



NSF-Funded Convergence
Accelerator Workshop

Reimagining Advanced Research for Human Good through Industry and Educational Partnerships

Principal Investigators

Dr. Lauren Thomas Quigley, IBM Research
Dr. Stacy Hobson, IBM Research

May-June, 2021
NSF Award No: OIA-2119846

Hosted By 

Developed and Facilitated by 

Authors

Lauren Thomas Quigley, Ph.D.
(Principal Investigator)

Research Scientist
Responsible and Inclusive Technology
IBM Research

Stacy Hobson, Ph.D.
(Co-Principal Investigator)

Director
Responsible and Inclusive Technology
IBM Research

Yvette E. Pearson, Ph.D., P.E.
(Co-Project Manager)

Founder and Principal Consultant
The PEER Group, LLC

Michael D. Smith, D.Eng.
(Project Manager)

Operations Specialist
The PEER Group, LLC

Lisa Black, Ph.D.

Qualitative Research Specialist
The PEER Group, LLC

Casey Harris, M.Ed., M.A.

Research Assistant
The PEER Group, LLC

Geraldine E. Jackson, MBA

Training Coordinator
The PEER Group, LLC

Terrence Mosley, M.S.

Project Development Consultant
The PEER Group, LLC

Lisa Sargent, M.A.

Research Assistant
The PEER Group, LLC

Layout and Graphic Design

Dan Losapio, M.A.

Graphic Designer and User Experience
(UX) Specialist
The PEER Group, LLC



Executive Summary

As part of the National Science Foundation's (NSF's) Convergence Accelerator program, IBM was funded to host a virtual workshop series titled "Reimagining Advanced Research for Human Good through Industry and Educational Partnerships" under award number OIA-2119846. We branded it "Reimagining Innovation in STEM Education for Human and Social Good," or RISE. The workshops brought together over 60 participants from various public and private institutions, including institutions of secondary and higher education, industrial and academic research organizations, social justice organizations, government agencies, tech companies and startups to focus on a convergent approach in addressing four areas:

- support for advancement of underrepresented groups in STEM,
- social and human good research foundations,
- artificial intelligence (AI) and technology supported education, and
- data trust development.

The workshops were designed to explore each topic and identify the actions needed to inform the next decade of STEM education and research. The constituents of the workshop ecosystem shared a vision of leadership and implementation of an inclusive, human-focused future. This was represented in the

disciplinary, geographic, organizational, and personal demographic diversity represented along with the equitable engagement of everyone present. An inclusive future for technology requires that those who have often had less access to leadership and influence in the technology and policy spaces have equal footing with recognized leaders in this space. Value was steeped in both experiential expertise and research expertise as both are required to solve difficult human-facing problems.

RISE was organized into four 3.5-hour virtual workshops on May 25, May 27, June 3, and June 8, 2021 to support meaningful engagements. Each day focused on one of the four workshop topics, with connections and framing for the full convergence approach throughout. An advisory board of subject matter experts was engaged to provide insight to the project team, meeting in advance of and throughout the duration of the workshop.

Each workshop session in the four-part series began with overview of the aims of the NSF Convergence Accelerator program, contextualization of the respective series themed topics, and robust "TED"- style presentations from two expert provocateurs from academia; industry; community-based and community-led nonprofits; diversity, equity, and inclusion-focused





consulting firms; and social science organizations to lay the foundation for interactive breakout sessions focused on in-depth ideation on the key issues, root causes, utopic views of the future, and potentially transformative solutions that meet three key Convergence Accelerator criteria: requiring convergent approaches, having strong societal impacts, and having tangible deliverables that are achievable within three years.

The groundwork that set the stage for the development of a representative ecosystem of collaborators toward achieving collective impact was laid by researcher, scholar, and author of *Lessons from Plants*, Dr. Beronda L. Montgomery, who shared a framework for understanding how individuals perceive, respond to, and are impacted by the environments in which they exist. Other provocateurs including Dr. Rayvon Fouché of Purdue University, Dr. Wendy Smythe of the University of Minnesota Duluth, Dr. Antwi Akom of San Francisco State University and Streetwyze, Dr. Lauren Thomas Quigley of IBM and Dr. Yvette E. Pearson of The PEER Group set the stage for participants to generate opportunity statements, empathize with stakeholder perspectives, understand key pain points that stifle progress, and reimagine solution pitches for the ecosystem to pursue and create change. As a result, participants were able to collectively generate several ideas with the potential

to be highly transformative, out-of-the-box solutions that not only support the broader community of future innovators and researchers, but also **include them** in problematization and creation of solutions for social and human good, emphasizing a need for reinvestment back into their communities. An online networking community created via Mighty Networks was and will continue to be used to create an ongoing ecosystem for resource sharing, network building, ideation, and collaboration on real-time “big ideas” that connect AI, STEM education, research and social and human good efforts.



Key Workshop Outcomes

Convergence Accelerator Deliverables

The driving purpose behind the Convergence Accelerator ideation phase is “[to accelerate solutions toward societal impact](#)” with a focus on deliverables. Through this workshop experience, consistent focus remained on deliverables for societal impact through convergence in topics, disciplines, perspectives and experiences. Our workshop aimed to highlight outcomes in segments of three-, five-, and ten-year horizons with emphasis on radically changing STEM education for human and social good through industry and educational partnerships. Across the four workshops, we have generalized the outcomes included throughout the report into a timeline format summarizing deliverables that can be achieved within three, five, and ten years. Across the entire workshop experience, the urgency of these issues was clear as workshop participants saw, experienced, and vocalized how necessary it is for STEM education to make these changes for the broad benefit of society. The aim in the items discussed below is to clearly identify and offer timing for targets that could be achieved through a convergent approach.

Within Three Years: Curating and Incubating an Ecosystem

- Bring STEM education to people in their geographic, regional, and community spaces to address the concerns and topics that they care about in ways that have direct meaning in their lives. These efforts must be focused on reducing barriers to access by making STEM education and innovation more mobile, more accessible, and promote justice. The primary methodologies need to be participatory **with** Black, Indigenous, and People of Color (BIPOC) populations – not just **for** or **about** them.
- STEM education and innovation research projects led by or led in authentic partnership with individuals and communities most impacted by the inequities of differential benefits to science and technology innovation. Project leadership and related research positions, conceptualization of proposals, decision-making processes, and the interpretation and dissemination of evidence and research results should be led by people of the communities that are most excluded. This necessitates redefining domains, research endeavors, and education efforts in more inclusive and equitable ways that reflect a broader set of cultures and values than solely traditional science and engineering culture.



- K12 students need a strong community, a strong network of support. They need not only the academic or technical skills, but also support that addresses the whole person. We need new approaches to revolutionize what STEM looks like in K-12. Students need to be positioned to lead initiatives and engage in project-based learning that is centered on equity. Faculty and administrators need to ask students what they want and need and put learners the driver's seat.
- Technology and digital infrastructure must be a priority to close the digital divide that widens the gap between those that have been historically excluded. Technology tools and infrastructure must connect learners to opportunities for work and/or further education. Technology leveraged in STEM education must engage diverse students' ways of knowing and being.

Within Five Years - Shifting STEM Culture and Processes

- Establish majors specific to human and social good problems with concentrations related to specific STEM fields that allow learners the opportunity to leverage their experiential sensitivity and awareness of issues that impact their lives to develop solutions. Educational research and innovation environments become places where deep cultural connections, joy, purpose, and recognition of abilities are abundant for all. STEM education and literacy can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit. This requires the selection and training of caretakers with principles of asset building and anti-assimilation at the core of their approach.
- Develop community-led collaborations and data trusts where value and benefits are shared across sectors and within communities. Technology infrastructure, platforms, and product development would rely on deep connections in the community to identify issues, create meaningful solutions, and enable economic growth and innovation. Leveraging a "learn to earn and own" model that engages community members, recognizes their contributions, and enables them to solve their concerns will help more people benefit from our technologically-driven society.
- Identify approaches to leverage artificial intelligence in meaningful STEM education that are personalized and unbiased in terms of race/ethnicity, gender, ability, and other identity features that have impacted participation in STEM.

Within Ten Years - Changing the Climate and Outcomes of STEM Education and Innovation

- We will have a well-prepared and diverse workforce prepared to address the pressing technology needs of the present day and working to anticipate the emerging needs of the future. Marginalization in STEM will be an artifact of the past -- people representing the diversity of the country will not only have a seat at the table, but will be leaders who steer the direction of science, engineering,

and technology to benefit society at large. Exclusion and harm to some will no longer be tolerable outcomes of scientific and technological advancement. The ecosystems that were incubated and cultures shifted will result in a change in the climate of STEM education and innovation for the better.

Additional Workshop Outputs and Recommendations

The following recommendations were informed by the convergence of stakeholder perspectives on desired outcomes tabulated during the workshops and are aligned with three key Convergence Accelerator criteria: *requiring convergent approaches, having strong societal impacts, and having tangible deliverables that are achievable within a few years.*

Ideas from the three themes that emerged from Workshops 1 and 3 that do not directly fit into the recommendations in the prior section are summarized here. Additional details are provided in the Summary and Recommendations section of this report.

Reconceptualize social, systemic, and technical approaches to creating impactful STEM education programs and experiences.

- Prioritize project-based learning that is centered on equity and student voices.
- Identify ways to further understand environments surrounding students by understanding the connection to land, ancestry, identity, and economic prosperity.
- Create AI systems that can provide ways to measure grit, individual impacts on the environment and that can also provide competency-based evaluation.
- Connect learners to opportunities to work and/or further education through mapped learning experiences.
- Create technology-supported education tools that support individuals having autonomy and access to their personal data to track individual data points so that they can provide informed consent for its use.
- Create effective and appealing social robotics.

Broaden participation and access to STEM education and careers for all.

- Redefine STEM domains and participation in more inclusive and equitable ways that reflect a broader culture.
- Use technology-supported tools such as AI to teach empathy.
- Ensure fairness and explainability in use of AI technology.
- Create education that can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit.
- Ensure technology-supported education tools used in STEM are ethically aligned.

- Develop meaningful solutions to current “widy” technology-supported education tools.
- Create ways to codify decision-making that prioritizes attention to the potential harms of technology development, deployment and use.

Reconceptualize STEM education to serve greater humanity and social good as well as drive technological impact.

- Engage non-traditional learners (e.g., people acquiring skills outside of traditional education settings and the incarcerated) in lifelong learning opportunities. Ensure all have access to knowledge.
- Design technology-supported education solutions that consider diverse students and ways of knowing, to include community and education/research.
- Create a more equitable education system that focuses efforts on decreasing the disparity between well-funded schools that were not nearly as impacted during the pandemic as lesser funded schools.
- Create more accessible technology-supported education tools to increase workforce accessibility for workers identifying as disabled.
- Integrate AI into STEM education so that it becomes a valuable tool for all stakeholders and not something perceived as separate, frightening, or magical.
- Ensure people do not get pigeonholed by the sum of their data points by creating multiple pathways to opportunities and experiences.

Ideas from the three themes that emerged from Workshops 2 and 4 are summarized here. The takeaways are in the form of themes that emerged from pains, which represent the barriers that need to be overcome, and gains, which represent the possibilities. Additional details are provided in the Summary and Recommendations section of this report.

Major Themes: Pains

For Workshop 2, the first four major themes listed here emerged from the convergence of stakeholder perspectives related to pains (barriers that need to be overcome); the last three emerged for Workshop 4.

- Lack of resources, support, and understanding
- Unwillingness to shift paradigms/ways of thinking about who can succeed and how to succeed in STEM education and/or careers.
- Traditional ways of thinking pose barriers and limit broader participation and access to STEM education
- Personal and institutional challenges to advancing equity
- Social and technical challenges associated with data use and impacts
- Personal and/or institutional challenges associated with data and data use
- Challenges of managing data responsibly and ethically

Major Themes: Gains

For Workshop 2, the first three major themes listed here emerged from the convergence of stakeholder perspectives related to gains (possibilities); the last four emerged for Workshop 4.

- Increase support, resources, and understanding necessary to enhance participation and access for all
- Implement social and technical solutions to broaden participation and access for all
- Challenge harmful ways of thinking/mental models through education and research
- Data provides ways to measure progress and identify where support is most needed and/or wanted
- Data provides means of giving stakeholders voice and representation
- Data is a tool for enacting change in how we do our work and how we impact stakeholders for the greater good
- Data contributes to our understanding of the community we serve

Broader Perspectives from the Advisory Board

The RISE NSF Convergence Accelerator Workshop planning team and advisory group met twice after the close of the event to discuss a retrospective of the workshop series, including feedback on the workshop organization, implementation, and potential outcomes and recommendations that inform the final report. Several recommendation themes emerged with regard to both the final report and actionable deliverables within three, five, and ten years. The overarching ideas are shared here. Additional details are provided in the Summary and Recommendations section of this report.

Workforce Skillsets Gap Analysis. There were discussions regarding employers’ ability to ascertain skillsets needs that truly support convergent, collaborative work projects with a social good focus. These questions centered on employers (industry or academia) and whether most have conducted sufficient gap analyses on skills needed, whether they know what skillsets are needed, and/or if key skillsets are missing from current hiring requirements.

Workforce Hiring Perspectives that Inform Collaborations. Advisors were sure to clarify that the term “workforce” be applied across industry and academia hiring practices with regard to convergent thinking in project development and collaboration.

Strengthening Representation of Social/Behavioral Sciences. An emphasis on strengthening the representation of social/behavioral sciences in proposed projects was highlighted as a key recommendation, which can address social good and much stronger convergent STEM education, research, and practice.





