National Girls Collaborative Project

The State of Girls in STEM: A Conversation to Plan Action Summary Report & Recommendations

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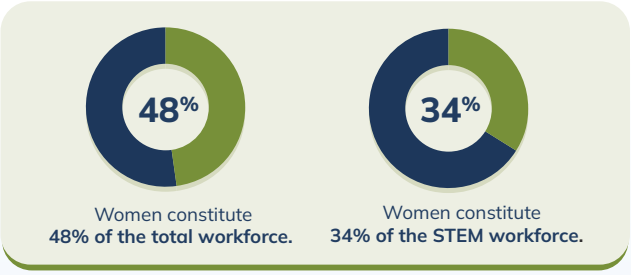
INTRODUCTION

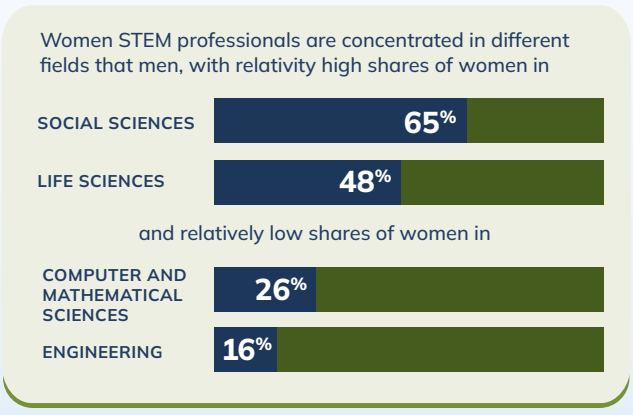
The National Girls Collaborative Project (NGCP) organized and held a national convening on Tuesday, September 26, 2023, at the New America offices in Washington, DC, to bring together thought leaders for a candid conversation on the persistent issues facing girls and women in STEM. The purpose of these conversations was to create an action agenda for accelerating solutions to make real progress related to girls and women's representation and experiences in STEM.

Women make up half of the total United States college-educated workforce but only 34% of the science and engineering workforce (National Science Board, 2022). Although there are relatively high shares of women in the social sciences (65%) and life sciences (48%), they are extremely underrepresented in physical sciences (25%), computer and mathematical sciences (26%), and engineering (16%) (National Science Board, 2022; National Center for Science and Engineering Statistics, 2023). In the disciplines in which women are at parity or seemingly overrepresented, there is a lack of women in senior positions (National Academies, 2020), and women have lower median earnings than men in all science, technology, engineering, and mathematics (STEM) and STEM-related fields (National Center for Science and Engineering Statistics, 2023). While Black, Hispanic/Latina, and Indigenous women make up approximately 17% of the United States population (U.S. Census Bureau, 2020), they earn 14% of the bachelor's degrees in STEM fields and represent less than 10% of the STEM workforce (National Center for Science and Engineering Statistics, 2021). Many women are disproportionately excluded from high-paying sectors, and these sectors are deprived of their diverse perspectives and experiences (Hill et al., 2010; Master et al., 2016). These gender inequities are not a result of gender differences in abilities. Instead, they are rooted in the multiple factors that result from systemic and institutional inequities. In addition to gender, the intersectionality of race, ethnicity, and class produces varied and compounding

STEM Workforce

Women remain underrepresented in the science and engineering workforce, with the greatest disparities occurring in engineering and computer sciences.





National Center for Science and Engineering Statistics (NCSES). 2023. Diversity and STEM: Women, Minorities, and Persons with Disabilities 2023. Special Report NSF 23-315. Alexandria, VA: National Science Foundation. https://ncses.nsf.gov/wmpd

National Science Board. (2022). Science and Engineering Indicators 2022: The State of U.S. Science and Engineering (NSB-2022-1). National Science Foundation. https://ncses.nsf.gov/pubs/nsb20221

barriers to STEM. These barriers often discourage and hinder girls' identification with STEM, influencing women's career trajectories and long-term participation in STEM (Archer et al., 2012; Carlone et al., 2015; Carlone & Johnson, 2007; Kang et al., 2019; Ladson-Billings, 2006; National Academies of Sciences, Engineering, and Medicine, 2022; Tan et al., 2013).

