Recommendations Across the Lifecycle for

Direct Partnerships with the Directorate for STEM Education

A Report to the

Directorate for STEM Education

by the

NSF Federal Advisory Committee for Education and Human Resources

Subcommittee on Leveraging Partnerships to Reach the Missing Millions

May 28, 2023

Not Yet Accepted by the EHR Advisory Committee at an open meeting on June 1, 2023

Leveraging Partnerships to Reach the Missing Millions

I.   Background Information

The U.S. National Science Foundation (NSF) Directorate for STEM Education (EDU), formerly the Directorate for Education and Human Resources (EHR), works to develop a well-informed citizenry and a diverse and capable workforce of scientists, technicians, engineers, mathematicians, and educators. Both, **direct external partnerships** (e.g., with other U.S. Federal agencies, industry, private foundations) and **catalyzed partnerships** (e.g., stimulated indirectly through programs that require or encourage grantees to work in collaboration with non-academic entities), can contribute to the attainment of these goals. These two types of partnerships (illustrated in Figure 1) are described more fully in the 2021 *NSF Partnerships: Landscape Study.*[1]

Figure 1. Schematic of NSF Partnerships

NSF Direct Partnerships
• Interagency (U.S. government)
• Industrial
• Private foundation and NGO
• International

NSF Catalyzed Partnerships
NSF Expects grantees to work with non-grantee partners
Ex: Advanced Technology Education (ATE), Racal Equity, Established Project to Stimulate Competition (EPSCoR)

Schematic of NSF Partnerships
(Modified from NSF's Landscape Study of Partnerships)

During the Spring 2019 EHR Advisory Committee (AC)[2] meeting and all subsequent AC meetings to date, the Committee considered the role partnerships could play in broadening STEM participation at every juncture of education and the workforce. Past discussions in the directorate yielded the idea of forming a new, short-term subcommittee. It was determined that a short-term EHR-AC Subcommittee charge to provide recommendations on pathways that advance partnerships intentionally focused upon broadening participation (i.e., reaching the missing millions) would be useful to the directorate (see Figure 2). The Subcommittee on Leveraging Partnerships to Reach the Missing Millions was established in January 2023. The Subcommittee met twice, in February 2023 and May 2023 to consider key issues facing partnerships, in general, and direct partnerships, specifically, including how to assure optimal selection and use of partnerships to achieve directorate level goals. This document summarizes those

---

[1] See the National Science Foundation's *NSF Partnerships: Landscape Study* (NSF 21-201), available online at https://www.nsf.gov/pubs/2021/nsf21201/nsf21201.pdf.

[2] While the Directorate was renamed early in Fiscal Year 2023, the Advisory Committee's charter renewal and name change do not become effective until June 28, 2023, so this report refers throughout to the EHR AC.

discussions and the Subcommittee's recommendations, which will be presented to the full EHR-AC during its Spring 2023 meeting. Appendix B contains a list of EHR AC members who participated in this subcommittee.

Figure 2. Subcommittee charge

> The EHR-AC Subcommittee on Leveraging Partnerships to Reach the Missing Millions in STEM is charged with the preparation of a recommendation report to the EHR-AC that offers advice on policies, practices, processes, and programs that can advance the use of partnerships with the directorate and across programs to reach the missing millions in STEM.

II.   Summary of Emerging Themes from Meeting 1

Prior to their February meeting, Subcommittee members read key NSF documents[3] and reflected upon questions including where partnerships make the most the sense and with whom.

Having considered these questions, the Subcommittee was encouraged to offer the Directorate recommendations for developing an EDU partnership strategy that builds on Foundation-wide efforts to encourage and guide partnership development[4] and

- Enhances the Directorate's capacity to realize the goals of Missing Millions[5], that is to broaden participation in STEM such that the US STEM workforce is representative of the US population,
- Keeps EDU's vision, mission, and goals central,
- Realizes a "gestalt" that is the whole is greater than the sum of the parts, (i.e., partnerships that take EDU places where it cannot go alone), and
- Assures that the time and resources needed to achieve the outcome is reasonable, efficient, and worth it.

Themes from the first meeting discussion

Reaching the missing millions will require that the nation builds capacity and infrastructure in institutions and communities that serve these students. The Subcommittee suggested a pair of general considerations for forming partnerships.