Need for More Representative Panels. Advisors with a history as NSF program directors shared the need for panels that have cross-discipline and cross-institutional (two-year colleges, Minority-Serving Institutions, etc.) representation. Collective thoughts were expressed that the panel composition requirements be stipulated in the solicitation and that the panel design aligns with convergence and equity. Understanding that within the Convergence Accelerator, the initial track selection is a responsibility of the team of program officers, advisors stressed the need for representation of panelists who are reviewing convergence (and other) NSF proposals to have diversity of thought, backgrounds, etc. The recommended list of panelists should include people who represent the identities/stakeholder groups that were elevated out of the workshop breakout activities, and represent convergence, broadening participation, social science, behavioral science, industry and technology. For example, participants in the RISE workshop should be encouraged to register to serve Convergence Accelerator review panelists.

Need to Explicitly Counter Systemic Racism. Core to the next wave of funding opportunities are proposals, platforms, and processes that lift up the voices, knowledge, and experiences of those who have been impacted by enduring racial and social inequities in STEM education, research, and practice. These include but are not limited to: data collection and analysis with BIPOC populations; eliminating biases and inequities in digital infrastructure; diverse, equitable, and inclusive project leadership and research positions; and engagement in ideation, problematization, decision-making, and in the interpretation and dissemination of evidence and research results.

Other Considerations and Recommendations. In addition to those recommendations and feedback shared during the advisory group meeting, the thoughts below were tagged as critical thinking points in the conversation on how they might inform the NSF Convergence Accelerator solicitation and NSF practices, as a whole.

- Can an effort like this be started as a platform?
- Understanding how employers consider or manage non-traditional applicant pools: What about skillsets of non-traditional learners?
- How do we distinguish reimagined ideas (pitches) for people who say “we already do that” with regard to existing programs at NSF to combat “been there, done that” ideation?
- How are collaborators informed of and encouraged to submit Convergence Accelerator proposals that allow them to remove traditional constraints; in other words, can they remove the box altogether rather than simply “think outside the box” in reimagining innovation in STEM education in an “Industry 4.0” environment?

NSF solicitations can be enhanced by including rubrics that value “Future of Work” proposals that focus on collaborations with communities served (community-led projects), not simply for communities impacted.



Introduction

Background and Rationale

In a recent letter that then President-Elect Joseph R. Biden sent to his selected candidate to lead the White House Office of Science and Technology Policy (OSTP), he asked the office to focus on five questions and make recommendations on “general strategies, specific actions, and new structures that the federal government should adopt...”. One question was “How can we guarantee that the fruits of science and technology are fully shared across America and among all Americans?”. He specifically mentioned “that benefits of science and technology remain unevenly distributed across racial, gender, economic, and geographic lines” and asks, “How can we ensure that Americans of all backgrounds are drawn into both the creation and the rewards of science and technology?” [1] This discussion highlights a well-known but poorly addressed issue in our society – that the expertise, development and benefits of key technical areas are often concentrated in the hands of few communities. It is critical to the advancement of many science- and technology-based fields and our continued leadership as a society that we promote opportunities for people of all backgrounds and identities – race, ethnicity, gender, socioeconomic, disability, geographic, discipline, and others – to pursue a quality education and build the necessary skills to obtain a foundation in the emerging technology fields of to-

day and that are poised to become industries of the future. As OSTP begins to explore how “the fruits of science and technology are fully shared across America and among all Americans” [2] we need to combine knowledge of broad human needs and STEM to achieve the goal. This opportunity necessitates that we reimagine education that encompasses science, technology, the arts, culture and social science and the rich diversity of society itself. We must reimagine education in STEM – including whom, how and the ecosystems that inform the next generation of scientific and technological endeavor.

The education of scientists and technologists has not been a typically interdisciplinary or representative endeavor. Too often, scientists and technologists struggle to connect their work to social good, or unassumingly contribute to social harm because we are not including social scientists and end-users in technology ideation and development. There is little formal education in STEM that focuses on social issues in the context of science, technology and society. The distant idea that these research endeavors advance humanity are lofty and often departed from the socially constructed reality and complications of modern society. While there are segments of STEM research that directly impact people, disparate impacts abound in energy, medicine, artificial intelligence (AI), and many other areas.



Reimagining Innovation in STEM Education for Social and Human Good

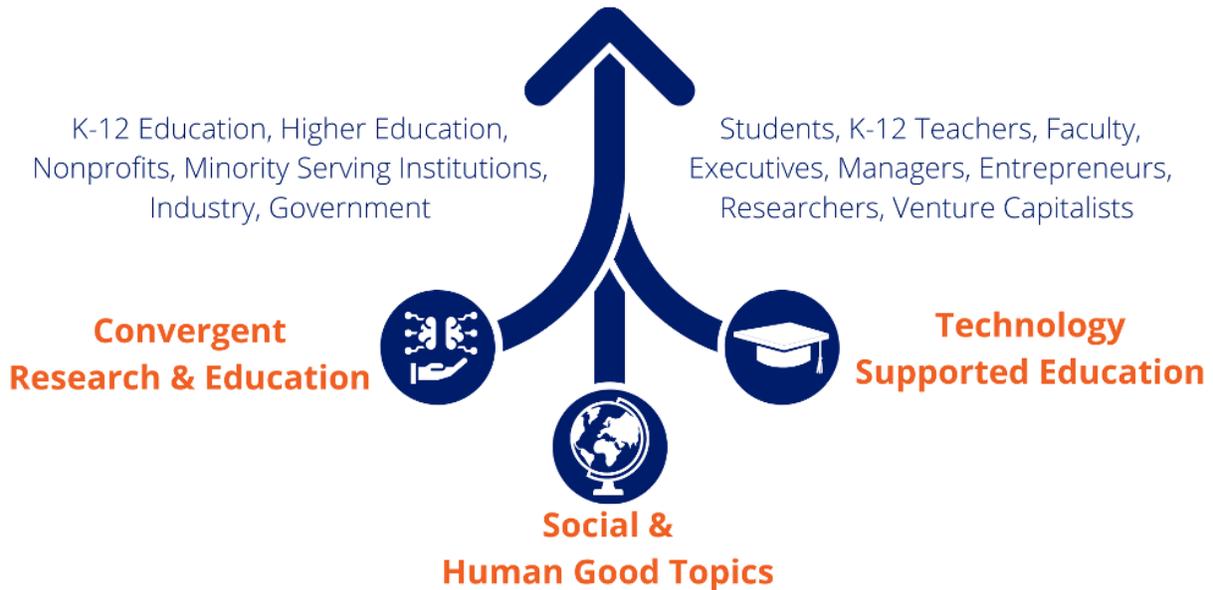


Figure 1. Convergence Model for Reimagining Innovation in STEM Education for Social and Human Good

These areas of science, engineering, and technology have an impact on individual and community health, economics and education which are often mediated by identity and contribute to a cycle of exclusion for generations. A retrospective approach for determining the impact of science, engineering, and technology on people is no longer acceptable or tolerable by society and is increasingly a regulated issue. We must include the entire group of diverse stakeholders at the beginning of the development process in order to not create even greater inequities by waiting to include them later in the process or at the end. We know from the data published by the National Science Foundation (NSF) that representation in STEM degree attainment at all levels has been a challenge for education in the US. NSF data indicates that from 1996-2016, the total share of doctorate degrees in science and engineering earned by underrepresented minorities (Hispanics or Latinx, Blacks or African Americans, and American Indians or Alaska Natives) ranged from 4.4% to 8.8% [3]. Black and Latinx students who go on to earn doctorates largely earn their baccalaureate degrees at Minority Serving Institutions (MSIs), so much so, that within all science and engineering, 25.3% of the Black doctorate recipients attended Historically Black Colleges and Universities (HBCUs) and 36.7% of Latinxs attended high-Hispanic enrollment institutions (HHEs) at the baccalaureate level from 2013-2017. These statistics are undeniable, particularly when one considers that the number of Black doctorates is nearing 1,500 per year as of 2016; for Latinxs the number is closer to 2,000, but overall, the nation is awarding 25,000 science and engineering doctorates a year. The standard pathway to careers in computing, artificial intelligence, and related fields includes at least one degree in computer science. Considering associate's degrees in

computer science, in 2016, Latinxs earned 3,771 degrees; Blacks or African Americans, 3,918; American Indians or Alaska Natives, 277; and Native Hawaiians or Other Pacific Islanders, 106. At the bachelor's level in 2016, Latinxs earned 10.8% of bachelor's degrees in computer science; Blacks or African Americans, 9.3%; American Indians and Alaska Natives, 0.4%; and Native Hawaiians or Other Pacific Islanders 0.3% [4].

When we look beyond educational attainment toward technology development and entrepreneurship, the indicators are worse. The *Crunchbase Diversity Spotlight 2020: Funding to Black and Latinx Founders* reports that since 2015, among 970 Black and Latinx founded companies raised \$2.3 billion in start-up funds, but this only represented 2.4% of the total venture capital raised overall. In 2018, Black and Latinx founders raised \$4 billion; however, the same year a total of \$141 billion was invested in startups. Exclusion in tech and social startup space is worrisome as minoritized individuals run into similar barriers in nontraditional spaces as well as in traditional pathways [5].

The PI team envisioned three focus areas within an ecosystem model to move rapidly toward a future of science, engineering, and technology research that is inclusive and exceeds social justice needs (Figure 1). A convergent approach to education and research prepares learners to understand STEM in a different and more meaningful way so that they are positioned to lead and inform meaningful projects. The focus on human good topics is the motivation for STEM endeavors, intended to prioritize issues that spark passion in learners and emphasize social justice impact. The ability to implement solutions is delivered through scientific and technology-supported education.

Workshop Purpose

Advanced research in artificial intelligence, quantum computing, cloud computing, and other science, engineering, and technology related areas has the opportunity to change the world as we know it. To ensure an equitable scientific future, we envision an ecosystem approach to educating and training the next generation of advanced researchers and social entrepreneurs who embrace the social sciences, arts, cultural relevance and responsibility. The purpose of the workshop series was to create a consortium consisting of people from secondary and higher education – including Minority Serving Institutions (MSIs) and two-year colleges – and tech companies to nurture and engage students from underrepresented groups in advanced research leveraging connections from K-12 to Ph.D., with many career options along the journey. Together, addressing the gap in representation in advanced research and addressing high human impact research areas, the broader STEM community has an opportunity to reimagine the future of science and engineering and their potential for impacts for social good. There is also a significant opportunity to support the future of research and development in these areas, and to leverage technologies from these fields in the educational process itself. Through collaboration, workshop participants can transform what is taught and how education experiences are modernized, particularly following the COVID-19 pandemic and our increasing understanding from neuro and cognitive sciences that offer new considerations for the learning environment.

In May and June 2021, IBM hosted an NSF-funded, four-part NSF Convergence Accelerator virtual workshop series titled “Reimagining Advanced Research for Human Good through Industry and Educational Partnerships” under award number OIA-2119846. It was branded “Reimagining Innovation in STEM Education for Human and Social Good,” or RISE. Over 60 participants from public and private institutions including institutions of secondary and higher education, industrial and academic research organizations, social justice organizations, government agencies, tech companies, and startups came together to focus on a convergent approach in addressing four areas:

- support for advancement of underrepresented groups in STEM,
- social and human good research foundations,
- artificial intelligence and technology supported education, and
- data trust development.

RISE was designed to explore each topic and identify the actions needed to inform the next decade of STEM education and research. The IBM PI team created initial ideas on outcomes, which workshop participants used to expand and potentially transform with the aim of generating innovative ideas for topics the NSF can consider for upcoming Convergence Accelerator funding opportunities.

Within two years, we expect to accelerate pathways for diverse students to engage in advanced research and education,

with a focus on social good applications at the pre-college, undergraduate and graduate levels. Students will be enrolled in interdisciplinary educational programs and will complete a research internship on their selected topics. By scaling efforts and access to opportunities across many organizations, we expect to establish a method to track progress, improve educational outcomes, and increase the diversity of the STEM workforce and startup founders. In five years, we will have graduated the first two cohorts of students who will either be continuing their education or joining the workforce in the targeted areas, ideally with affiliated partners. In ten years, we hope to see tangible progress in the expansion of the tech workforce in the United States.

We will have developed intentional organizational structures and cultures that support minority student advancement. These efforts will further accelerate progress in the development of a well-prepared and diverse workforce ready to address the pressing needs of the present day and anticipate the emerging needs of the future. We aim to disrupt the narrow scope of science, engineering, and technology outcomes that have been tightly held by some demographics and communities. By engaging the intellectual capital of more diverse constituents, the benefits of science, engineering, and technology will meet and exceed the public’s requirements for STEM..

Workshop Design and Facilitation

The workshop Principal Investigators are Dr. Lauren Thomas Quigley, Research Scientist, and Dr. Stacy Hobson, Director of Responsible and Inclusive Technology at IBM Research. Both are alumnae of Historically Black Colleges and Universities (HBCUs); they initiated this project by exploring how IBM can leverage its existing programs and networks with HBCUs and other MSIs to connect students to inclusive technology education and research careers. Specifically, their aim is to advance the representation of Black, Latinx and Indigenous people in advanced research along the educational pathway to the Ph.D. while also enabling various career options at the formal education stopping points learners select.