Forty-eight participants attended The State of Girls in STEM event, representing a variety of organizations invested in increasing our collective impact on girls and women in STEM education and careers. The goal was to have a diverse group of professionals participate, including girl-serving organizations, community-based organizations, higher education, and corporations, to facilitate discussion and generate solutions that are comprehensive and inclusive of a variety of perspectives. The following organizations, representing K-12 education, higher education, community-based/ non-profit organizations, corporations, and funders, participated in the event: AAUW, The American Association for the Advancement of Science, Afterschool Alliance, Applied Materials, Big Mission Consulting, CihuaTEC Connect, Futuristas, Girl Scouts of the USA, Girls Inc., Girlstart, Google, Last Mile Education Fund, Lean In Girls, Mott Foundation, National Afterschool Association, National Girls Collaborative Project, National League of Cities, National Science Foundation, New America, New York Hall of Science, The PEER Group, Qualcomm, Sharma-Holt Consulting, Smart Girls HQ, Snap Inc., Society of Women Engineers, STEM for Her, STEM Next Opportunity Fund, Techbridge Girls, U.S. Department of Education, United Way, and The University of Texas at Austin.

OVERVIEW OF THE DAY

The day began with networking time for participants to meet each other and reconnect with those with whom they have previously worked. Karen Peterson, CEO and Founder of NGCP, and An-Me Chung, Ph.D., the Director of Teaching, Learning & Tech, and Strategic Advisor to the Education Policy program at New America, welcomed participants and set the agenda for the day.

The formal program began with ***YOUTH VOICES: The Current State***, a panel of young women in STEM comprised of one high school student and two college students. The goal of the panel was to elevate youth voices and reflect on their viewpoints regarding effective resources and support for girls and women in STEM.

Following the panel presentation, participants broke into small groups according to the sector they represent (Education, Workforce/Corporate, Funders) to discuss the barriers the young women shared as well as their own perceptions of the barriers that exist for girls and women in STEM in their sector. Participants then shared highlights from their conversations with the whole group, before breaking for lunch and networking.

After lunch, participants reconvened for ***IMPACT STORIES: Inspiring Change***, a panel of professionals focused on gender equity in STEM in various realms. Panelists shared their experiences of barriers, solutions, and lessons learned from their efforts to support girls in STEM and discussed how they aim to center equity in their work.

Following the panel presentation, participants broke into small groups according to the topic they were most interested in:

- **The Whole Girl**: Connecting gender/intersectional inequities in STEM to systems of oppression and girls' whole selves.
- **Partnering with Corporations**: Bringing together corporations and STEM businesses with educational efforts to create a positive impact for both sectors.

- **Connected Pathways**: Facilitating connections between all phases of the K-12 trajectory, higher education/post-K-12, and the workforce.
- **Influencing the Systems**: Exploring the systems that facilitate and/or hinder girls' participation in STEM opportunities, studies, and careers.

The goal of these discussions was for each group to identify actionable goals to address the needs of girls and women in STEM in their respective sectors. Groups worked to identify both short and long-term objectives. Each group shared their top solutions, answered questions, and voted to pursue the objective they felt was the most relevant and important action. Gabriela González, Ph.D., NGCP Board Member, shared closing thoughts with the group, and Karen Peterson presented next steps and thanked everyone for their commitment to making a difference for girls and women in STEM.

KEY THEMES AND IDEAS

The following sections summarize the key themes and ideas that emerged during each panel discussion and small group discussion.

YOUTH VOICES: The Current State

This 45-minute panel, moderated by Shihadah Saleem, Director of Youth Programs and Pathways, New York Hall of Science, brought together a panel of three young women. College students Naomi Wilson and Daisy Navarro and high school student Denaya Smith discussed their experiences with STEM, opinions on mental health and education, ideas about the most useful STEM resources, and more. Event organizers and the panel moderator set the stage for the panel via discussions with teachers, parents, and panelists before and at the event, to help panelists understand the context of the event and feel comfortable sharing their experiences and opinions.

> "Support is crucial to continuing in the field, but the opportunities being there are important as well."
>
> —YOUTH VOICES panelist

> "Give them confidence, build them up. Show them girls can do anything a man can!"
>
> —YOUTH VOICES panelist

Left to Right: Shihadah Saleem, Daisy Navarro, Denaya Smith, and Naomi Wilson

The panelists highlighted the importance of support from educators, peers (both those in STEM and not in STEM), and family members. The panelists also shared the types of resources they felt were most important for supporting young women like them in STEM. These included: training and information for parents (particularly first-generation families), more access to internships and other opportunities outside of school, scholarships, support for building confidence, and support for overcoming the pitfalls of perfectionism. Lastly, conversations with the panel highlighted that while STEM career exposure is important, there may be a disconnect between the interest and developmental readiness of youth to learn about these careers, particularly in middle school. One panelist reflected on her middle school experience saying, "No one is thinking about careers in middle school, they just want to pass their classes." The panelists were invited to continue their participation in the convening after the panel, and two of the young women were able to stay, engaging in the remainder of the day's activities and discussions.