- **Partnership types will be varied.** The Subcommittee discussed varying forms of partnerships, some ongoing, which could facilitate targeted gains. Examples include:
  - Focus on longer-term partnership commitments that lead to systemic change to strengthen the organizations, institutions, and communities that support those individuals.
  - Make use of the NSF Regional Innovation Engines[6] designed to increase funding and innovation, particularly in U.S. geographic regions that have not participated in STEM ecosystem advances.

---

[3] NSB (2020) *National Science Board Vision 2030* (NSB-2020-15) available online at National Science Board Vision 2030 (nsf.gov); NSF (2021) *National Science Foundation's Partnerships: Landscape Study* (NSF 21-201), available online at https://www.nsf.gov/pubs/2021/nsf21201/nsf21201.pdf.

[4] As an example: "Expand public and private partnerships to enhance the impact of NSF's investments and contribute to American economic competitiveness and security" can be found in the NSF Strategic Plan for Fiscal Years (FY) 2018-2022, *Building the Future: Investing in Discovery and Innovation* (NSF 18-045), available online at https://www.nsf.gov/pubs/2018/nsf18045/nsf18045.pdf

[5] NSB (2020) *National Science Board Vision 2030* (NSB-2020-15), page 17

[6] Additional information on NSF's Regional Innovation Engines can be found here: Regional Innovation Engines | NSF - National Science Foundation

o   Explore partnerships that deliver innovations for teaching and learning to enable implementation and sustainability to have lasting positive impacts.

- **Incentivize partnership formation.** Partnerships require time, effort, and staffing. Efforts to incentivize partnership participants from industry, government agencies, and NGOs may be needed. This is particularly true for participants from resource-limited organizations.

III.   Four Areas that May Benefit from Partnerships

The Subcommittee identified four areas that may benefit from partnerships. They are:

1. **Supporting Healthy STEM Ecosystem and Infrastructure.** A healthy STEM ecosystem that reaches the missing millions depends on broadly available learning opportunities, PreK – Post-graduate, delivered by a diverse and stable STEM education workforce. The nation continues to struggle to nurture such an ecosystem due to persistent social inequities, poor professional conditions, and lack of societal will to invest in improvements. Targeted efforts to secure infrastructure is needed across the U.S. to coordinate, monitor, and evaluate multiple efforts for positive collective impact.

2. **Expanding Workforce that Support Students.** Partnerships could be used to advance the K-12 STEM teacher workforce as well as undergraduate faculty. This can include replenishing, diversifying, and engaging research faculty who prepare students for advanced STEM fields. This can then assist in expanding the pool of well-prepared students to enter the STEM workforce.

3. **Supporting Evidence Supported Practices.** EDU investments have led to the identification of numerous evidence-based practices that have the potential to reach the missing millions (e.g., authentic problem-based learning, service learning.**)** Partnerships could have a role in expanding such practices to more communities, K-12 schools, and institutions of higher education.

4. **Recognizing Mathematics as the Cornerstone of STEM.** Mathematics is the foundational language needed for success in many STEM disciplines. Low math performance as well as limited access to trained math teachers continues to be a challenge in schools, particularly those which support the missing millions. Partnerships have the potential to address this persistent challenge for which the pandemic has made worse particularly in low-resourced communities.

IV.   Partnership Types that Support Identified Needs

The Subcommittee considered both direct partnerships (with NSF), and indirect partnerships (catalyzed by NSF).

1. With respect to *direct* partnerships (e.g., with industry, other governmental organizations, and NGOs) the Subcommittee suggested that EDU:
   o   Explore a variety of partnerships that impact capacity and infrastructure for systemic change, working beyond the support of individuals to the support of the institutions and communities that serve them.

   o Pay particular attention to partnerships that can facilitate the link between research/innovation and practice/application.

2. With respect to **catalyzed** partnerships which specific programs across EDU often encourage or require between groups in the STEM ecosystem, the Subcommittee suggested that EDU:
   o Incentivize regional collaboration among educational institutions around technology hubs for workforce development.
   o Incentivize collaboration to pair work/service with learning (education, industry, community organizations).