The IBM PIs contracted The PEER Group to provide support and expertise to the design, facilitation and analysis of workshop findings to inform the 2022 NSF Convergence Accelerator Phase 1 and 2 call for proposals. The PEER Group is an organization with deep knowledge, expertise and experience in STEM education research, evaluation, and practice in higher education and non-profit contexts strongly rooted in justice, equity, diversity, and inclusion (JEDI). Dr. Michael D. Smith served as the project director with Dr. Yvette E. Pearson as the co-project director and subject matter expert. The PEER Group’s expertise in these areas and goal to “help organizations achieve ubiquitous inclusion (UI) so that diversity, equity, and inclusion (DEI) become universal standards of practice inextricably linked to organizational excellence” made them the ideal partner.



Sessions were designed in consultation with the advisory board and NSF Program Director, Dr. Linda Molnar. The IBM PI team created initial ideas on outcomes, which The PEER Group developed into an agenda that was a carefully crafted combination of provocations and interactive activities. Provocateurs who were experts on the workshop topics were identified through the project team's and the program director's networks and previous engagements as audience members for some of their talks. Activities were designed to include rapid ideation building on the topics of the talks and varying degrees of synthesis toward potentially transformative topics that meet three key Convergence Accelerator criteria: **requiring convergent approaches, having strong societal impacts, and having tangible deliverables that are achievable within three years**. There is also a RISE community in Mighty Networks that allows for networking, engagement, and collaboration amongst participants before, during, and after the workshop.

The workshops were held via Zoom on May 25, May 27, June 3, and June 8, 2021 from 1:00 – 4:30 p.m. EDT each day. The dates and times were chosen to facilitate participation by faculty and students (i.e., the dates were after commencement for most institutions) and by people in various geographic regions of the US (i.e., afternoon time blocks allowed participants across all US time zones to engage during “typical” work hours).

Each workshop session began with an overview from Dr. Molnar of the aims of the NSF Convergence Accelerator program, followed by a recap of previous workshop's activities and outcomes, led by Dr. Pearson. A contextualization by Dr. Quigley (Workshops 1 through 3) and advisory board member, Dr. Chris Draper (Workshop 4) set the stage for the remainder of each session's activities. Provocateurs provided “TED”-style presentations on the session topics that laid the foundation for interactive breakout sessions focused on in-depth ideation on the key issues, root causes, utopic views of the future, and potentially transformative topics that can inform the next round of NSF Phase I and Phase II Convergence Accelerator funding opportunities.

Breakout session activities alternated, with those for Workshops 1 and 3 focused on generating opportunity statements in the form of “How can we?” questions that align with a reimagined STEM ecosystem that addresses the three key Convergence Accelerator criteria. Activities for Workshops 2 and 4 were based on empathy maps for various stakeholder communities, which led to the development of “Shark Tank”-style pitches to address pains and/or gains identified for each group. As a result, participants were able to collectively generate several ideas with the potential to be highly transformative, out-of-the-box directions that not only support the broader community of future innovators and researchers, but also **includes them** in problematization and creation of solutions for social and human good, emphasizing a need for convergence and reinvestment back into their communities.

The remainder of the report provides summaries of the provocations along with details on the process and outcomes from the breakouts of each workshop session, followed by a summary and recommendations. Appendices include provocateur biographies, lists of advisory board members and participants, and detailed instructions for breakout sessions and the resulting raw data.

Participant Recruitment and Selection

The workshop planning team desired to identify a diverse group of participants who brought a combination of personal and professional backgrounds, topical expertise, and interest in making meaningful workshop contributions while keeping the workshop participation to a manageable size and to allow for input and collaborative discussion from all the participants. To accomplish this goal, a pre-workshop questionnaire was created for distribution to a contact list of approximately 100 possible invitees, which was developed by the workshop planning team. The team established a process that brought in a broad group of perspectives and stakeholders to help achieve the workshop objectives and offer a constructive, informative process for doing so. Sample questions included, but were not limited to:

- Please provide up to three examples of your/your organization's work and accomplishments relevant to,
 - Topic 1: Support for advancement of people from underrepresented groups in STEM to pursue and obtain post-secondary degrees in high-demand tech fields like artificial intelligence (AI), quantum technology, cloud technology, cybersecurity, biotechnology, etc.
 - Topic 2: Social and human good research foundations to explore how research topics, such as the use of technology for social or human good, might ignite the interest of students from underrepresented groups by associating the application of technology with issues they care about.
 - Topic 3: Artificial intelligence and technology-supported education to identify how advanced technology areas like AI can be used to shape new models of education; evaluate and potentially course correct traditional education models; make connections from initial technology entry points (e.g., social/human good contexts) to application of the expertise to other technology challenges; recommend specific internship or research opportunities based on student skills and interests, or conversely, help hiring organizations identify candidates from underrepresented groups with appropriate skills; identify learning modules to address particular tech education gaps; and help bridge the educational, aspirational and financial gaps caused and exacerbated by the COVID-19 pandemic.
 - Topic 4: Data trust development to capture details on student demographics, educational pursuits, participation in specific programs to support their advancement, and the resulting student educational and career outcomes.

- Please rate your expertise in the workshop themed topics [listed above].
- One of our goals with the workshop and subsequent efforts is to ensure a broad, diverse and intersectional approach toward advanced research, STEM education, and industry leadership. A value that our team brings to this is an ethic of care for the whole person and all the identities that influence their experiences in STEM. We want the workshop experience, ideas developed, and information shared to represent all of our participants' backgrounds and identities in STEM. If you'd like, please share your diverse background and/or identity story as it relates to your possible participation in this workshop (3 to 5 sentences).
- Based on the ideas proposed here, are there thought leaders from your sector, or another sector, whom you believe should be invited to respond to this questionnaire?

Links to the questionnaire were additionally sent to most of the individuals recommended by the people who completed it. The questionnaire responses were reviewed by the IBM PI team and those selected received a direct email invitation to register for the workshop series. Each invited participant had the opportunity to register for participation in the full workshop series, or could register for one or more specific topical sessions. Additionally, some participants, including provocateurs, advisory board members, and individuals recommended by the NSF program director, received invitations to register for the workshops, regardless of whether or not they completed the questionnaire.

The planning team recognized that there was likely very broad interest in the workshop themed topics and created a communication plan to share additional updates including our workshop output report with those who have expressed an interest in staying aware of any advancements in this effort. We invited interested community members in the developing ecosystem to stay connected with the project via our website and the NSF Convergence Accelerator website.



Workshop Session 1

Support for Advancement of Underrepresented Groups in STEM

Context Setting

by Dr. Lauren Thomas Quigley

Planning a workshop to reimagine STEM education prompted reflection, research, examination of practices that exist, and identification of what is working and what is not. An analogy that arose during conceptualization was that of a terrarium. What would STEM education be like if we focused on developing a cohesive, collaborative, supportive, and enriching ecosystem for all? What would be required of an environment in which choosing to become a scientist, engineer, or technologist was a nurtured experience for those who have been left out of participation and the benefits of science and technology in this country? This spurred the selection of this workshop's convergent model and four workshop topics. To begin this reimagining, as leaders and learners within the ecosystem we needed to reflect on our role in the environment as well as internalize information about what works and does not. We needed to interrogate our value structure when it comes to STEM education for human and social good and how those of us who have had limited access, opportunity, and benefits of modern STEM can redirect the future.



Provocation 1: Lessons from Plants

Dr. Beronda Montgomery | Michigan State University



Dr. Beronda Montgomery, Michigan State University Foundation Professor and Interim Assistant Vice President for Research and Innovation, discussed her work, which centers around understanding how individuals perceive, respond to, and are impacted by the environments in which they exist. She began her discussion revealing a photograph of two genetically identical bean seedlings with nearly similar nourishment except for one critical, external condition - one had been deprived of the light it needed to fully thrive. From there, she shared three major lessons:

Lesson #1 - Environment Matters.

This important lesson from plants is analogous to how our own environments matter in shaping our outcomes. Montgomery stated, “Equal aptitude results in different outcomes depending on the external environment.” This natural phenomenon grounds her thinking around how STEM traditionally builds communities of support, mentorship and leadership and investigates needed changes to promote environmental care to support individuals more broadly in STEM.

Lesson #2 - Bias Attributions and Misguided Assumptions.

The emphasis here was to reject deficit-based engagements. A plant's behavior is determined by interaction with its external environment. For example, a plant that grows in darkness will reach for any semblance of light in the hopes of removing itself from an environment that is not ideal. In contrast, STEM educators, researchers, and employers go through highly selective processes, choosing individuals who have been successful elsewhere. If a student or colleague consistently performs well, they are viewed as being smart. People look at the outcome and then make judgments. Oftentimes, if students are from historically underrepresented and minoritized communities, people make judgments about whether or not they are a “good fit.” If and when they decide to offer mentorship, it is largely done through an assimilation-based lens.

Lesson #3 - Model Human-Plant Relationships.

As is the case with plants, students should be expected to grow. When a plant is not doing well, people examine the environment (nutrients, light, caretaking, etc.) because the default expectation is that plants should grow. No one looks at the plant and thinks it is incapable of greening. No one tries to teach plants how to be better plants.

Dr. Montgomery ended her talk urging attendees to challenge the ways in which they interact with students and colleagues by assessing whether current ecosystems of support are ones that meet individuals where they are.



Provocation 2: REDEFINE STEM Education

Dr. Yvette E. Pearson, P.E., F.ASCE

The Pearson Evaluation and Education Research Group, LLC



Dr. Yvette E. Pearson, Founder and Principal Consultant of The PEER Group, began with an eye-opening look at data illustrating demographic changes in engineering over time. While many may view increased numbers of degrees awarded to women and Blacks/African Americans as a promising and clear indicator of improvement in the realm of gender and racial diversity in STEM, a closer look at the data paints a starker picture - one where the fraction of women has been fairly constant for more than a decade and for Blacks/African Americans, has actually decreased. Within this context/framing, she highlighted three of the reasons why diversity efforts fail:

- 1. Relegated and Delegated.** Diversity efforts are often relegated to the margins of STEM education and practice (not prioritized/centered) and delegated to marginalized and minoritized groups who are tasked with both dealing with and solving problems they did not create. Additionally, many of these same individuals are oftentimes not in positions of power to bring about significant change.
- 2. Limited Perspectives.** Some have tunnel vision when it comes to diversity, choosing to focus on a single group, and not realizing the exacerbation of adverse impacts when people have intersectional marginalized identities (e.g., disabled Black women).
- 3. Focus Solely on Diversity.** Many diversity efforts fail because they are solely “diversity” efforts. Diversity is just one building block; it addresses representation that is reflective of society. Three additional building blocks must be in place for diversity to be achieved, sustained, and grow (picture these building from the ground up):
 - **Justice (the foundational block)** – identifying systems and policies that create inequities and eradicating them;
 - **Equity** – ensuring fairness, dignity, and respect for all; and
 - **Inclusion** – having and valuing a variety of voices “at the table.”

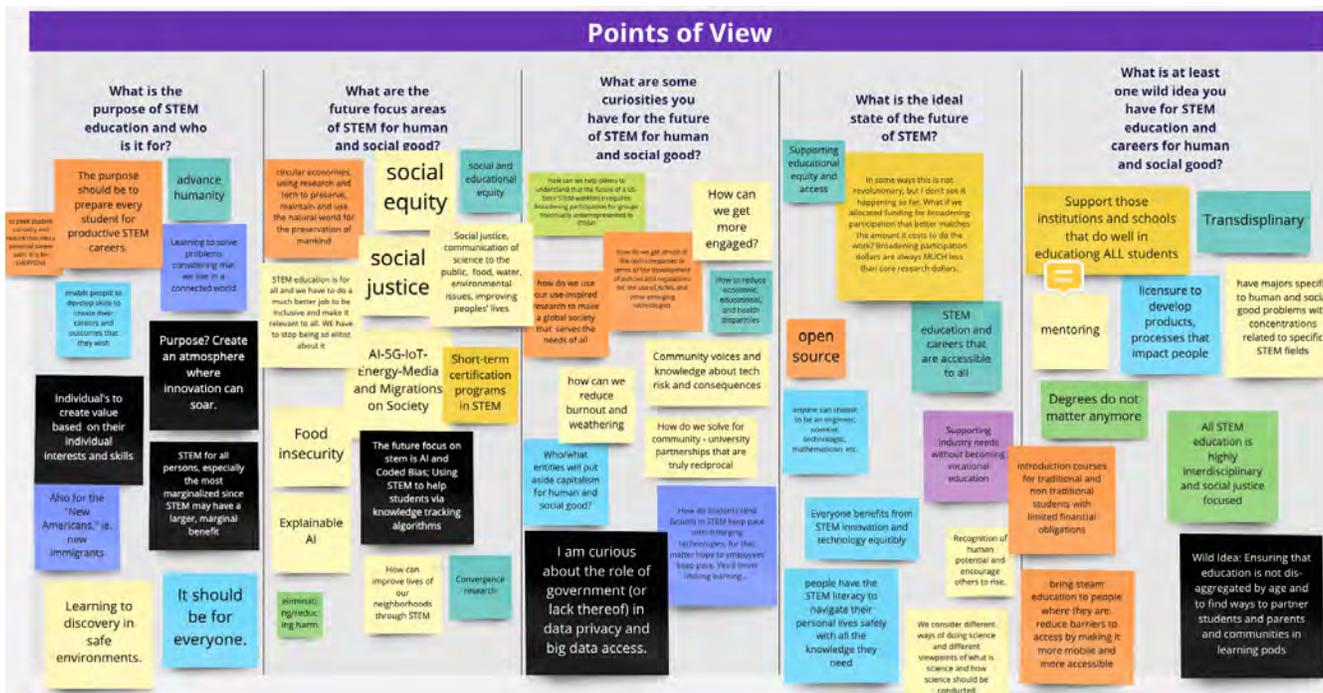
Diversity, then, would be on top. Together, these building blocks create what she described as a JEDI culture.