Sector Group Discussions

Participants broke into small groups according to the sector they represent: Education, Workforce/Corporate, and Funders, to share their own perceptions of the barriers that exist for girls and women in STEM in their sector and to reflect upon the barriers the young women shared in the previous panel.

Education Group

Many participants chose to take part in the Education breakout group, including formal and informal educators as well as those who work in training and development, so two separate groups were created. Education sector leaders came together to discuss their perspectives on the most significant barriers and issues across STEM education settings that need to be considered for helping girls and women persist in STEM education and careers. Various themes emerged, with some overlap between the two groups, including:

- Making STEM relevant to girls' lives, including providing real-world experiences and changing practices in schools;
- Addressing myths and stereotypes of perfection related to STEM;
- Inspiring curiosity in STEM learning vs. an overt focus on careers;
- Promoting girls' STEM identity development, including valuing girls' experiences and individual characteristics and interests;
- Changing teaching and messaging related to math; and
- Making high-quality STEM opportunities more equitable in terms of availability.

When talking about these issues, participants in the Education groups emphasized that the methods for addressing these barriers vary based on girls' experiences and that there is a need for personalized microsolutions. One participant explained this saying, "The thing that helps an individual girl will be different based on families and backgrounds. Everyone is at a different starting point. There needs to be tailored solutions, there is no one macro thing we can do."

Workforce/Corporate Group

Workforce/Corporate sector leaders came together to discuss their perspectives on the most significant barriers across STEM industries to support girls' persistence in STEM careers. Four overlapping themes emerged:

- Reimagining corporate investments and philanthropy by shifting corporate mindsets to see the value of supporting girls in STEM (to both impact girls' experiences and benefit the corporation);
- Reframing corporate approaches to philanthropy to more effectively direct resources to support girls in developing STEM skills and learning about STEM careers;

Left to Right: Ruthe Farmer, Julie Lata, Ashley Huderson, Tricia Berry, and Shane Woods

- Supporting the whole girl; and
- Shifting workplace culture.

Participants emphasized the need for changes to the values and norms of corporations, including shifting corporate values to see the importance of a long-term investment in girls and STEM. The question "How can we make corporate culture ready for youth?" emerged as a central thread as the participants discussed the need to change norms and practices within STEM industries to better value girls and women (and their multiple identities).

Funders Group

Participants representing Funders came together to share their reactions to the youth panel and to discuss barriers for girls and women in STEM from their perspectives. They reflected on points made by the young women on the panel, especially the barriers and support they have experienced along their educational trajectory. The following themes emerged from the discussion:

- The importance of making opportunities and funding accessible for young women in STEM, especially those most in need;

- The role of internships, apprenticeships, and mentorship in encouraging and supporting girls and women in STEM;
- The concept of privilege versus potential and the challenge of providing opportunities and support in an equitable way, acknowledging that students' needs differ based on prior experiences and backgrounds; and
- The need to fix the 'system' - the cultural, structural, and institutional barriers that exist for girls and women in STEM.

IMPACT STORIES: Inspiring Change

This one-hour panel discussion, moderated by Ashley Huderson, Ph.D., STEM and CS Equity Fellow with the U.S. Department of Education, featured leaders representing various sectors involved with STEM: Tricia Berry, Executive Director, Women in STEM (WiSTEM), The University of Texas at Austin; Shane Woods, Executive Director, Girlstart; Ruthe Farmer, Founder, Last Mile Education Fund, Tech Inclusion Advocate, and Entrepreneur; and Julie Lata, Global Community Affairs Manager, Applied Materials.

Panelists shared success stories and lessons learned from their efforts to advocate for girls in STEM and discussed how they aim to center equity in their work. Panelists highlighted the importance of collaboration and partnerships across sectors in creating new spaces for girls to thrive in STEM and beyond, including "creating spaces where certain aspects of your identity do not have to be explained." Several panelists emphasized casting a wide net when thinking about the diversity of girls, including gender, race/ethnicity, socioeconomic status, and neurodivergence. One panelist asked participants to reflect on a key question: "Are we allowing all girls to enter and be heard?" and encouraged participants to consider their biases and to center diverse girls' voices and identities.