V. Critical Characteristics of Successful Partnerships

While noting there are few absolutes (partnerships can be established and thrive under very different frameworks), the Subcommittee noted successful partnerships often share at least some of the following characteristics:

- a clear statement of purpose and commitment of time and resources for action,
- community empowerment,
- mutually beneficial (equitable/bilateral, win/win – our gain is your gain),
- institutional capacity to start, implement, and sustain the relationship, and
- a well-defined partnership lifecycle.

EDU created a partnership life cycle (Figure 3) from the information gleaned in the first meeting of the Subcommittee. EDU then brought this lifecycle to the Subcommittee, who then considered it in the second meeting. This Partnership Life Cycle has six phases that though, in general are temporally related, some phases can take place simultaneously and/or may need to be repeated throughout a process. Central to those six phases is relationship building and effective communication.

Figure 3. Phases of the Partnership Life Cycle

VI.   Key Stages in the Lifecycle of Direct Partnerships: Meeting 2

The Subcommittee's second meeting focused on NSF direct partnerships; (described above). Members shared and discussed their perspectives on key considerations for EDU in pursuing and maintaining direct partnerships at the following four stages of the partnership lifecycle:

- Identifying opportunities,
- Identifying prospective partners,
- Assessing and adjusting, and
- Decisions to continue, scale up, revise, or retire.

Key issues for EDU's consideration are summarized below.

Phase 1: Identify Opportunities

The Subcommittee recommended several issues for EDU's consideration in identifying (and deciding whether to pursue) partnership opportunities.

- **Problem Definition.** NSF needs to be clear about the nature of the opportunity, and clearly articulate it.

- **Priority.** High-priority problems need to be identified. Such problems need to be within NSF's scope to solve and be worth the cost of going into a partnership to solve. The need for timeliness and/or time constraints of opportunities should be factored into determining if an opportunity is appropriate for a partnership.

- **Approach.** Optimal opportunities should provide a clear method for defining roles and responsibilities with potential partners.

- **Scale.** The size and extent of the partnership engagement need to be considered. For some partnerships, beginning with a pilot project may make sense, while other partnerships may be ready for more extensive involvement. "Right sizing" the involvement needs to be ascertained.

- **Benefit.** Partnerships need to define benefits, and benefits should go beyond just money, and instead seek tangible increases in Intellectual Merit and/or Broader Impacts.

- **Competition.** The partnership needs to be necessary for goal achievement if it is to be undertaken. Also of consideration is the identification of any potential downsides or tradeoffs to engaging in a partnership vs. taking an alternative approach to achieve the intended goal.

- **Partner Attributes.** As identified in the next phase (Phase 2), partner attributes need to be explored in determining partnership opportunities.

- **Relationship Attributes.** Trust is critical. Trust is often established through relationships (e.g., between NSF and others), and as such may require time to build ahead of a formalized partnership. Organizations need to exhibit a willingness to enter into cooperative agreements or MOUs that establish ground rules and expectations for the partnership.

- **Clear Expectations.** This should include timelines, credit, ownership of work, expectations regarding public communication (e.g., what can and cannot be said.), and a "no-drama" exit plan.

Phase 2: Identify Prospective Partners

NSF in general and EDU, in particular, may benefit from considering the following attributes in identifying prospective partners:

- **Mission Alignment.** An organization's mission and its level of alignment with both that of NSF, as well as those centered around the partnership should be evaluated. When the mission aligns in both word and historical action, particularly in an inclusion or equity space, fewer challenges may arise. Careful consideration should be given to potential difficulties that may be encountered when prospective partnering organizations have competing and/or rigid ideologies that might inhibit an optimal relationship.
- **Effective Leadership.** NSF should seek recognized leaders in equity and access efforts with a collectivist mindset.
- **Brand and Reputation.** EDU may desire to seek organizations noted for student-focused caring, authenticity, and scientific rigor in critical areas of STEM particularly as it relates to diversity, equity, inclusion and access (DEIA) goals. The partnership's brand and reputation should be one that strengthens public trust in the partnership with NSF.

