty by 2045.		
Innovation *Leveraging Diverse Minds in R&D*	*(1) Ensure historically excluded and marginalized researchers receive equitable funding and support.* ***Metrics**:* Double percentage of historically marginalized and excluded scientific review officers by 2030; Cut the funding gap for PIs from historically marginalized and excluded PIs by 2035; Quadruple number of R1 MSIs by 2045.	Increase both federal and private grant funding to researchers from diverse backgrounds, targeting opportunities to build research capacity in support PIs from historically excluded and marginalized groups, including PIs of color, women, PIs with disabilities, and PIs from all sexual orientations and gender identities	**Diversify Leadership:** Include diverse voices in agency leadership positions and, redefine agency agendas in ways that reflect needs and issues across diverse communities; pursue diverse voices to drive innovation and provide opportunities to a wider array of scientists to explore topics, have greater success in success funding, publications, and patenting and creating start-ups.
			MSI Research Infrastructure: Invest in the research and innovation infrastructure of HBCUs, TCUs, and other MSIs and research centers.
			Incubate Nascent Programs: Provide resources to emerging research institutions, minority-serving institutions, and community-based organizations that offer models and pathways for success.
		Build STEMM research capacity and infrastructure within MSIs.	**Government Funding Assistance:** Increase federal and state funding to Historically Black Colleges & Universities (HBCUs), Tribal Colleges & Universities (TCUs), and other Minority-Serving and 2-year Institutions with the aim of increasing these institutions' degree production of historically excluded and marginalized STEMM majors.
			Eased Financial Responsibilities: Reduce the financial burden on students and their families through scholarships, grants, loan forgiveness, and relevant work-study, internship and co-op opportunities. Rally conversation on student loan relief, especially with industry partners reliant on highly skilled workers.
			Increased Infrastructure for MSIs: Ensure that MSIs have sufficient capacity and infrastructure, such as experienced grant writers, to make them more competitive for various public and private funding streams and more effective in providing students with research experiences directly and through partnerships.

		Expand diversity of researchers and administrators working in scientific publishing and broader knowledge production.	**Create Enabling Institutions:** Incentivize and scale successful institutional strategies for supporting students and practitioners from diverse backgrounds to fully participate in STEMM research and development.
			Support Emerging Diverse Leadership: Incentivize the inclusion of diverse perspectives among the leadership of academic research institutions, professional STEMM organizations, and scientific journals.
			Responsive and Inclusive Administration: Increase diversity among scientific review administrators while simultaneously providing culturally aware education to all scientific review and program officers.
			Incentivize Board Diversity: Address the need for diversity among scientific advisors and boards of university-funded start-ups. Incentivize such diversity through investment policies.
		Expand understanding and adoption of community-led research, education and service initiatives and community-based organizations that are crucial to engaging underserved populations in advancing STEMM.	**Uplift Community Organizations:** Incentivize investment in diverse and inclusive community organizations and scaling up successful community-led initiatives focused on supporting STEMM pathways and the overall research enterprise.
			Resource Community Scientists: Create opportunities for community scientists to learn about and apply for funding solicitations and grants.
			Connect Researchers and Communities: Increase funding for programs and initiatives that facilitate connections and public engagement between researchers and communities through citizen science, crowdsourcing, prize competitions, challenges, and university-community research partnerships.
	(2) Encourage entities in the STEMM R&D ecosystem to utilize robust plans for envisioning and	Develop a process for equity reviews of government, philanthropic, and private funding for STEMM research at all decision points.	**Funding Sustainability:** Ensure the long-term durability of funding and program maintenance, investing in culture change over time, with a focus on retention and continuous improvement, building on opportunities to confront and respond to emerging challenges and to scale successful efforts.