Impact Group Discussions

Following a short break, participants joined an Impact Group based on the topic they were most interested in: *The Whole Girl, Partnering with Corporations, Connected Pathways*, and *Influencing the Systems*. Each Impact Group had robust discussions related to barriers and potential pathways forward to addressing the needs of girls and women in STEM and brainstormed action items relevant to the topic of their group.

The Whole Girl Impact Group

This breakout group discussed how aspects of the whole girl have nothing to do with STEM (at least on the surface) and relate to girls' livelihoods and mental health. The group discussed the importance of asking girls what they want and need and acknowledged the need to shift power dynamics to enable girls into decision-making processes. Three themes emerged from the discussion: the impacts of intersectional inequalities (and disrupting these inequalities); listening to and centering girls' voices; and contributing to and connecting with the ecosystems around girls.

The group members also asked how we build collective action across partnerships and levels to center girls and address social norms and systemic issues that impact girls.

Three action items emerged through the discussion:

- Development and investment in community capacities;
- Changing power dynamics - putting girls at the center; and
- Disrupting, identifying, and addressing societal norms and systemic and institutional issues.

Influencing Systems Impact Group

This breakout group focused on influencing systems that impact girls and women in STEM. Group members began by discussing the variety of 'systems' that impact girls and women in STEM and whether they should focus on one or all (or which ones). The discussion was wide-ranging and the following themes emerged:

- Building on what works;
- Acknowledging businesses and corporations that support girls and women;
- The importance of collaboration between corporations and K-12 education and community-based programs; and
- The need for public policy and legislation that empowers girls and women.

The group members agreed that many effective programs and initiatives already exist related to girls and women in STEM, but they also felt there needs to be more focus on sharing knowledge of effective strategies from those programs and initiatives. The group discussed how to acknowledge best practices within STEM businesses and corporations that provide opportunities and a positive culture to women professionals, and support K-12 education efforts to encourage girls in STEM. An example would be creating a certification or accreditation of some type, building off other similar efforts that might already exist. The group also discussed the potential for impact when corporations work with the K-12 field, again emphasizing that there are strong models for doing this to learn from rather than invent something new.

Connected Pathways Impact Group

This breakout group set out to explore how to facilitate collaboration between and among groups serving girls at different points along STEM pathways to provide a seamless experience for girls and women in STEM. Additionally, conversations in this group aimed to identify the key factors encouraging (or discouraging) those working in these pathways from collaborating more effectively. Three themes emerged in the discussion:

- The need to revise common STEM pathways language to avoid the implication that STEM pathways are linear and to refrain from using the offensive 'pipeline' term;
- The need to create a better system for data collection, data sharing, and measurement across the pathways; and
- The need for a customizable model for new connected pathways.

The group discussed existing material available related to supporting connected pathways, noting that the "STEM pipeline" metaphor is still commonly used. The group emphasized that the term pipeline is problematic in many communities and does not reflect girls and women's diverse experiences and journeys through education and into STEM careers. Moving away from the "STEM pipeline" metaphor allows for normalizing alternate pathways to STEM careers and opens up opportunities for a more realistic view of STEM. Building off this, two action items were identified in the Connected Pathways Impact Group discussion: revising the common STEM pathways language and developing a new customizable model for thinking about connected pathways. This model, rooted in the ecosystem model and existing work, would be something that different organizations and communities could use to understand the various influences and supports that girls need.

Partnering with Corporations Impact Group

This breakout group came together to discuss challenges and successes of partnering with corporations and how partnerships between corporations and organizations serving K-12 girls could be more effective and impactful. The group members discussed existing corporate initiatives focused on supporting girls in STEM, the disconnect that can occur between human resources and philanthropy at corporations, the tension related to defining success between corporations and K-12 entities, and potential ways corporations could support K-12 girls moving forward.

The group landed on three themes to focus on:

- Promoting the importance of storytelling for girls and young women to see themselves in a STEM career;
- Similar to one of the themes from the Influencing Systems Impact Group, holding corporations accountable related to recruitment and hiring, culture, and the support they provide to girls and young women; and
- Creating coalitions among the youth-serving organizations committed to gender equity in STEM.

RECOMMENDATIONS

1. Create a program to acknowledge corporations who support girls and women in STEM.

Two of the impact groups (Partnering with Corporations and Influencing Systems) recommended creating a program to acknowledge STEM corporations and businesses to motivate STEM workplaces to invest in recruiting and retaining women employees and sustain a positive workplace culture. Participants discussed the need for STEM workplaces to develop more positive cultures for women to incentivize entering and remaining in these fields. As mentioned in the introduction, women continue to be underrepresented in the STEM workforce. Women who do enter STEM fields earn less on average than men in STEM and are not as likely to reach senior leadership positions.