- **Creative, critical, and compassionate problem solvers.** Prudent risk takers, that are forward, flexible, and innovative in their thinking, particularly regarding subgroup differences, should be sought for partnerships.
- **Experience with Targeted Populations.** Partnerships should be entered with organizations that have demonstrated ability, staffing, and financial infrastructure to build mutually beneficial, authentically reciprocal relationships with MSIs and/or historically underserved communities to advance STEM education.
- **Value Proposition**. In identifying potential partners, NSF should seek partnerships that have the potential to increase Intellectual Merit and Broader Impacts. Consideration of what could be gained or what may be compromised if entering a partnership should be identified and weighed. Seeking partnerships that expand NSF's engagement in new areas (e.g., PIs, institutions, regions of the country) should be encouraged.
- **Capacity and Stability of the Partnering Institution**. Such attributes should be sought, as in doing so it increases the ability for the partnering team members to carry out, with long term commitment and consistency, the plans of the partnership for the purpose of achieving the intended goals.

Phase 5: Assess and Adjust

- **General Signs from the Field.** The partnership and its outcomes are being discussed, both formally in the literature and publications, but also through more informal settings. The general tenor of the discussion should be favorable if the partnership goes well.

- **Project-Specific Established Metrics and Methods.** Such metrics would be identified ahead of time and agreed upon by all stakeholders. This process may require the use of an external evaluator in gathering data (e.g., student learning), data analytics, and interpretation.

- **Organizational Objectives are Met or Exceeded.** All partners can map the outcomes, goals and metrics to each other's business objectives, and there is evidence that organizational goals/objectives are being met or exceeded.
- **Leadership Evidence.** There is evidence of a collective mindset and a collaborative approach to the partnership. Leadership from all partners demonstrates levels of active engagement. Leaders are effective at communicating vision, requirements, and constraints surrounding the partnership as well as the decision-making process.
- **Metric Adjustments Across Partnership Lifecycle.** As a partnership advances through the lifecycle, metrics should be adjusted as appropriate to provide the most up-to-date and illuminating evidence that provides feedback for future directions.

- **Partnership Well-being Metrics.** Applying organizational well-being measures to the partnership may provide an indication that team members are feeling valued and involved, that meta-decision making is high, and two-way communication pathways are effective. There should be value congruency among all constituents, such that the actions and efforts of the project align with organizational vision.

Phase 6: Continue, Scale Up, Revise, or Retire

- **Evidence to Continue.** Partnerships should be continued when there is evidence that they are healthy and meet the characteristics described under Phase 2 listed above. Additionally,

partners should leverage each other's strengths. Evidence that goals are being met, and that enthusiasm and excitement remain is a key sign that a partnership should continue. It is also important that partners be open to revising goals as a partnership matures.

- **Signs to Scale**. Subcommittee members encouraged EDU to consider the extent to which there is demand from the field before committing to scale-up efforts. Though not necessarily sufficient for scaling, it is necessary that leadership be actively engaged with stakeholders prior to consideration of further scaling efforts. Another indicator of scale-up potential is a desire among the current partners to increase the number of collaborating organizations in a way that expands impact. Of course, one should consider the feasibility of scaling a project (e.g., available resources) ahead of such efforts.

- **Method for Achieving Success through Scaling.** Two-way, effective communication remains critical. Collective impact and networking of grantees is critical, as well. Partnerships can benefit from creating a scaling-appropriate evaluation protocol that enables adjustment along the way, when dealing with differing groups and populations. Engaging the public and broad level care-holder to assure their understanding of why this is important will increase scaling success.

- **Signs to Consider It Is Time to Revise a Partnership.** When communication breaks down because of a lack of shared language, mixed signals, and/or confusion among grantees as to what is expected, this could indicate a time for significant revision. If regular check-ins with partners are unproductive, and there is no clarity of the goals or understanding of why the partnership exists, this could signify that a partnership needs to be revised.

- **Approaches to Consider in Making Change.** Creating an agreed upon timeline/ Gantt chart with identified roles and responsibilities could help clarify partnership outcomes. In doing so, progress could be assessed based on that agreed upon timeline. This will enable pivoting (particularly data informed revisions). Such expected use of the timeline should be made clear at the start of a partnership. While it is desirable for partnerships to be guided by democratic principles, in practice it can be hard for all members to agree on a proposition for a revision, particularly if the revision is significant. Good leadership is critically important when hard decisions need to be made.

- **Signs to Consider It Is Time to Retire the Partnerships:** When the goals of the partnership have been met, sunsetting the partnership can be celebrated. If the goals of a project have not been met in the target timeframe, and the project seems to have stalled despite efforts to revive it, it may be time to consider retiring the partnership. A lack of or changes in characteristics identified in Phase 2 could signal that a relationship will have limited productivity, thus retirement should be considered. This is particularly true if a lack of trust develops. Tightening of resources that impede progress could signal a time to retire the partnership, as well.