Dr. Pearson continued by urging attendees to REDEFINE STEM education.

- **RE-image** who we see as engineers and scientists and what we see as engineering and science, emphasizing societal impacts of science and engineering;
- **DE-silo** academic programs, research and problem solving, bringing together different ways of thinking, knowing, and doing from various disciplines and from communities to create new curricula and to understand and solve problems; and
- **FINE-tune** climate and culture using a JEDI approach so everyone can succeed.

She wrapped up by sharing insights on challenges to organizational culture change.

- **The Mirror.** Many organizations have a problem looking in the mirror because it shows the good as well as the bad, and it is hard to look at the bad.
- **Speed (or the lack thereof).** Change takes time. There will always be folks who believe change is happening too fast and others who believe it is too slow. There needs to be a balance of “quick wins” so folks will know things are progressing with the deeply-rooted systemic change that takes time. And there must be clear communication through it all.
- **Pain.** People have to reach a pain point before they are moved to change. Another type of pain may come in when organizations are in the change process. She related this to surgery and recovery processes.
- **Legal Considerations.** As states and the federal governments have changes in administrations, there are legal challenges to change. Thus, change processes must include consultations with legal professionals.
- **The Way We’ve Always Done It.** One of the biggest challenges to change is routine, or the attitude that “this is the way we have always done things.”



Points of View Miro board used for collaborative ideation.

Breakout Session 1: Groundskeeping for Representative Ecosystems in STEM Education

The goal of the session was to allow groups of participants to collectively identify 10-15 ideas they believed to be top priority and have the highest transformative potential for a Convergence Accelerator along with the stakeholder groups impacted and engaged. Participants were split into three groups with mixed personal, professional, and organizational demographic identities. The activity took place in three stages. Detailed instructions and complete raw data sets are provided in Appendix B. A summary is provided here.

Points of View Statements. Participants were asked to write “Points of View” statements representing their own perspectives on STEM education, addressing five questions adapted from the American Society of Civil Engineers Education Summit [6]:

1. What is the purpose of STEM education and who is it for?
2. What are the future focus areas of STEM for human and social good?
3. What are some curiosities you have for the future of STEM for human and social good?
4. What is the ideal state of the future of STEM?
5. What is at least one wild idea you have for STEM education and careers for human and social good?

Using rapid ideation, they were asked to generate as many thoughts/ideas as possible, pushing and eliminating traditional boundaries to challenge the status quo for STEM education and careers. Facilitators stressed the importance of considering all facets of the STEM ecosystem – education, careers, communities.

Stakeholder Group Impact. The next step in the process was to have participants take turns briefly sharing their statements, identifying stakeholder groups impacted/involved. Three broad stakeholder groups were pre-identified for categorizing the ideas: education/research, workforce, and community. An “other” category was also available for ideas that extended beyond those three. Ideas that fit multiple categories were duplicated as needed.

Emoji Voting. Each participant then voted on the five ideas/statements they believed to be top priority and have the highest transformative potential. In doing this, they were encouraged to not allow their votes to be limited by constraints or feasibility. The top ideas from each group were gathered by stakeholder identity for use in Breakout Session 2.



Breakout Session 2: Ecosystem Building

For this session, participants self-selected groups based on the stakeholder group to which they wanted to contribute – Education/Research, Workforce, or Community. This was not necessarily their personal stakeholder identity. For example, there were employers in the Education/Research group and educators in the Workforce and Community groups. This was designed so that participants from different backgrounds and identities contributed perspectives to ideas in each group. The aim of the session was to identify ideas that met three key Convergence Accelerator criteria – **requiring convergent approaches, having strong societal impacts, and having tangible deliverables that are achievable within three years** – and existing barriers that need to be removed in order to achieve the desired outcomes.

Fruit – What do participants want to see? In the first stage, participants transformed top ideas from the emoji voting into questions starting with “How can we?”. These were considered “fruit”; they represented what participants want to see as outcomes.

Educators/Researchers

- How can we make STEM courses more relevant to students?
- How can we change temporal format of education to better support deep engagement, still compatible with constraints of life?
- How can we expand educational preparation, access and opportunity?
- How can we create reflective institutions that think about changing the context as the primary method of helping individuals/institutions thrive?
- How can we reduce burnout and weathering?
- How can we restructure STEM education to be integrative areas of practice with social sciences?
- How can we practically create space in degree granting environments for students to both specialize and maintain breadth enough to consider humanity of what they are doing?
- How can we incorporate critical thinking and questions around social impact in STEM education (so individuals can navigate the ethics of scientific research and its relationship to social inequality)?

Workforce

- How can we ensure that STEM competencies built into our education system are culturally responsive, impactful, and relevant?
- How do students (and faculty) in STEM keep pace with emerging technologies, for that matter, [how do] employees keep pace? Yes, I know lifelong learning....
- How can we do more to include and value disabled researchers as much as any other group?
- How can we help others to understand that the future of

a US-born STEM workforce requires broadening participation for groups historically underrepresented in STEM?

- How can we ensure that those academic-industry learning partnerships are appropriately aligned for student-centered, life-long learning?
- How [can we ensure] that apprenticeships are an integral part of STEM education and designed with equity in mind?
- How can we respond to global impacts of globalization on our workforce?
- How can our workforce have a global impact?
- How do we ensure that AI increases equity and does not decrease it?
- How can we provide a respected pathway to completing “skilled STEM” careers for those in a traditional bachelor program?
- How can we engage with industry to learn from them and share with them, models to create a more representative STEM workforce?

Community

- How can we identify ways to further understand the environments surrounding students by understanding the connection to land, ancestry, identity, and economic prosperity?
- How can we determine which scientific questions serve and/or harm marginalized communities? Should these questions be pursued?
- How can we make sure that rural America is involved in the process?
- How can we make sure that parents and other potentially underrepresented groups are included as stakeholders?
- How can we get everyone involved?
- How can we use qualitative research methods to dig deeper in understanding beyond the quantitative numbers?
- How can we bring STEM education to people where they are to reduce barriers to access by making it more mobile and more accessible?
- How can we create accountability measures to ensure an ROI?
- How can we work with local service organizations to advance STEM in rural areas?
- How can we foster and encourage self-efficacy and self-identity?

Categorization. In the context of three key criteria for Convergence Accelerators – **requiring convergent approaches, having strong societal impacts, and having tangible deliverables that are achievable within three years** – participants then binned their ideas (How can we? statements) into one of three categories:

- **Been There, Done That:** These ideas align with the status quo. They may be effective to some degree, but have not yet proven to be impactful in effecting change at scale. They do not address convergence; they are not likely to yield deliverables in three years.
- **Boundary Pushing:** These ideas go above and beyond status quo, but are not radically different. They may potentially effect change, but not revolutionize STEM education

and careers. They may address some, but not all, three key Convergence Accelerator criteria.

- **Reimagined:** These ideas re-create concepts from an entirely new perspective, having the potential to revolutionize STEM education and careers. They address all three key Convergence Accelerator criteria.

Ideas that emerged as “reimagined” were:

Education/Research

- How can we establish majors specific to human and social good problems with concentrations related to specific STEM fields?
- How can we change school curricula and pedagogy to prioritize project-based learning, centered on equity and student voices?
- How can we redefine STEM domains and participation in more inclusive /equitable ways that reflect a broader culture?
- How can we bring STEAM education to people where they are to reduce barriers to access by making it more mobile and more accessible?

Workforce

- None noted.

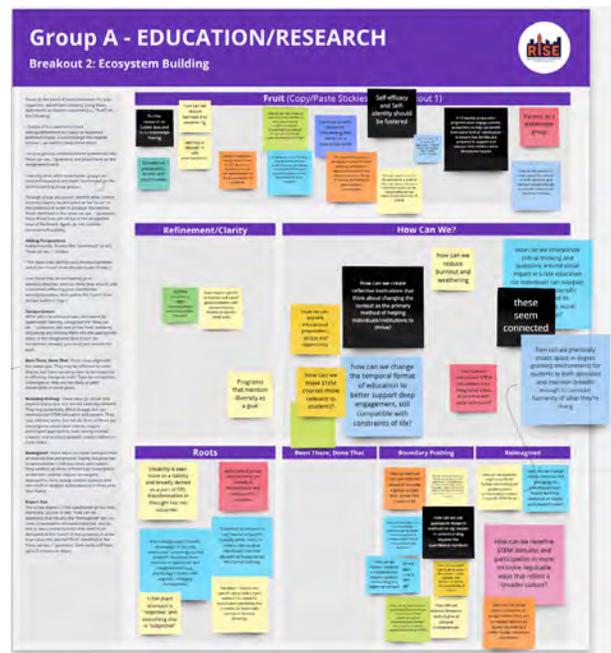
Community

- How can we prepare K-12 teachers to engage parents-as-teachers so to ensure that families are prepared to support and educate their children when disruptions happen?
- How can we identify ways to further understand environments surrounding students by understanding the connection to land, ancestry, identity, and economic prosperity?

Roots – What disruptions are needed? Finally, participants identified existing “roots” – current systems, practices, mind-sets, etc. – that need to be disrupted or eradicated to produce the desired fruit.

Education/Research

- Disability is seen more as a liability and broadly denied as a part of DEI; transformation in thought has not occurred.
- Social justice issues and concerns are viewed as nontechnical and nonscientific concerns.
- “Expertise” is limited to very few sets of people (usually White, male, cis-hetero, able-bodied individuals from elite educational backgrounds with formal training).
- Acknowledge even “scientific knowledge” is “socially constructed” and recognize that scientific disciplines have histories of oppression and marginalization (e.g., psychology’s history with eugenics, misogyny, homophobia).
- Paradigm - Only a very specific set of skills (“hard science”) is useful for society and everything else is viewed as essentially useless or window dressing.



Collaborative board for Breakout Session #2.

- STEM (“hard science”) is “objective” and everything else is “subjective.”

Workforce

- Disrupt the current isolationist philosophy and mental models.
- Examples of successful engineering need to be from Global South as well as Global North.
- Non-transparency and lack of adoption of ethical guidelines in AI.
- The idea that education and workforce are separate.
- Entry level jobs for people not coming from an academic background should have a career path.
- Differences in when we collaborate and when we compete between academia and industry.
- The idea that the completion of an educational course is an objective in itself (e.g., that the paper being means something on its own).
- The value of student labor when evaluating internship purpose.
- The protectionist approach to IP being developed in an academic institution.
- The idea that successfully completing higher degrees is more valuable in STEM than succeeding in something that earns an associate’s degree.

Community

- Understand the geography of opportunity.
- Enable local voices. They know their issues and what works best.
- Culture and community are connected.
- Listen to marginalized communities to understand what the needs are - bottom up not top down.



Workshop Session 2

Social and Human Good Research Foundations

Context Setting

by Dr. Lauren Thomas Quigley

The year 2020 will be remembered and recorded as one of the most disruptive years of this generation's lifespan. While science, engineering, and technology advances surround mainstream American and global culture, there remain large swaths of people whose basic needs and rights are left unmet, often exacerbated by technology. The arrival of the COVID-19 pandemic left the global population vulnerable to a health disruption that science was not fully prepared to address. Adding the social justice uprising in the US and globally with environmental disasters attributed to climate change, the clear moment for something to change arrived. To explore human and social good topics in STEM we must focus on both social justice topics, frameworks, institutional mechanisms and how social entrepreneurship can lend space for reimagination.



Provocation 1: Social Justice and STEM

Dr. Lauren Thomas Quigley | IBM Research



Dr. Lauren Thomas Quigley, Research Scientist in Responsible & Inclusive Technology at IBM Research spoke on the topic, “STEM as Social Justice.” She has previously worked with students to prepare them to be math and science tutors of persons in a highly diverse school district who spoke many languages, represented a significant refugee population, were on reduced lunch or had other social or economic indicators that marginalized them in STEM education. The question was how to help them think critically and deeply about social justice and the role of math and science in their role as tutors. So, rather than thinking about STEM and STEM **with**, or STEM **next to** social justice, she focused on STEM **as** social justice, emphasizing three things – process, product and knowledge.

Questions Dr. Quigley posed included:

- What would engineering or STEM processes look like if they were socially just from the onset and were only used for social justice?
- How would we re-think that process?
- Would engineering or STEM products do or be different if we designed them for social justice purposes?
- How would engineering and STEM education be different if the knowledge of STEM prioritized social justice criteria to achieve other learning outcomes?

She followed by stating social justice can be defined in terms of three broad ideas: (1) beloved community, recognizing that all people can share in the wealth of the world; (2) identities and affiliations, where people are a part of groups and groups are valued unequally; and (3) social justice work is lifelong, and it requires knowledge of prior work.

Dr. Quigley pointed out the need to recognize what is happening and have deep reflections of self, deep reflections of society and of systems to have social justice movements in STEM that follow other movements (e.g., environmental justice, equal rights movements for Blacks and the LGBTQ+ community, voters’ rights). She noted that the challenge today is centered on how STEM education can be used to achieve social justice. Dr. Quigley emphasized that when identifying a STEM identity, there can be competing factors wrestled with by learners as they move through a STEM world that may not value a justice framework that they value. She illuminated this with a quote from W. E. B. DuBois,

It is a peculiar sensation, this double-consciousness, this sense of always looking at one’s self through the eyes of others, of measuring one’s soul by the tape of a world that looks on in amused contempt and pity. One feels his two-ness; an American, a negro, two souls, two thoughts, two unreconciled strivings; two warring ideals in one dark body, whose dogged strength alone keeps it from being torn asunder.