	implementing equity. ***Metrics:*** Half of top 100 patent producers commit to equity and inclusion plans by 2035; All top 100 patent producers share equity and inclusion metrics by 2040.	Implement processes in public and private sector research and development institutions that prioritize identifying and addressing disparities in STEMM research and development.	**Working Groups for Equity:** Establish a working group to develop processes to advance equity in research and development, including agenda setting, needs assessments, and the implementation of equity checks and reviews.
			Equity-Centered Research Oversight: Support institutions that vet academic and industry research practices, especially adding capacity to educate organizations about equity-centered research practices and holding organizations accountable which fail to comply.
		Expand the use of equitable and legally sustainable talent identification, recruitment, hiring, retention, and promotion strategies.	**Access to Legal Expertise:** Connect legal experts to organizational leaders and recruiters for training and consultations on equitable talent identification, hiring and retention and advancement.
			Share Legal Guidance: Provide opportunities to learn legal strategies that can support equitable talent pathways.
Opportunity *Ensuring All Workers Thrive*	*(1) Identify, hire, retain, develop, and promote persons from historically excluded and marginalized communities in the workplace.* ***Metrics:*** 5 million new STEMM professionals from historically marginalized and excluded groups by 2035; 10 million new STEMM professionals from historically marginalized and	Support workforce development, entry, and re-entry along the multiple STEMM pathways.	**Common Sense Standards:** Adopt and implement shared definitions for terms, data collection, and data sharing across employers and industries.
			Company-Wide Diverse Hiring: Implement hiring of candidates from diverse populations at all company levels, so that company diversity is reflected in all levels of leadership.
			Skills-Based Hiring: Scale skills-based hiring practices and similar routines that demonstrate proficiency as part of evaluating candidates for employment.
			Support Untraditional Backgrounds: Encourage employers to hire candidates without traditional educational or previous work experience, and to provide on-the-job training to orient workers to new job skills and responsibilities.
			Expand Company Mentorship: Introduce or scale up mentorship programs for all employees, particularly those from historically excluded and marginalized backgrounds.

	excluded groups by 2050.		**Employer-Sponsored Upskilling:** Encouraging employers to sponsor employee's continued education or upskilling.
			Expand Professional Specialization: Increase access to STEMM 2-year and certificate/technical programs to upskill America's workforce.
		Remove barriers that exclude STEMM innovators from historically excluded and marginalized communities from coaching, serving on boards, and when accessing capital to launch new businesses.	**Equity-Centered Accelerators:** Expand start-up incubator and accelerator programs, especially ones aimed at expanding and financially supporting social entrepreneurship in historically excluded and marginalized communities.
			Demystify Financial Supports: Enhance education regarding pathways to accessing capital and establish programs to connect innovators from historically excluded and marginalized communities with start-up incubators and accelerators. Additionally, monitor program participants to ensure those benefiting from such programs are the intended audience.
		Uplift and resource affinity programs for historically excluded and marginalized communities in the workplace.	**Authentic Leadership Buy-In:** Garner and demonstrate organizational leadership buy-in and responsiveness to affinity programs.
			Concretizing Affinity Connections: Compensate and recognize leadership and attendees for time spent building and participating in affinity and service programs.
	(2) Ensure workplaces feel supportive of historically excluded and marginalized communities. ***Metrics:*** Three-quarters of the top 100 STEMM employers commit to transparent job descriptions and	Root out bias, discrimination, and harassment in all STEMM workplaces, and support efforts to improve belonging.	**Just Job Descriptions:** Include salary ranges and remove gendered, ableist and ageist language from job descriptions and advertisements to recruit a broader range of applicants.
			Just Career Mobility: Mitigate bias in performance evaluations, promotion decisions, and award and recognition selection to promote equitable career advancement and access to leadership positions.
			Proactive Anti-Harassment: Establish proactive and inclusive anti-harassment structures that promote transparency, accountability, ongoing measurement and assessment, and support for individuals who have been targets of harassment. Implement consequences for perpetrators of harassment and discrimination while supporting those who've demonstrated allyship.

	career mobility plans by 2030; Three-quarters of the top 100 STEMM employers adopt robust equity and inclusion plans by 2045.	Ensure all STEMM companies have robust benefits packages, including parental leave, to support workers.	**Total Employee Well-Being:** Provide support for critical life events that can occur through the course of a career, such as caregiving, chronic illness, disability and accessibility services, mental health, and pandemic recovery. Offer comprehensive wraparound services to employees juggling multiple responsibilities and/or challenges.
			Protections from Technological Advances: Outline protections and plans for employees for job security and dignity from AI and machine learning technologies.
		Deploy rigorous and regular employer-sponsored upskilling programs with clear paths for upward mobility in the workplace.	**Options for Career Advancement:** Implement regular training during work hours for employees interested in upskilling programs.
			Clear Job Pathways: Document and publicize pathways for career growth in the workplace. Moreover, assess how a diverse set of employees progresses through such pathways.