- **Approaches to Consider When Ending a Partnership:** Jointly establishing, at the outset, criteria and a pathway for sunsetting a partnership is one of the best ways to assure a smooth conclusion to a partnership. Ideally, a healthy exit concludes a partnership by documenting and appropriately disseminating information on its legacy and lessons learned and maintains communication for the purpose of keeping a heathy, non-partner, relationship active.

VII.   Recommendations

Based on its deliberations, the Subcommittee offers five recommendations for EDU to consider in its efforts to continue building and maintaining direct partnerships. These recommendations are pertinent to direct partnerships in general, not only those designed to advance EDU/NSF efforts to reach the missing millions.

Recommendation 1: Relationships must be built upon trust.

A necessary condition for two entities to engage in a successful partnership is an established relationship built on trust. The entities must both get to know one another and learn that they can trust one another to follow through on their commitments. Building such relationships takes time and investment. Even before specific opportunities for partnerships present themselves, EDU might consider bolstering its efforts to initiate relationship-building with potential industry, NGO, international, and other Federal agency partners to build common understanding, a spirit of reciprocity, and mutual trust.

There may be opportunities for EDU to partner with organizations with limited financial resources, but which bring unique expertise and authenticity for service to a particular community. Relationship-building is so important that EDU may want to consider providing financial support for less well-resourced organizations so that people within the proposed partner organization can devote the necessary time to building a trusting relationship. These kinds of efforts can expand potential partners into areas that are more apt to reach the missing millions.

Recommendation 2: Engage in actions to assure mission alignment among partners.

Entities more naturally gravitate toward establishing partnerships when they develop a common understanding about and language for the problems that might be better addressed collectively than individually. Given an established relationship of trust, partner organizations can work toward aligning their goals and objectives with the work of the partnership and come to realize that what each gives up individually is offset by the potential benefit of working collaboratively.

Federal agencies already well-aligned with NSF's mission and/or sharing common goals with respect to broadening participation in STEM may have great potential as prospective partners. Interagency efforts are often received favorably by rural or under resourced communities that might not have the capacity to interact with multiple Federal agencies.

Recommendation 3: Actively attend to environmental considerations across the partnership lifecycle.

There are several organizational characteristics that might draw EDU into exploring relationship-building with potential partners. The Subcommittee encourages EDU to consider prospective partners who:

- see the benefit of a collective impact approach,
- demonstrate a collective mindset, a willingness to learn and to share credit for collective work,
- monitor and act when conditions are advantageous for positive impacts,
- commit to bringing their unique assets to a partnership,
- demonstrate authenticity in their programs and through their communication,
- avoid making assumptions about groups, taking the time to engage, listen, and learn, and
- promote respectful interpersonal engagement internally and externally.

EDU should consider whether the social and political environments in which a partnership is established will support or impede the partnership activities. Additionally, EDU should consider whether the views or actions of a partner – even if unrelated to the goals of the proposed partnership – might impact EDU's reputation negatively.

Recommendation 4: Hold regular meetings of the partnering organizations' leadership.

As a partnership is established, attending to internal governance is critical. The leadership of each entity needs to be involved to support the partnership while developing a mutually-agreed-upon timeline for monitoring and evaluating the activities of the partnership. Periodic (e.g., quarterly) check-in meetings are recommended to mark progress, assess effectiveness, and allow for re-focusing or re-directing. A developed timeline and regular check-ins can help to keep both short-term objectives and long-term goals in mind from the outset. One cautionary note – incremental success can be mistaken for overall partnership success. Even if, in the short-term, the partnership looks "good," regular monitoring can keep the focus on overall, long-term success.

Recommendation 5: Effective and on-going communication is critical.

Communication between partners should be part of the internal governance plan. Additionally, and perhaps more critically important, clear, and consistent communication with the communities that the partnership intends to serve, and with the community at large, can support confidence and public trust in partnership work.

There is a tendency to treat organizations, communities, and groups as if there were no internal variation in the voices and views of those who belong to each. Communication about a partnership can acknowledge this variation, while emphasizing the grounding principles and/or founding documents that bind the partnership together.