Dr. Quigley summarized by stating that if we are to achieve what is needed for society, different theoretical perspectives should drive the way we do things both in the classroom and in our research. If we want to have a truly socially constructed environment, we need to look at the multiple subjective realities. To be able to understand those phenomena, we need to use approaches that emerge instead of committing to one particular method of doing research. The researcher and participants are partners. This represents a shift from doing research “on” participants to doing research “with” participants. There are different ways to create output that is not just a context re-generalization. If we want to develop a new structure and a new system, we have to deconstruct the existing narrative around who gets to be scientists and engineers and deconstruct the system that has supported the same people receiving the benefit of our innovations.



Provocation 2: Lessons Learned While Building an Institute for Social Justice in Chicago

Dr. Malik Henfield | Loyola University Chicago



Dr. Malik S. Henfield, Professor and Founding Dean of the Institute for Racial Justice at Loyola University Chicago, began his talk by explaining that he learned many lessons while building the Institute for Racial Justice. He discussed the various challenges he has faced in different institutions, especially concerning what it means for larger institutions to be a partner with the community. He then explained that when discussing social and human good research, it is important to understand that social good research is a euphemism for the treatment of Black and Brown folks in society and the need to ensure they have more equitable outcomes.

Dr. Henfield continued with a discussion of the importance of community-university partnerships as well as community-engaged scholars and found that not much was scalable because it requires a lot of time and funding that students deserve, but that universities do not provide.

In 2020 when George Floyd was murdered, Dr. Henfield wrote a letter to the people in his department urging the need to be antiracist. Once this letter was written, the provost wanted to have a conversation, and this was the beginning of the Institute of Racial Justice. The provost challenged him to think globally with this institute and to think about other areas that should be involved; and thus, there are now five interdisciplinary areas. During the development of the institution, Dr. Henfield reached out to the mayor's office and spent three months meeting with people throughout Chicago to learn of their experiences. He realized that many individuals were disappointed with higher education, as they typically did research **on** them but not **with** them. He asserted that people need to ask themselves how they can respect the research expertise of the scientist and also the expertise of the folks in the community.

Strong university impacts can be realized by asking questions about how the institution can meet the needs of both the community and the people on campus when university policies cannot be changed. He explained that there are important questions to ask such as: What are the experiences of our people? Who are those who are falling through the cracks? And how does that relate to some of the scientific endeavors we are pursuing?

Dr. Henfield ended his talk by sharing three key takeaways and one question:

- Develop a foundational understanding of internal and external Black, Indigenous, and People of Color (BIPOC) experiences.
- Find the courage to acknowledge what is not working internally and externally and the strength to do something about it as an institution.
- Establish key performance indicators and understanding their interconnected nature.
- Question: Are we leading with equity or science or both?

Breakout Session 1: Sociotechnical Problems from Education to Research to Society

This exercise was designed to help participants gain deeper insights into the needs of various STEM stakeholder communities and to recognize and “own” their roles in both meeting those needs and serving as barriers, using convergence to move along the spectrum from education to research to society. Detailed instructions and complete raw data sets are provided in Appendix B. A summary is provided here.

Empathy Maps. To facilitate participant ideation, the planning team created empathy maps in Miro for six stakeholder groups:

- University Faculty and Administrators
- K-12 Teachers
- Employers
- Students (K-12, Undergraduate, Graduate)
- Community Members/Community-Based Organizations
- Funders

Participants independently browsed the empathy map(s) of their choice based on stakeholder identities they serve or support, not their own identities. For each stakeholder empathy map, they were asked to think about: (1) who the stakeholder is and what they are trying to understand about the stakeholder (what their situation is, what their role is in the situation), and (2) what the stakeholder’s needs are (what they need to do, know, or understand; what they need to do differently) relative to STEM for social and human good.

Participants placed sticky notes in each quadrant of the empathy maps noting what the stakeholder sees, hears, says and does, and thinks and feels. In the next step, participants reviewed the empathy maps and identified at least one pain and one gain from the stakeholder’s perspective. They were also asked to think of how their role has contributed to both the pains and gains of the stakeholders.

Adding Personal Perspectives. Next, participants browsed the empathy map boards again, this time focusing only on the stakeholder group(s) with which they personally identify or have personally identified before. They added comments or emojis as needed to question, correct, and/or clarify what others perceive of their stakeholder group. This could be a “thumbs up” to validate the perspective on the sticky, a “thumbs down” to disagree, or a comment to question or correct misperceptions of others. Further, the participants added sticky notes that reflected their points of view if something was not represented, with a focus on pains and gains. The pains and gains that resulted for each group were:

University Faculty and Administrators

- Pains
 - Not seeing yourself in STEM and/or academia.
 - Being mischaracterized or mistreated by technology.
 - No work-life balance/burnout.
 - Staying in touch with what happens in the classroom and how students’ and instructors’ needs change.
 - Dealing with student groups who have a problem with your work.
 - Keeping the finances in check.
- Gains
 - Feeling empowered by working with others from different areas on problems of importance to society that also promote justice.
 - Greater participation by those not normally included in STEM.
 - Exciting students and non-academics about science and technology.
 - Academic freedom!
 - Being a part of bringing disabled students into STEM and the university as a whole.
 - Being able to set the direction for their university.
 - Being able to leverage technology to connect with stakeholders across their institution.

K-12 Teachers

- Pains
 - Lack of leadership at school level to create equitable environment for teachers.
 - Unwillingness to move from focus on standardized tests.
 - Introduction of legislation to prevent the very education needed (i.e., race-conscious historical analysis).
 - Pedagogy is pretty much the same - sit and get - with a few variations. No incentive to teach differently.
 - Disabled students don’t receive the same K-12 education, but they will receive the same education in higher ed. How do I prepare them?
- Gains
 - More districts offering racial equity training, with some making it mandatory.
 - More districts created “technical” solutions to getting students of color in high level classes, forcing teachers to acknowledge their presence.
 - More districts seeing teachers of color and working on retention efforts.
 - Talking about disability and ableism early, we create a more compassionate future generation.
 - Some movement on resources allocated to address inequities.



Employers

- Pains
 - Mid-level, not the top - pressure to fill roles and impose standards they may not even fully agree with.
 - Employees soft/professional skills have diminished.
 - Disabled students are never taught how to get into the workplace and [employers] were never taught how to support them.
 - Cultural competence is nonexistent.
 - Transitioning back from working at home to going back to the office while respecting the needs of those who need to continue working from home.
 - Research and development funding for social good pales in comparison to funding for defense and commercialization.
 - Efforts to help can backfire because [employers] are not experts at everything.
- Gains
 - [Employers] have the funding to support programs that serve students.
 - Having an anti-ableist environment will improve well-being to speak openly about disability.
 - Having disabled employees will help to create solutions for everyone through the work we do.
 - Students (K-12, Undergraduate, Graduate)

Students (K-12, Undergraduate, Graduate)

- Pains
 - Systemic racism.
 - Toxic masculinity.
 - There is no conversation at all about systemic ableism.
 - Negatively affected by social media (mental health, time and attention...).
 - Lack of understanding and ineffective support from home support systems (parents, family, HS friends, etc.).
 - Higher education costs.
 - White supremacy.
 - Navigate racism, sexism, xenophobia, etc.
 - The emotional abuse of disabled students is condoned by no one saying anything against ableism.
 - Mental health is never named as a disability and delays disability identity formation.
 - Isolation.
 - Lack of support from teachers/faculty with interest in solving problems around issues of social injustice.
 - Disabled students have to work much harder than non-disabled students.
 - Have to work especially hard, harder than others.
 - Disabled students do not have the same degree of programs to help them succeed in research.
- Gains
 - Natural at using social media (for good).
 - Experience in managing multiple perspectives and identities.

- Underestimated to recognition of actual capabilities.
- Deep cultural connections to joy and love.
- Joy from achievement; some economic gain; ability to continue to help others.
- Continued persistence even in confrontation with implicit bias, etc.
- Finding a disabled mentor can really change everything.
- Learning that our lived experience as disabled students matters in grad school.
- First person witness-expert on subject matters.
- Great careers doing good for all humanity.
- Opportunity to leverage sensitivity to issues that impact their lives. From pain to purpose.
- STEM advocacy and insights.

Community Members/Community-Based Organizations

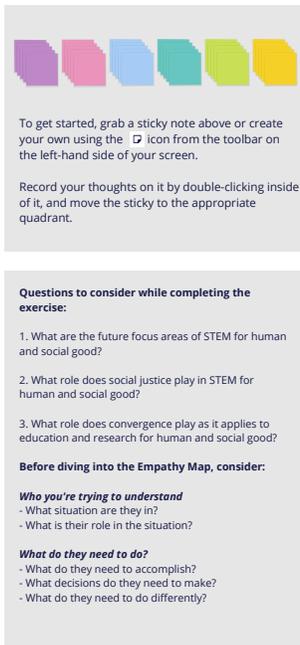
- Pains
 - Create more work for them.
 - Not enough resources.
 - Competing for funding, support and/or strategic partnerships.
 - Inability to create the desired impact based on the tremendous need.
 - Finding true advocates and allies with power/pockets that they will use.
 - Immediate needs outweigh ability to innovate.
 - Solution costs too much for too little gain.
- Gains
 - Opportunities for skills training and income.
 - Solutions for environmental impact.
 - Tangible solutions.
 - Close to the communities they serve - aware of the issues.

Funders

- Pains
 - Not enough funding to address/solve the need.
 - Who/how to collaborate with other funders.
 - More work in the evaluation of proposals.
 - Successfully creating public/private funding models.
 - Funders do not let the communities experiencing the issues define the solution and outcomes.
 - Acquisition restrictions may limit what applicant aspects can be considered.
- Gains
 - Help backers see new paths for opportunities no one even knew to consider before.
 - Strategic partnerships.
 - Impactful initiatives that help to secure additional funding.
 - More impactful research.
 - More research in collaboration with disabled researchers.

Empathy Map

Community Members/Community-Based Organizations



To get started, grab a sticky note above or create your own using the  icon from the toolbar on the left-hand side of your screen.

Record your thoughts on it by double-clicking inside of it, and move the sticky to the appropriate quadrant.

Questions to consider while completing the exercise:

1. What are the future focus areas of STEM for human and social good?
2. What role does social justice play in STEM for human and social good?
3. What role does convergence play as it applies to education and research for human and social good?

Before diving into the Empathy Map, consider:

Who you're trying to understand

- What situation are they in?
- What is their role in the situation?

What do they need to do?

- What do they need to accomplish?
- What decisions do they need to make?
- What do they need to do differently?



Empathy Map for Community Members/Community-Based Organizations.

Breakout Session 2: Educational Opportunities for Interdisciplinary Framing

The goal of this exercise was to define a product, service, system, etc. (broadly referred to as "product") to address pains and gains identified in the first session, then develop a pitch for that product as if they were trying to get a venture capitalist to invest in their idea. Think Shark Tank!

Three breakout groups were created, each focusing on empathy maps for two stakeholder groups:

- University Faculty/K-12 Teachers
- Employers/Students
- Community/Funders

Participants were asked to self-select groups that not necessarily represent their own identities; thus, the groups were mixed so that not all participants matched the group labels. Once in the groups, facilitators described the instructions, then divided the participants into two subgroups. Each subgroup had to: (1) select a pain/gain on which to focus, (2) decide on a "product," and (3) develop a pitch. The two subgroups reconvened and shared pitches with each other. In the full session, one subgroup from each breakout group shared their ideas.

The following pitches were shared during the report-out when the full group reconvened:

- **University Faculty/K-12 Teachers.** K12 students need a strong community, a strong network of support. They need not only the academic or technical skills, but also support that addresses the whole person. We need to revolutionize what STEM looks like in K-12. Students need to lead initiatives. Faculty and administrators need to ask students what they want and need and put them in the driver's seat.
- **Employers/Students.** For students, social media is used to isolate, agitate and amplify our social differences. We can combat these issues by identifying them early by being able to spot negative trends and interactions; being able to provide a counternarrative to it. This group's pitch was to look at something that is able to crawl social media and identify negative behavior and deter creation; engage those individuals directly with counternarrative actions and efforts that would change perceptions that would otherwise amplify and potentially be problematic.
- **Community/Funders.** Community-based organizations never have enough resources to achieve the desired impacts. This group's idea was to have a community-based private/public collaboration where employers in cyberspace data ethic algorithm organizations would partner with community-based organizations. The community-based organization's role would be having deep connections in the community to recruit and support youth for technology creation and provide them with technological skills and form partnerships to provide on the job skills training – learn to earn.





Workshop Session 3

AI and Technology Supported Education

Context Setting

by Dr. Lauren Thomas Quigley

As our technical advancements continue to update and grow, with new capabilities becoming a part of our daily lives, there remain opportunities to leverage those technologies in the educational process. The disruption to in-person, sage on the stage pedagogy caused by the pandemic has given us a prime opportunity to reimagine the role of technology in education. Many researchers and practitioners in education broadly have begun to embrace and find new ways to support student learning and innovation in education. This session focused attention on learning lessons from both culturally-informed place-based education and knowledges and reframing innovation in the context of inclusion.



Provocation 1: The Incommensurability of Blackness and Innovation

Dr. Rayvon Fouché | Purdue University



Dr. Rayvon Fouché, Professor of American Studies in the School of Interdisciplinary Studies at Purdue University, began his talk by explaining the importance of the concept that people are turned into numbers, specifically by explaining that the problems with AI and algorithmic thinking has been around since before machines existed. He guided participants by asking foundational research questions:

1. How can we understand the place of difference, specifically race and Blackness, in scientific and technological innovation?
2. How does scientific and technological innovation by those who are marginalized challenge and disrupt traditional beliefs and beloved narratives about our societies?