While it is critical to focus efforts on K-12 and post-secondary education to engage and encourage girls and young women in STEM, there is also a need for women to have STEM workplaces where they feel they have a sense of community. Research has identified potential barriers for women entering STEM professions that need to be addressed, including persistent STEM stereotypes, gender bias and discrimination, lack of support and opportunities for advancement, and negative workplace culture (Ganley, George, Cimpian, & Makowski, 2018; Hamrita, Hall, Fling, & Mendoza, 2023; Pew Research Center, 2018; Thébaud & Charles, 2018).

The acknowledgment program would involve STEM corporations and businesses applying or being nominated for recognition as a positive place for women to work. Women currently employed in STEM fields could also nominate their workplace. A committee would review the applications and rate each application based on a rubric (that would need to be developed). The committee would provide feedback to applicants, including strengths and areas that are in need of further development. The committee could also ask applicants for additional information or to make improvements before acceptance. Potential factors to consider include the following: Recruitment methods, current employee demographics and positions, opportunities for advancement, mentorship opportunities, workplace culture, policies, support systems, and support of K-12 and/or post-secondary education efforts.

2. Build the capacity of corporations to collaborate with and support K-12 STEM education efforts.

Participants emphasized the importance of collaboration between corporations and K-12 education and community-based programs. They discussed how bringing together STEM corporations with educational efforts can positively impact both sectors and how such partnerships are crucial in influencing the systems that affect girls and women in STEM. There are models for fostering partnerships between the K-12 field and corporations, and participants emphasized learning from these models rather than inventing something new. One example of a strong collaboration between the corporate sector and the K-12 field is Generation Girl®, an initiative of the Applied Materials Foundation. Through Generation Girl®, the Applied Materials Foundation partners with girl-serving organizations throughout the United States to help girls of color and low-income girls to foster girls' empowerment, facilitate leadership development, and provide access to high-quality afterschool enrichment programs, including STEM (Applied Materials, 2023). NGCP partnered with Applied Materials by writing *Women in the Workplace: Key Barriers to and Recommendations for Increasing Female Participation in Male-Dominated Fields*. This white paper helped corporate leaders understand the overlapping barriers to gender equity in STEM, as well as the research-based strategies for engaging girls in STEM, providing a foundation for this corporate K-12 partnership.

Participants and others working to advance gender equity in STEM can play a crucial role in encouraging corporations to invest in girls and STEM by empowering corporations with research and data on gender equity in STEM by developing a white paper. The white paper would be developed in collaboration with subject matter experts to provide corporations with a high-level overview of more than twenty years of equity research related to the barriers to gender equity in STEM education and the workforce, as well as strategies for engaging girls in STEM to support their interest and positive STEM identity development. A white paper would serve as a tool for corporations to make informed decisions about their role in supporting girls and women in their STEM journeys.

3. Develop a new model for illustrating the complex influences on girls and women in STEM.

The Connected Pathways impact group suggested the development of a new model (using updated terminology where needed), to replace the problematic "STEM pipeline" metaphor and approach for understanding girls and women's trajectories through PK-12 education and into the STEM workforce. Participants expressed agreement that this would be a useful tool for researchers, practitioners, industry professionals, educators, and other girl-serving individuals and organizations. This new model, to be rooted in ecological systems theory (Bronfenbrenner, 1979), adaptations of this theory, and current STEM ecosystems work, will provide a comprehensive way of thinking about connected pathways and understanding all the complex influences on girls and women pursuing STEM. The goal of this new model is to provide a holistic understanding of the critical influences on girls' journeys into STEM, including barriers to participation (e.g., stereotypes, intersectional inequalities, etc.), that happen both within and outside of formal education and career experiences. Rather than portraying pathways into STEM in a linear fashion the way the pipeline metaphor does, this new model would focus on illustrating the frequently nonlinear STEM journeys of girls and women.

For decades, researchers and policymakers have relied on the "STEM pipeline" metaphor to illustrate the trajectory from PK-12 education into a STEM degree or career (e.g., Alper, 1993; Berryman, 1983; Blickenstaff, 2005). However, critics of the pipeline metaphor argue that it has led to "patchwork" solutions and overly simplified efforts (Cannady, Greenwald, & Harris, 2014; Metcalf, 2010; McGee, 2020). Despite criticism, it has persisted as the dominant model when examining issues of diversity, equity, and inclusion in STEM, used in 135,000 publications and counting (Garbee, 2017; McGee, 2020). By developing a new model built on existing work (e.g., Chavatzia, 2017; Santo, Ching, Hoadley, & Peppler, 2019), individuals and organizations invested in supporting girls and women will have a more comprehensive and accurate understanding of their journeys into STEM, along with an understanding of where and how, based on research, they can effectively support them.