VIII.   Approval Process and Next Steps

Members of the Subcommittee were asked to review and comment on a draft of this report. The Subcommittee approved report is to be posted on the EHR-AC web site. This final version will also be shared with the entire EHR-AC in advance of the Spring (May 31-June 1) 2023 AC meeting. Collectively, it is expected that the EHR-AC will use the contents of this document as a foundation for further discussion during the Spring 2023 AC meeting. At the Spring 2023 meeting, the EHR-AC will provide further guidance and recommendations to EDU Leadership in the context of *Leveraging Partnerships to Reach the Missing Millions*.

Appendix A: List of Acronyms

AC	Advisory Committee
ATE	Advanced Technology Education
DEIA	Diversity, Equity, Inclusion and Access
EDU	NSF's Directorate for STEM Education (formally EHR)
EHR	NSF's Directorate for Education and Human Resource
EPSCoR	Established Program to Stimulate Competitive Research
MOU	Memorandum of Understanding
NGO	Non-government Organization
NSF	National Science Foundation
STEM	Science, Technology, Engineering, Mathematics

Appendix C: HER-AC Partnership Subcommittee Biographies

Stephanie Adams, Ph.D.

Dr. Stephanie G. Adams is the Dean of the Erik Jonsson School of Engineering and Computer Science and the Lars Magnus Ericsson Chair in Electrical Engineering at the University of Texas, Dallas. Dr. Adams is a leader in the advancement and inclusion of all in science, technology, engineering, and mathematics (STEM) education. She has worked with a number of colleges and universities, government agencies and non-profit organizations on topics related to graduate education, mentoring, faculty development and diversifying STEM. Adams is an honors graduate of North Carolina A&T State University, where she earned a Bachelor of Science in mechanical engineering. She earned a Master of Engineering in systems engineering from the University of Virginia, and a PhD in interdisciplinary engineering and management from Texas A&M University, where she concentrated on industrial engineering and management.

Andrés Henríquez

Andrés Henríquez, EDC director of STEM education strategy, is a national expert in science, educational technology, and policy. He brings extensive experience in philanthropy, having served as a program officer at the National Science Foundation and the Carnegie Corporation of New York. Henríquez is deeply committed to making a difference in the lives of underserved children. For decades, he has worked to achieve this goal as an educator, researcher, advocate, and funder. He has led work in adolescent literacy and college and career ready standards and assessments, including the writing and adoption of the Next Generation Science Standards. Most recently, Henríquez led a partnership between the New York Hall of Science, public schools, and first generation Latinx families in Corona, Queens. Earlier in his career, he worked at EDC's Center for Children and Technology, where he led a partnership between Bell Atlantic and Union City Schools that fueled a community transformation in Union City, New Jersey, and received national recognition from President Clinton. Henríquez holds an MA from Teachers College and a BA from Hamilton College

Kay Husbands Fealing, Ph.D.

Kay Husbands Fealing is Dean of the Ivan Allen College of Liberal Arts at the Georgia Institute of Technology, formerly the Chair of the School of Public Policy Georgia Tech. She specializes in science of science and innovation policy, the public value of research expenditures, and the underrepresentation of women and minorities in STEM fields and workforce. Prior to her position at Georgia Tech, Husbands Fealing taught at the Humphrey School of Public Affairs, University of Minnesota, and she was a study director at the National Academy of Sciences. Prior to the Humphrey School, she was the William Brough professor of economics at Williams College, where she began her teaching career in 1989. She developed and was the inaugural program director for the National Science Foundation's (NSF) Science of Science and Innovation Policy program and co-chaired the Science of Science Policy Interagency Task Group, chartered by the Social, Behavioral and Economic Sciences Subcommittee of the National Science and Technology Policy Council. At NSF, she also served as an Economics Program director. Husbands Fealing was a visiting scholar at Massachusetts Institute of Technology's Center for Technology Policy and Industrial Development, where she conducted research on NAFTA's impact on the Mexican and Canadian automotive industries, and research on strategic alliances between aircraft contractors and their subcontractors. Husbands Fealing holds a Ph.D. in economics from Harvard University, and a B.A. in mathematics and economics from the University of Pennsylvania.

Iheoma Iruka, Ph.D.