Dr. Fouché continued his discussion by explaining that he is troubled by the Black inventor list because there is little context about the inventor. The list itself was derived from Henry Baker, who was given the task of creating the list of Black inventors for the sake of celebrating American greatness. However, he struggled to create this list because in the historical context of innovation and intellectual property, there was no space given for Blackness. Additionally, Dr Fouché gave examples of the ways in which technology has been used as a tool to harm Black people and asked participants to consider the following questions as they move forward:

- Is technology as oppression the only way to see this relationship?
- What about moving away from the language of innovation toward Black technological agency, resistance, and creativity?

He then discussed three methods concerning Black vernacular technological creativity:

- **Re-deployment** – the process by which the material and symbolic power of technology is reinterpreted but maintains its traditional use and physical form;
- **Re-conception** – the active redefinition of a technology that transgresses that technology's designed function and/or dominant meaning; and
- **Re-creation** – interested in the idea of re-creation as the redesign and production of a new material artifact after an existing form and/or function has been rejected.

Dr. Fouché concluded that it is clear that we do not get to the place of AI without understanding the preexisting cultural and social conditions that dictate and predict the choices that are being made about how AI is supposed to function and exist in this world. He wrapped up with a set of questions to think about for the future.

- Does it work for and/or support Black, Indigenous, and People of Color (BIPOC)?
- Does it produce equitable social relations (is it anti-racist)?
- Does it improve upon prior conditions, or create social relations that are better than a prior technology (does it make life better for BIPOC)?



Provocation 2: Reimagining STEM Experiences by Acknowledging the Intersectionality of Diverse Scholars: Identity, Belonging, and Place

Dr. Wendy Smythe | University of Minnesota Duluth



Dr. Wendy F. K'ah Skaahluwaa Smythe, Assistant Professor of American Indian Studies and Earth & Environmental Science at the University of Minnesota Duluth, began with a warning: If we do not take a step back and observe the spaces we exist in, the products we are designing and who these products are for, then we will continue to perpetuate the same biased environments and technologies. The focus on her work is on identity, place, and belonging.

The following tenets lie at the core of her call to action for scholars in industry and academic spaces (shown visually in her presentation as strands of a single braid):

- Diverse scholars must own their identities.
- White allies must learn how to be comfortable being uncomfortable (retire the term and concept around diversity fatigue).
- Reconsider how we categorize people, the diversity within these groups, and what this diversity can bring to science and technology.
- Learn who you are working with to avoid extractive practices.
- When engaged in recruitment and outreach for programs, accountability structures need to be in place when discussing who succeeds and who does not. What community organization and partners are you working with to change these spaces?
- To be good scientific citizens, we must understand the historical and cultural connection to space. What meaning does this space have for different groups?
- We must create safe, welcoming environments of belonging and understand the cultural needs of the diverse communities with whom we engage.
- How science works and how science works in society are two different things. Science should awaken a greater sense of cultural knowledge and best practices in diversity, equity, and inclusion.
- Diversity efforts take time; allow for this change to happen.
- We must create products that can be used by all.
- We all have a culture and a way of knowing and engaging with the world.

Breakout Session 1: Lessons from the Pandemic and Opportunities to Innovate

The goal of the session was to allow groups of participants to collectively identify 10-15 ideas to address tech education gaps and help bridge the educational, aspirational and financial gaps caused and exacerbated by the COVID-19 pandemic. Participants self-selected into three groups with mixed personal, professional, and organizational demographic identities. The activity took place in three stages as described for Workshop 1, Breakout 1. Detailed instructions and complete raw data sets are provided in Appendix B. A summary is provided here.

Points of View Statements. Participants were asked to write “Points of View” statements representing their own perspectives on AI and technology supported education, addressing five questions:

1. What lessons has the COVID-19 pandemic taught us about technology-supported education?
2. What are some curiosities you have for the future of technology-supported education?
3. What is the ideal state of the future of advanced technologies like AI in STEM education?
4. What is at least one wild idea you have for AI and technology-supported education?

Stakeholder Group Impact. In the next step, participants shared their ideas and categorized them by stakeholder group(s) impacted: education/research, workforce, community, and other.

Emoji Voting. Each participant then voted on the five ideas/statements they believed to be top priority and have the highest transformative potential.

Breakout Session 2: How, What Content, and Through What Means Can STEM Education be Restructured?

For this session, participants self-selected groups based on the stakeholder group to which they wanted to contribute – Education/Research, Workforce, or Community. The aim of the session was to identify ideas that met three key Convergence Accelerator criteria – **requiring convergent approaches, having strong societal impacts, and having tangible deliverables that are achievable within three years** – and existing barriers that need to be removed in order to achieve the desired outcomes. The activity took place in three stages as described for Workshop 1, Breakout 2. Detailed instructions and complete raw data sets are provided in Appendix B. A summary is provided here.

Fruit – What do participants want to see? In the first stage, participants transformed top ideas from the emoji voting into questions starting with “How can we?”. These were considered “fruit”; they represented what participants want to see as outcomes (note some are duplicated among multiple stakeholder groups).

- Educators/Researchers
 - How can we use AI to teach empathy?
 - How can we use smart technology that is not driven by consumer data but is utilized by consumers? Use data about myself to improve life - not have others use data about me.
 - How might AI enable individualized education, meeting every student where they are, leading them to the highest future potential?
 - How can we use our own experiences to create customized learning?
 - How can we move past “widgety” education solutions to meaningful solutions?
 - How can we create education that can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit?
 - How can we create personalized learning that is explainable and unbiased in terms of race/ethnicity/gender/disability?
 - How can we engage all in lifelong learning?
 - How can we use AI to measure grit?
 - How can we ensure designs consider diverse students, ways of knowing?
 - How can we use AI to measure individual impacts on the environment?How can we provide opportunities that are supported by, but do not require broadband?
 - How can we improve learning infrastructure for all students?
- Workforce
 - How can we use AI to teach empathy?
 - How can we use smart technology that is not driven by consumer data but is utilized by consumers? Use data about myself to improve life - not have others use data about me?
 - How might AI enable individualized education, meeting every student where they are, leading them to the highest future potential?
 - How can we use our own experiences to create customized learning?
 - How can we move past “widgety” education solutions to meaningful solutions?
 - How can we create education that can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit?
 - How can we create personalized learning that is explainable and unbiased in terms of race/ethnicity/gender/disability?
 - How can we engage all in lifelong learning?
 - How can we use AI to measure grit?
 - How can we ensure designs consider diverse students, ways of knowing?



- How can we use AI to measure individual impacts on the environment?
- How can we provide opportunities can we provide that are supported by, but do not require broadband?
- How can we improve learning infrastructure for all students?

- Community

- How can we balance education with human-to-human interaction? Human interaction is important, especially at young age.
- How can we define equity in an implementable manner (i.e., we can calculate inequity, but how do we define when we have reached equity)?
- How can we ensure fairness and explainability in AI?
- How can we use AI to help parents learn so that they can support their children's learning?
- How can we design technologies for diverse students and use traditional ways of knowing?
- How can we better design technology that supports multiple ways of knowing and helps students and teachers from disparate backgrounds interact productively?
- How can we adequately support families and parents?
- How can we create ethically aligned technologies and spaces?
- How can we ensure that efforts to build large, inclusive datasets with education and workforce do not pigeon-hole an individual's potential?
- How can we provide greater support for students with learning disabilities?

Categorization. In the context of three key criteria for Convergence Accelerators – **requiring convergent approaches, having strong societal impacts, and having tangible deliverables that are achievable within three years** – participants then binned their ideas (How can we? statements) into one of three categories:

- **Been There, Done That:** These ideas align with the status quo. They may be effective to some degree, but have not yet proven to be impactful in effecting change at scale. They do not address convergence; they are not likely to yield deliverables in three years.
- **Boundary Pushing:** These ideas go above and beyond status quo, but are not radically different. They may potentially effect change, but not revolutionize STEM education and careers. They may address some, but not all, three key Convergence Accelerator criteria.
- **Reimagined:** These ideas re-create concepts from an entirely new perspective, having the potential to revolutionize STEM education and careers. They address all three key Convergence Accelerator criteria.

Ideas that emerged as “reimagined” were:

- Education/Research
 - How can we use AI to teach empathy?
 - How can we move past “widgety” education solutions to meaningful solutions?

- How can we engage all - incarcerated and other non-traditional learners - in lifelong learning? ALL [should] have access to knowledge.
- How can we use AI to measure individual impacts on the environment?
- How can we create education that can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit?
- How can we use AI to measure grit?

- Workforce

- How can we have mapped learning to connect learners to opportunities to work and/or further education?
- How can we design tech solutions that consider diverse students, ways of knowing?
- How can we decrease the disparity between well-funded schools that were not nearly as impacted as lesser funded schools during the pandemic to create a more equitable education system?
- How can we ensure the development of technology used in STEM education is ethically aligned?
- How can we create personalized learning that is explainable and unbiased in terms of race/ethnicity/gender/disability?
- How can we codify decision-making that prioritizes [avoiding/mitigating] the potential harms?
- How can we go beyond use of technology to increase workforce accessibility for the disabled to enhancing diversity in tech?

- Community

- How can we ensure fairness and explainability in AI?
- How can we create effective and appealing social robotics?
- How can we support each individual having autonomy and access to their personal databases to track individual data points so that they can provide informed consent for its use?
- How can we use AI to provide self-leveling competency-based evaluation?
- How can we fully integrate AI into STEM education so that it becomes a valuable tool for all stakeholders (and not something separate, frightening, or magical)?
- How can we ensure people do not get pigeonholed by the sum of their data points?

Roots – What disruptions are needed? Finally, participants identified existing “roots” – current systems, practices, mindsets, etc. – that need to be disrupted or eradicated to produce the desired fruit. In some groups, participants described what is needed rather than what needs to be disrupted. Those items are marked with an *.

- Education/Research
 - Dismantle caste system.
 - Dismantle silos: DE-Silo education, research, practice, etc.
 - Must no longer ‘dismiss’ parents.



- Dismantle “norms” and the culture of standardization.
 - Destroy belief that things must happen top-down instead of bottom-up.
 - Dismantle belief that it is someone else’s problem.
 - Dismantle perceptions about who is worthy to learn.
 - Must create accountability measures.*
- Workforce
 - We need to create education initiatives around understanding the history and nature of disability and ableism.*
 - Not including the community that is being served in the decision-making process (e.g., the disability community).
 - Get comfortable with being uncomfortable.*
 - We need to stop thinking of disability as purely accessibility and accommodations.
 - Develop shared understanding of AI and technical capabilities.*
 - Definition of who a worker is in _____ field to be revised/changed.
 - Apply “nothing for us without us” to solution design and development.*
- Community
 - View social and technological development as two wings of the same bird, and enable mutually beneficial relationships between them.*
 - Overhaul how we identify/accept competence-based assessment.
 - Engage inclusive stakeholders in sense-making before decisions are made.*
 - We need asset-based thinking in education; we have innate capacity, and education is to provide enabling conditions.*
 - Overcome the fear of change; embrace discomfort.
 - Ethically aligned.
 - Engaging rather than dismissing family service organizations.*
 - Competency over degrees and credentials.*



Workshop Session 4

Data Trust Development

Context Setting

by Dr. Chris Draper

In the context of education, a massive amount of data is produced and generated, and often treated as a byproduct of the process, yet in an AI and insights driven society, there are underutilized opportunities to collect, analyze, make meaning and drive value from that data. The concept of a data trust, owning our own oil, allow us to identify the counternarratives in vacancies of data (and our perspectives), pool resources, own our contributions and engage in a community refinement process of collaboration. We explored ways to rebalancing power in the STEM education and labor space by owning what defines us so that we can contribute to the ecosystem we wish to see.



Provocation 1: Advancing People and Technology with Data Trusts

Dr. Loretta H. Cheeks | Strong TIES



Dr. Loretta H. Cheeks, Chief Executive Officer of Strong TIES and DS Innovation, opened by showing a picture of a sculpture created by Bill Woodrow called “English Heritage (Humpty ***** Dumpty).” It was a stack of wooden blocks with various objects wedged between alternating ends. At the bottom was a wheel, symbolizing the marrying of technology and architecture. The second object was a book, representing a leap forward in history, signifying knowledge. Building up from there was a clock, representing the industrial era. Above that was a yellow box, denoting danger and the era of nuclear power. At the top was a figure of Humpty Dumpty, representing the Western world getting better in a lot of regards, but still unstable. This unstable state of progress, she noted, ushers in the Fourth Industrial Revolution. . Society is experiencing shared economics like never before; people share beds through Airbnb, information through cloud storage, and cars through services like Lyft and Uber. There is a decrease in birth rate and an aging population. The world is experiencing climate change and a pandemic.

Similar to Dr. Draper’s earlier statement about data being the “new oil,” Dr. Cheeks stated that data is the “new gold.” A challenge is that there is an overflow of data, yet the data does not yield a great deal of insights. Organizations, institutions, and nations are responsible for sharing data for the common good; however, there are uses and abuses of data all around. Some abuses of data she shared included: countries harvesting the DNA of their citizens as a way of policing; self-driving cars killing pedestrians because they are not “aware” of jaywalking.