4. Develop and disseminate a comprehensive report on the state of girls and young women in STEM.

Participants emphasized the importance of centering and listening to girls' voices multiple times throughout the State of Girls in STEM event, to position them at the front of our efforts and allow them to lead the movement to inform our work to increase gender equity in STEM. One method for addressing this is to collect data directly from girls to share with the field. Research on and with girls and young women has greatly increased over the past two decades and can help us understand their perspectives and lived experiences, including the following large-scale reports:

- Girl Scouts of the USA research on girls and STEM
- National Center for Women & Information Technology research on girls and IT
- AAUW research on girls and women in STEM
- Centers for Disease Control research on youth mental health
- Pew Research Center research on teens, social media use, and technology
- DiscoverE research on what teens and their parents think about engineering

However, significant gaps in our knowledge remain, especially related to STEM engagement (interest, confidence, sense of belonging in STEM, etc.) and barriers to this engagement. There is a need to connect the existing research to form a complete picture of the lives of girls and young women, update the research that was conducted over a decade ago, and collect additional data to maximize our understanding and ability to effectively engage and support girls in STEM and in their lives overall. The comprehensive report will address these goals by 1) summarizing existing research that amplifies girls and young women's voices and shares their perspectives and lived experiences, and 2) including additional data that addresses gaps in our knowledge related to girls and young women's STEM engagement (interest, confidence, sense of belonging, etc.).

5. Create an online clearinghouse focused on gender equity and STEM initiatives and resources.

The idea of creating an online clearinghouse was shared multiple times during the State of Girls in STEM event. While there are numerous initiatives, programs, and resources available to connect with and learn from related to gender equity in STEM, there is no one place to find all this information. Even professionals working in this field for decades cannot possibly know everything that is happening across the United States. However, participants at the event emphasized the importance of sharing knowledge and learning from each other to not reinvent the wheel or duplicate efforts.

The online clearinghouse would serve as a central location for information related to gender equity in STEM and could focus on information for a particular audience, such as educators working with girls in K-12 STEM programs, or professionals working at the national level on gender equity in STEM initiatives. The clearinghouse could also be more comprehensive and serve multiple audiences. Online clearinghouses have been developed in a variety of fields, ranging from resource collections focused on a specific topic to comprehensive clearinghouses of information and resources that focus on multiple topics within a field. The following models might be helpful as this recommendation is further developed:

- Howtosmile is an online collection of math and science activities available to anyone, free of charge. The project is dedicated to bringing STEM activities developed by informal science organizations around the country to the wider informal educator community while encouraging that community to both use and contribute to the growing collection.

- The Results First™ Clearinghouse Database is an online resource that brings together information on the effectiveness of social policy programs from nine national clearinghouses. It applies color-coding to the clearinghouses' distinct rating systems, creating a common language that enables users to quickly see where each program falls on a spectrum from negative impact to positive impact. As such, this database can help users easily access and understand the evidence base for a variety of programs.
- The U.S. Department of Education Institute of Education Sciences What Works Clearinghouse collects, screens, and identifies studies on the effectiveness of educational programs, products, practices, and policies for educators, policymakers, researchers, and the public.
- The WEPAN (Women in Engineering ProActive Netowrk) Knowledge Center is a publicly available collection of WEPAN-generated and curated resources focused on women in STEM. The Knowledge Center represents a body of knowledge, tools, and promising practices for gender equity in STEM initiatives.

CONCLUSION

The State of Girls in STEM event brought together professionals from diverse sectors who are passionate about and committed to making a difference in the lives of girls and young women, with a particular focus on equity and inclusion in STEM. The panel presentations, small group conversations, and large group discussions confirm that, while there are a significant number of activities, programs, and initiatives focused on increasing girls and women's participation in the STEM workforce, we have yet to see a significant shift in the landscape. A throughline across the discussions was the importance of scaffolding the current work in advocacy and fostering strong collaborations to enhance existing initiatives with more effective solutions.

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- Daisy Navarro, Student
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- Gina Warner, National Afterschool Association
- Naomi Wilson, Student
- Imogene Winkleman, Girls Scouts of the USA
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