Iheoma U. Iruka, Ph.D., is a Research Professor in the Department of Public Policy, a Fellow at the Frank Porter Graham Child Development Institute (FPG), and the Founding Director of the Equity Research Action Coalition at FPG at The University of North Carolina at Chapel Hill. Dr. Iruka is leading projects and initiatives focused on ensuring that minoritized children and children from low-income households, especially Black children, are thriving through the intersection of anti-bias, anti-racist, culturally grounded research, program, and policy. Some focus areas include family engagement and support, quality rating and improvement systems, and early care and education system and programs. Dr. Iruka serves on numerous national and local boards and committees, including the National Academies of Sciences, Engineering, and Medicine, the American Psychological Association's Board of Educational Affairs, Brady Education Foundation, and Trust for Learning. In addition to being on the National Advisory Committee for the U.S. Census Bureau, Dr. Iruka is a Census Advisor for the National Urban League. Dr. Iruka is the recipient of the 2022 American Psychological Association Mid-Career Award for Outstanding Contributions to Benefit Children, Youth, and Families. She has a B.A. in Psychology from Temple University, an M.A. in Psychology from Boston University, and an M.S. and Ph.D. in applied developmental psychology from the University of Miami, FL.

Erick Jones, Ph.D.

Dr. Erick Jones is the dean of the College of Engineering at the University of Nevada, Reno, a position he took on in September 2022. He is an internationally recognized researcher in industrial manufacturing and systems engineering, with expertise in RFID technologies, Lean Six Sigma quality management and autonomous inventory control. Before joining UNR, Dr. Jones was a senior science advisor in the Office of the Chief Economist at the U.S. State Department. Dr. Jones also has experience in the private sector: he held engineering management and executive management positions for such companies as UPS, Academy Sports and Outdoors, Arthur Andersen. **College of Engineering dean joins NSF advisory committee | University of Nevada, Reno (unr.edu)**

David Monk, Ph.D.

David H. Monk is Professor of Educational Administration and Dean Emeritus of the College of Education at The Pennsylvania State University. He earned his A.B. in 1972 at Dartmouth College, his Ph.D. in 1979 at the University of Chicago, and was a member of the Cornell University faculty for 20 years prior to becoming Dean at Penn State in 1999. He has also been a third-grade teacher. Monk is the author books and numerous articles in scholarly journals and has served as co-editor and on editorial boards for several journals focused on education finance and policy. He consults widely on matters related to educational productivity and the organizational structuring of schools and school districts and is a Past President of the Association for Education Finance and Policy (1993).

Felecia M. Nave, Ph.D.

A passionate, student-centered leader, Dr. Felecia M. Nave has dedicated more than 20 years serving our nation's Historically Black Colleges and Universities. Dr. Nave is an innovative educator and progressive leader who has served as a faculty and administrator at Alcorn State University, Prairie View A&M University and North Carolina Central University. She has compiled a diverse academic and administrative portfolio, working on projects that support the growth and success of students, established strategic community and corporate partnerships, implemented innovative strategies to increase enrollment and retention of students, faculty, and staff, developed robust academic programs,

strengthened the academic profile, and designed programmatic solutions grounded in analytical analysis. Dr. Nave received a Bachelor of Chemistry from Alcorn State University and a Master's degree in Chemical Engineering and Doctorate of Engineering from the University of Toledo. She has been widely published in scholarly journals on topics related to science, technology, engineering, mathematics and minority students.

Anne-Marie Núñez, Ph.D.

Anne-Marie Núñez is the inaugural Executive Director of the Diana Natalicio Institute for Hispanic Student Success and Distinguished Centennial Professor in Educational Leadership and Foundations at the University of Texas at El Paso. Her work employs sociological approaches to examine how multiple social identities (e.g., racial, ethnic, class, linguistic) shape educational opportunities. A national expert on Hispanic-Serving Institutions, her book *Hispanic-Serving Institutions: Advancing Research and Transformative Practice* was the first ever to focus on HSIs as organizations, and it won an International Latino Book Award. In her collaborations with scientists to build more inclusive educational environments, she has worked extensively with the Computing Alliance of Hispanic-Serving Institutions (CAHSI), an NSF INCLUDES alliance of over 80 HSIs and other partners, to raise Latinx attainment in computing fields. She has also contributed to efforts to diversify geosciences fields. As a policy-engaged scholar, she also served as a National Academies of Sciences, Engineering, and Medicine Committee member to co-author and disseminate the report, *Minority Serving Institutions: America's Underutilized Resource for Strengthening the STEM Workforce.* In 2022, she was inducted as an American Educational Research Association (AERA) Fellow. In 2023, she was named in *Education Week's* Edu-Scholar Public Influence Rankings, as among the top 200 scholars in the U.S. having an influence on educational practice and policy. Dr. Núñez received a BA in Social Studies from Harvard University, a MA in Education from Stanford University and a masters and PhD in Education from the University of California-Los Angeles.