Dr. Cheeks shared that there are risks in vulnerable communities and posed these questions:

- How do we use data, tech, and labor and how do we bring people forward?
- How do we create and manage data trusts focused on people, empowering people and organizations to create policies together?
- Is there a vision for data being shared for the common good or public good? Can data become a tool for public good in the way libraries support public education?
- Is data seen as personal property?
- How do we include voices from the most vulnerable communities?

She went on to note that these questions do not have answers yet because these are emerging challenges that come with new technological advances. Dr. Cheeks pointed out that there is an awakening for some with regard to data infrastructure and ownership, but laws focused on data trusts in the interest of social and human good are uncertain.

Dr. Cheeks summarized and left participants with questions and insights around data ownership. How do we ensure data is used for the betterment of humanity or society? We do not have clarity in how our legal system believes ownership works. What is data versus information? A data set can be owned but data cannot. People do not have a sense of how data ownership works – or should work. The legal system would have to be looked at differently to make strides in this area. Large corporations could potentially purchase data unfairly. We have valuable intellectual property (IP) in universities that states do not know they own. It all comes down to who owns the data individuals create and to how – and if – individuals and organizations are educated and informed about data trusts.



Provocation 2: Democratizing Data through Emancipatory Technologies, Pedagogies, and Methodologies

Dr. Antwi Akom

UCSF and SFSU Social Innovation and Universal Opportunity Lab
Streetwyze



The second provocation for this workshop session was by Dr. Antwi Akom, Distinguished Professor and Founding Director University of California San Francisco and San Francisco State University Social Innovation and Universal Opportunity Lab and Co-Founder of Streetwyze. He began by sharing a brief video, “23 Ways You Could be Killed if You Are Black in America,” stating that one cannot talk about data equity, data trust, and decolonizing tech without talking about the relationship between race-making and place-making. He posed four key questions:

- How can we make STEM ecosystems relevant to people’s everyday lives?
- How can we revolutionize traditional knowledge?
- How can we ensure that the communities most affected by racial, spatial, and social inequities have a voice and choice in the decisions impacting their daily lives?
- How can we build STEM with pathways to prosperity (P2P) and pathways out of poverty (POP) not for the 1%, but with the 100% in active participation with front-line communities?

He then shared what he dubs as the 5 Vs of big data:

- **Velocity** – the speed at which new data is being generated, collected and analyzed at any given time.
- **Volume** – the amount of data produced every second across all online channels, including social media platforms from mobile devices through online transactions.
- **Value** – the worth of the data being extracted. Having endless amounts of data does not always translate into having high value data.
- **Variety** – the different types of data used.
- **Veracity** – the trustworthiness of the data collected.

Dr. Akom referenced the book *Heat Wave: A Tale of Two Neighborhoods* by Eric Klinenberg about the Chicago heatwave of 1995 being one of the deadliest in American history. He went on to explain that the variable that best explains mortality is social infrastructure – sidewalks, community organizations, active commercial corridors, and active public spaces. It’s the strength of the neighborhood that determines who lives and who dies. How do we build a JEDI STEM innovation ecosystem that is inclusive of both soft infrastructure and hard infrastructure? We should be looking not only at physical and social infrastructure, but also at digital infrastructure. We have to put the voices, knowledge and experiences of those who have been most impacted by racial, spatial, and social inequities at the center of research, leadership, decision making, data collection, analysis, interpretation, and dissemination. Streetwyze believes that the people closest to the problem are closest to the solution.

He went on to note that we have not correctly identified the problem. We’ve done a brilliant job of setting top-down ambitious goals for the design of the STEM innovation (hardware) and the power of place, lived experience, and what people care about and know to be happening on the ground (software), but the challenge for the 21st century JEDI data revolution is how do you bridge the gap between official knowledge and local knowledge in ways that make data more authentic and meaningful, valid, and reliable from the perspective of everyday people. The missing link is tech equity where people-powered place making equals real time two-way communication with communities with everyday people so they can participate and design solutions that meet their local needs.

Streetwyze is a mobile mapping and SMS platform that collects real time information about how people are experiencing cities and turns them into actionable analytics. It addresses two questions: (1) How can we have more inclusive community engagement processes; and (2) how can we use data to make better and more community-informed decisions? Dr. Akom visualized this by placing the words “community driven” in the center of the RISE convergence model presented by Dr. Lauren Quigley.

Breakout Session

1: Mechanisms and Requirements for Data Trusts

These exercises were intended to share insights on data trust development to capture details on student demographics as well as educational and career outcomes and how data trusts can be used to connect students with opportunities that have social and human good foci. The activity took place as described for Workshop 2, Breakout 1. Detailed instructions and complete raw data sets are provided in Appendix B. A summary is provided here.

Empathy Maps. To facilitate participant ideation, the planning team created empathy maps in Miro for six stakeholder groups:

- University Faculty and Administrators
- K-12 Teachers
- Employers
- Students (K-12, Undergraduate, Graduate)
- Community Members/Community-Based Organizations
- Funders

For each stakeholder empathy map, they were asked to think about: (1) who the stakeholder is and what they are trying to understand about the stakeholder (what their situation is, what their role is in the situation), and (2) what the stakeholder's needs are (what they need to do, know, or understand; what they need to do differently) relative to STEM for social and human good.

Participants placed sticky notes in each quadrant of the empathy maps noting what the stakeholder sees, hears, says and does, and thinks and feels. In the next step, participants reviewed the empathy maps and identified at least one pain and one gain from the stakeholder's perspective. They were also asked to think of how their role has contributed to both the pains and gains of the stakeholders.

Adding Personal Perspectives. Next, participants browsed the empathy map boards again, this time focusing only on the stakeholder group(s) with which they personally identify or have personally identified before. They added comments or emojis as needed to question, correct, and/or clarify what others perceive of their stakeholder group. This could be a "thumbs up" to validate the perspective on the sticky, a "thumbs down" to disagree, or a comment to question or correct misperceptions of others. Further, the participants added sticky notes that reflected their points of view if something was not represented, with a focus on pains and gains. The pains and gains that resulted for each group were:

- University Faculty and Administrators
 - Pains
 - Rankings, rankings, rankings
 - Accreditation
 - Too much data and too little time/resources to review

- Gains
 - Getting a more robust sense of student effort/time on task/fuller picture of student engagement and learning
 - If students had more access to their data they might make better decisions in planning their future
 - Data can help as a predictive tool
- K-12 Teachers
 - Pains
 - Sharing of student data, even de-identified data, can be very difficult, making it very hard to track impact of strategies to encourage STEM students
 - Little autonomy or agency over my person
 - The digital interface and data collection tools create a greater divide socially
 - Lack of collaboration
 - Gains
 - We have more data to measure progress
 - Data will create time to focus on the areas of learning where the students need to most support. We like sharing with other teachers in a collective way.
 - Data trust will give teachers a voice
 - Culturally-relevant data importance
- Employers
 - Pains
 - The loss of competitive information to a business competitor
 - Data costs too much
 - Data can be stolen and ransomed with poor security systems
 - The concept of patents on data and intellectual property (IP) is at risk
 - Complying with privacy laws
 - Entrepreneurs and start-ups are filling space where the big corporations use to dominate.
 - Hard to keep up with tools that will give insights
 - National threat to democracy and who shapes the new frontier.
 - Outdated labor force; a need for mass retraining/re-tooling ~large investments
 - Exploitation, abuse, and misuse of data.
 - Gains
 - Individual, group, and community buy-in.
 - People trust corporations and institutions; they have created the middle class
 - Creating an agnostic interface creates pseudo consumer trust; machines don't lie, right!
 - More accurate data means reaching customers who want to do business with us and not annoying those who do not



- Students (K-12, Undergraduate, Graduate)
 - Pains
 - Blocking access to my data gets in the way of living my life
 - My data could “out” me
 - Helpful/informative data is ignored
 - Data perpetuity
 - My data is used to penalize me (e.g., cheerleader Supreme Court case)
 - Data lasts forever and is only partially representative of who I am and what I can do
 - Gains
 - Data is community
 - Shared data can enact change
 - Helps me protect my interests now and in the future
 - Data trusts can reinforce student-led efforts for social good
 - Data is reflective
 - Data can be used as a support tool
- Community Members/Community-Based Organizations
 - Pains
 - Data is being used to exploit us and we do not have a way to fight back
 - We do not want to be further left out/behind because we cannot unlock the power of our data on our own
 - Tech companies and the government are exploitive or do not provide benefit to the public or our work with data
 - Problems that were not evident before are quite clear
 - If they become disenfranchised they cannot come back
 - Gains
 - The ability to quickly see where resources could be deployed most effectively
 - A vehicle for collaborating with partners who will not exploit people or our data
 - Shift tech data use for social good
 - They have a voice in shaping their own destiny
- Funders
 - Pain
 - Data accountability
 - Gain
 - Data dashboards

Breakout Session 2: Participatory Methods for STEM Education Research for RISE

The goal of this exercise was to define a product, service, system, etc. (broadly referred to as “product”) to address pains and gains identified in the first session, then develop a pitch for that product as if they were trying to get a venture capitalist to invest in their idea.

The following pitches were shared during the report-out when the full group reconvened:

- **University Faculty/K-12 Teachers.** There is a need for newcomers and students working on design problems to have a way to get to know their new city, including the history of the communities. The product is Street Smart, an educational add-on to Streetwyze. For classroom applications, faculty could create micro lesson plans and courses. This can be used to meet some accreditation criteria related to problem solving and communication.
- **Employers/Students.** Data can “out” you, identifying you in a damaging way. The product is a button that de-identifies you. A mobile app would have a toolbox associated with it, giving users the ability to protect their data. This would move the approach of data management into the hands of the people whose data it is.
- **Community/Funders.** Community data is currently being held in a non-transparent way. People are familiar with Redbox and with ATMs. What if we had these in communities where people can deposit their information and data? Most people have devices, so those devices could be used to deposit information like dropping a DVD into Redbox. Then, people could check in weekly to track who was looking at their information. Communities would have control; researchers and others would have to pay if they wanted the community data. People would feel like they have a voice.



Summary & Recommendations

The following takeaways are informed by the convergence of stakeholder perspectives on desired outcomes tabulated during the workshops and are aligned with three key Convergence Accelerator criteria: ***requiring convergent approaches, having strong societal impacts, and having tangible deliverables that are achievable within three years.***

Key Takeaways

Details from Workshops 1 and 3 (Workshop 1. Support for Advancement of Underrepresented Groups in STEM and AI and Technology Supported Education, respectively) are summarized first, followed by the pains Workshops 2 and 4 (Social and Human Good Research Foundations and Data Trust Development, respectively). This is reflective of the structures of breakout activities for each workshop. Example comments are included here; a full set of raw data is in Appendix B. The takeaways for Workshops 2 and 4 are pains, which represent the barriers that need to be overcome, and gains, which represent the possibilities.

Takeaway #1: Reconceptualize social, systemic, and technical approaches to creating impactful STEM education programs and experiences.

- Establish majors specific to human and social good problems with concentrations related to specific STEM fields.
- Prioritize project-based learning that is centered on equity and student voices.
- Identify ways to further understand environments surrounding students by understanding the connection to land, ancestry, identity, and economic prosperity.
- Create AI systems that can provide ways to measure grit, individual impacts on the environment and that can also provide competency-based evaluation.
- Connect learners to opportunities to work and/or further education through mapped learning experiences.
- Create personalized learning experiences that are explainable and unbiased in terms of race/ethnicity/gender/disability.
- Create technology-supported education tools that support individuals having autonomy and access to their personal databases to track individual data points so that they can provide informed consent for its use.
- Create effective and appealing social robotics.



Takeaway #2: Broaden participation and access to STEM education and careers for all.

- Redefine STEM domains and participation in more inclusive and equitable ways that reflect a broader culture.
- Bring STEAM education to people where they are to reduce barriers to access by making it more mobile and more accessible.
- Prepare K-12 teachers to engage parents/guardians as teachers to ensure that families are prepared to support and educate their children.
- Use technology-supported tools such as AI to teach empathy.
- Ensure fairness and explainability in use of AI technology.
- Create education that can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit.
- Ensure technology-supported education tools used in STEM are ethically aligned.
- Develop meaningful solutions to current “widgey” technology-supported education tools.
- Create ways to codify decision-making that prioritizes attention to the potential harms.

Takeaway #3: Reconceptualization of STEM education serving greater humanity and social good as well as technological impact.

- Engage incarcerated and other non-traditional learners in lifelong learning opportunities. Ensure all have access to knowledge.
- Design technology-supported education solutions that consider diverse students and ways of knowing, to include community and education/research.
- Create a more equitable education system that focuses efforts on decreasing the disparity between well-funded schools that were not nearly as impacted as lesser funded schools during the pandemic.
- Create more accessible technology-supported education tools to increase workforce accessibility for workers identifying as disabled.
- Integrate AI into STEM education so that it becomes a valuable tool for all stakeholders (and not something separate, frightening, or magical).
- Ensure people do not get pigeonholed by the sum of their data points by creating multiple pathways to opportunities and experiences.

One of the ideas that did not fit into one of the key themes was expressed by the workforce stakeholder group. This group highlighted the competitive nature of STEM education and the importance of students, faculty, and employees keeping pace with emerging technologies through lifelong learning.

Major Themes: Pains

For Workshop 2, four major themes emerged from the convergence of stakeholder perspectives related to pains; three emerged for Workshop 4. Example comments are included here; a full set of raw data is in Appendix B.

Workshop 2

Theme #1: Lack of resources, support, and understanding.