Becky Wai-Ling Packard, Ph.D.

Becky Wai-Ling Packard is Professor of Psychology and Education at Mount Holyoke College where she also served as founding director of teaching and learning, associate dean of faculty, and senior advisor for STEM initiatives. Packard is an expert in the area of strategic mentoring and the persistence of minoritized students in higher education, to include first-generation college students, low-income students, community-college transfer students, nontraditional students, people of color, and women in technical fields. A translator of research into practice, Packard has worked with numerous organizations to improve mentoring practice and infrastructure. A multi-racial, first-generation college graduate, Packard earned her bachelor's degree from the University of Michigan and a Ph.D. in Educational Psychology from Michigan State University.

Allen Pratt, Ed.D.

Dr. Allen Pratt has served as a high school science teacher and coach, high school principal, assistant superintendent/curriculum director, executive director of the Tennessee Rural Education Association, executive director of the East Tennessee Center of Regional Excellence for the Tennessee Department of Education, and rural outreach liaison for Lincoln Memorial University. His primary interests include issues that impact rural schools and the role of instructional leaders at the district and building levels. He is also involved at the University of Tennessee at Chattanooga School of Education and Educational Leadership. Dr. Allen Pratt is the executive director of the National Rural Education Association. He has served in this role for five years. The focus of his work is providing a unified voice for rural schools and communities. His work in the past has been in the areas of workforce development, school reform, professional learning communities, and rural education initiatives. Pratt earned a Doctor of Education focused in Educational Leadership and Administration from Liberty University.

Jeremy Roschelle, Ph.D.

Dr. Roschelle applies learning science theories and methods to understand how, when and why technology can enable improved and more equitable teaching and learning. He is nationally and internationally recognized for research in computer-supported collaborative learning; learning with connected, mobile devices; and technology in mathematics learning. He has conducted rigorous efficacy research on personalized, adaptive learning, on online homework tools, and on dynamic visualizations for mathematics learning. He is presently focused on the opportunities and risks of applying Artificial Intelligence and other emerging technologies to educational challenges, and works with others towards approaches that are ethical, equitable, and effective. Dr. Roschelle earned degrees in Computer Science from MIT and Learning Sciences from the University of California.

Marilyn Strutchens, Ph.D.

Marilyn E. Strutchens is an Emily R. and Gerald S. Leischuck Endowed Professor and a Mildred Cheshire Fraley Distinguished Professor of Mathematics Education in the Department of Curriculum and Teaching at Auburn University where she teaches graduate and undergraduate courses. Her research focuses on equity issues in mathematics education. Dr. Strutchens' goal has been to conduct research that illuminates what happens in the classroom to effect positive change. Her work shows the importance of hearing the voices of the key constituents involved in the mathematics education of students and the school, societal, and race/ethnicity factors that influence students' achievement. She is the leader of the Mathematics Teacher Education Partnership's Clinical Experiences Research Action Cluster and the Outreach Hub. She also currently serves as Chair of the Advisory Committee for the National Science Foundation's Directorate for Education and Human Resources. She was a member of the National Council of Teachers of Mathematics Board of Directors (2015 -2018), a member of the Executive Board of Directors for the Conference Board of Mathematical Sciences (2012 -2014) and president of the Association of Mathematics Teacher Educators [AMTE] (2011 – 2013). She received AMTE's Judith Jacobs Lectureship in 2017.

The following individuals contributed to the creation of this document:

- Bonnie A. Green, DUE Program Director/ EHR-AC Executive Secretary/ report author
- Jolene Jesse, EDU Acting Deputy Assistant Director
- Sarah-Kay McDonald, EDU Senior Advisor
- Dale Oliver, EES, AAAS Fellow