- Lack of school level leadership to create equitable environments for teachers
- Introduction of legislation to prevent the very education needed (i.e., race-conscious historical analysis)
- Some movement on resources allocated to address inequities
- Lack of understanding and ineffective support from home support systems (parents, family, high school friends, etc.)
- The emotional abuse of disabled students is condoned by no one saying anything against ableism

Theme #2: Unwillingness to shift paradigms/ways of thinking about who can succeed and how to succeed in STEM education and/or careers.

- Pedagogy is pretty much the same - sit and get - with a few variations. No incentive to teach differently
- Unwillingness to move from focus on standardized tests
- Systemic racism
- Navigate racism, sexism, xenophobia, etc.
- Funders do not let the communities experiencing the issues define the solutions and outcomes

Theme #3: Traditional ways of thinking pose barriers and limit broader participation and access to STEM education.

- Disabled students do not receive the same K-12 education, but they will receive the same education in higher ed. How do we prepare them?
- Mental health is never named as a disability and delays disability identity formation
- Disabled students have to work much harder than non-disabled students
- Being mis-characterized or mistreated by technology
- Staying in touch with what happens in the classroom and how students' and instructors' needs change

Theme #4: Personal and institutional challenges to advancing equity.

- No work-life balance/burnout
- Dealing with student groups who have a problem with your work
- Pressure to fill roles and impose standards they may not even fully agree with
- Transitioning back from working at home to going back to the office while respecting the needs of those who need to continue working from home
- Successfully creating public/private funding models
- Efforts to help can backfire because we are not experts at everything

Workshop 4

Theme #1: Social and technical challenges associated with data use and impacts.

- The digital interface and data collection tools create a greater divide socially
- Lack of collaboration
- Helpful/informative data is ignored
- Too much data and too little time/resources to review
- Problems that were not evident before are quite clear

Theme #2: Personal and/or institutional challenges associated with data and data use.

- Little autonomy or agency over my person
- Blocking access to my data gets in the way of living my life
- Data lasts forever and is only partially representative of who I am and what I can do
- Rankings, rankings, rankings
- Data accountability

Theme #3: Challenges of managing data responsibly and ethically.

- Sharing of student data, even de-identified data, can be very difficult, making it very hard to track impact of strategies to encourage STEM students
- Complying with privacy laws
- National threat to democracy and who shapes the new frontier
- Exploitation, abuse, and misuse of data

Major Themes: Gains

For Workshop 2, three major themes emerged from the convergence of stakeholder perspectives related to gains; four emerged for Workshop 4. Example comments are included here; a full set of raw data is in Appendix B.

Workshop 2

Theme #1: Increase support, resources, and understanding necessary to enhance participation and access for all.

- Move from under-estimated to recognition of actual capabilities
- Continued persistence even in confrontation with implicit bias, etc.
- Greater participation by those not normally included in STEM
- Exciting students and non-academics about science and technology
- Helping backers see new paths for opportunities no one even knew to consider before

Theme #2: Implement social and technical solutions to broaden participation and access for all.

- More districts creating “technical” solutions to getting students of color in high level classes, forcing teachers to acknowledge their presence
- More districts seeing teachers of color and working on retention efforts

- Deep cultural connections to joy and love
- Finding a disabled mentor can really change everything
- Feeling empowered by working with others from different areas on problems of importance to society that also promote justice

Theme #3: Challenge harmful ways of thinking/mental models through education and research.

- More districts offering racial equity training, with some making it mandatory
- Talking about disability and ableism early, we create a more compassionate future generation
- More research in collaboration with disabled researchers
- More impactful research
- Opportunities for skills training and income

Workshop 4

Theme #1: Data provides ways to measure progress and identify where support is most needed and/or wanted.

- We have more data to measure progress
- Data will create time to focus on the areas of learning where the students need to most support; we like sharing with other teachers in a collective way
- Data can be used as a support tool
- Getting a more robust sense of student effort/time on task/fuller picture of student engagement and learning
- The ability to quickly see where resources could be deployed most effectively

Theme #2: Data provides means of giving stakeholder's voice and representation.

- Data trust will give teachers a voice
- Data is community
- Students and communities have a voice in shaping their own destiny
- Individual, group, and community buy-in
- People trust corporations and institutions; they have created the middle class

Theme #3: Data a tool for enacting change in how we do our work and how we impact stakeholders for the greater good.

- Shared data can enact change
- Helps me protect my interests now and in the future
- Data trusts can reinforce student-led efforts for social good
- A vehicle for collaborating with partners who will not exploit people or our data; shift tech data use for social good.

Theme #4: Data contributes to our understanding of the community we serve.

- Culturally-relevant data importance
- Data is reflective
- If students had more access to their data, they might make better decisions in planning their future
- Creating an agnostic interface creates pseudo consumer trust; machines do not lie, right!



Advisory Board Recommendations

The planning team met with the advisory board twice after the close of the event to discuss a retrospective of the workshop series, including feedback on the workshop organization, implementation, and potential outcomes and recommendations that inform the final report. As a result of the robust discussions, which included some post-workshop ideation based on shared outcomes of the various sessions, the following feedback was shared to ensure an impactful final report with the potential to reach far beyond its purpose in informing an NSF Convergence Accelerator track topic in the 2022 solicitation.

“High Risk, High Reward” Ideas

Advisors shared the importance of framing final report recommendations around “high risk, high reward” ideas that were generated during the workshop. Highlight those “pitch” ideas that came out of breakout activities that have the potential to be highly transformative. Some examples shared during the advisory meetings included:

- collaborative projects that include two-year colleges/technical colleges, career technical education (K-12) programs, and dual enrollment opportunities between K-12 and two-year colleges;
- engagement with the U.S. Department of Education Tech Prep Education Program [7]; and
- consideration of cross-NSF directorate funding opportunities with a convergence focus.

Strengthening Representation of Social/Behavioral Sciences

The need for an emphasis on strengthening the representation of social/behavioral sciences in proposed projects was highlighted as a key recommendation, which can address social good and much stronger convergent STEM education, research, and practice. Specific ideas to support the recommendation included:

- the need for recognizing that social and behavioral sciences are, in fact, the “hard sciences,” shifting the paradigm on the idea that natural sciences, mathematics, computer sciences, etc. are the only ones that constitute “hard sciences”;
- creating curricular tracks focused on social good, for example, “technology for social good” or social impact curriculum tracks and/or courses that are part of education/industry-based partnerships that inform training for the future of work; and
- curricula that include non-STEM students taking STEM courses and STEM students taking non-STEM courses with social and human good applications.

Workforce Skillsets Gap Analysis

Questions were raised regarding employers’ ability to ascertain skillsets needed to truly support convergent, collaborative work projects with a social good focus. These questions centered on employers (industry or academia) and whether most have conducted sufficient gap analyses on skills needed, whether they know what skillsets are needed, and/or if

key skillsets are missing from current hiring requirements. As a result, the following thoughts and recommendations were shared with regards to Convergence Accelerator solicitation requirements.

- Proposal submissions should include plans for gap analyses of skillsets and promote or leverage collaborations that involve organizations that can serve as models in determining – and filling – skills gaps.
- Proposals that engage the idea of “problem finding” versus simply “problem solving” have the potential to be highly transformative [8].
- Proposals that consider an “anti-discipline approach” can be highly transformative. Is there an opportunity to provide value by developing a competency mapping approach where collaborators look at (1) target competency distributions and (2) prioritizing holes/gaps?
- Projects should address social good topics and issues within traditional STEM coursework. For example, the cross listed computer science/sociology course that Dr. Ruha Benjamin teaches at Princeton University is wildly popular, yet she notes it is just one course that cannot completely tackle the challenges of social good focused curriculum options [9].

Workforce Hiring Perspectives that Inform Collaborations

Advisors were sure to clarify that the term “workforce” be applied across industry and academia hiring practices with regard to convergent thinking in project development and collaboration. The following feedback was shared.

- Competency mapping in hiring between skillsets and actual “job needs” that support model teams via an anti-Myers-Briggs approach was an example shared of ideas that have the potential to apply three key criteria of the Convergence Accelerator.
- Employers can create a competitive advantage when they:
 - seek to understand what works and what DOES NOT work in hiring for projects with a social/human good and convergence focus;
 - learn how to manage potential team members who are not from traditional tech or tech research fields or backgrounds; and
 - begin to think outside of traditional “degree” boxes of hiring, and discover the value of redefining the “box.”

Need for More Representative Panels

Advisors with a history as NSF program directors shared the need for panels that have cross-discipline and cross-institutional (two-year colleges, minority-serving institutions, etc.) representation. Collective thoughts were expressed that the panel composition requirements be stipulated in the solicitation and that the panel design aligns with convergence and equity. Understanding that within the Convergence Accelerator, the initial track selection is a responsibility of the Convergence Accelerator team, advisors stressed the need for representation of panelists who are reviewing convergence (and other) NSF proposals to have diversity of thought, backgrounds, etc.



The recommended list of panelists should include people who represent the identities/stakeholder groups that were elevated out of the workshop breakout activities, and represent convergence, broadening participation, social science, behavioral science, industry, tech. Additionally, participants in the RISE workshop should be encouraged to register to serve Convergence Accelerator review panelists.

Need to Explicitly Counter Systemic Racism

Core to the next wave of funding opportunities are proposals, platforms, and processes that lift up the voices, knowledge, and experiences of those who have been impacted by enduring racial (and other) inequities in STEM education, research, and practice. These include but are not limited to: data collection and analysis with BIPOC populations; eliminating biases and inequities in digital infrastructure; diverse, equitable, and inclusive project leadership and research positions; and engagement in ideation, problematization, decision-making, and in the interpretation and dissemination of evidence and research results.

In addition to those recommendations and feedback shared during the advisory group meeting, the thoughts below were tagged as critical thinking points in the conversation on how they might inform the NSF Convergence Accelerator solicitation and NSF practices as a whole.

- Can an effort like this be started as a platform?
- Understanding how employers consider or manage non-traditional applicant pools: What about skillsets of incarcerated individuals?

- How do we distinguish reimagined ideas (pitches) for people who say “we already do that” with regard to existing programs at NSF to combat “been there, done that” ideation?
- How are collaborators informed of and encouraged to submit Convergence Accelerator proposals that allow them to remove traditional constraints; in other words, can they remove the box altogether rather than simply “think outside the box” in reimagining innovation in STEM education in an “Industry 4.0” environment?
- NSF solicitations can be enhanced by including rubrics that value “Future of Work” proposals that focus on collaborations **with** communities served (community-led projects), not simply **for** communities impacted [10].

STEM Education and Research Reimagined

We will have a well-prepared and diverse workforce prepared to address the pressing technology needs of the present day and working to anticipate the emerging needs of the future. Marginalization in STEM will we be an artifact of the past -- people representing the diversity of the country will not only have a seat at the table, but will be leaders who steer the direction of science, engineering, and technology to benefit society at large. Exclusion and harm to some will no longer be tolerable outcomes of scientific and technological advancement. The ecosystems that were incubated and cultures shifted will result in a change in the climate of STEM education and innovation for the better.





Acknowledgments

Support for this project was provided by the National Science Foundation under award number OIA-2119846, Reimagining Advanced Research for Human Good through Industry and Educational Partnerships.

Speaker Biographies

Dr. Beronda L. Montgomery

MSU Foundation Professor and Interim Assistant Vice President for Research and Innovation, Michigan State University

Beronda L. Montgomery, Ph.D., is a writer, researcher, and scholar who pursues a common theme of understanding how individuals perceive, respond to, and are impacted by the environments in which they exist. Dr. Montgomery is MSU Foundation Professor in the Department of Biochemistry & Molecular Biology and Microbiology & Molecular Genetics at Michigan State University (MSU). Her primary laboratory-based research is focused on the responses of photosynthetic organisms (i.e., plants and cyanobacteria) to external light cues. Dr. Montgomery received a National Science Foundation CAREER Award and is an elected Fellow of the American Academy of Microbiology (2018), the American Association for the Advancement of Science (2020), and the American Society of Plant Biologists (2021). She currently serves as interim assistant vice president for research and innovation at MSU. Dr. Montgomery is author of the recently published book *Lessons from Plants* (April 2021, Harvard University Press).

Dr. Yvette E. Pearson, PE, F.ASCE

Founder and Principal Consultant, The PEER Group

Dr. Yvette E. Pearson is founder of The PEER Group. A Fellow of the American Society of Civil Engineers (ASCE), she is recognized globally for 25 years of contributions to engineering education and research.

Pearson is the Inaugural Chair of Members of Society Advancing an Inclusive Culture (MOSAIC), ASCE's board-level advisory committee on diversity, equity, and inclusion (DEI). As past vice chair of ASCE's Committee on Diversity and Inclusion she was part of the team that integrated DEI into the Code of Ethics, providing specific leadership for the principle that requires engineers to consider the diversity of the communities they serve and to include diverse perspectives in planning and performing their work.

Pearson is a recipient of ABET's Claire L. Felbinger Award for Diversity and Inclusion and ASCE's Professional Practice Ethics and Leadership Award. She is a registered Professional Engineer, a Commissioner on ABET's Engineering Accreditation Commission, and she hosts Engineering Change Podcast, which has audience members in ~50 countries on six continents.

Speaker Biographies Cont'd

Dr. Malik S. Henfield

Professor and Founding Dean, Institute for Racial Justice, Loyola University Chicago

Dr. Malik S. Henfield is a Full Professor and Founding Dean of the Institute for Racial Justice at Loyola University Chicago. He has published multiple scholarly manuscripts and books, and delivered numerous national, regional, state, and local keynote addresses and professional presentations. His scholarship situates Black students' lived experiences in a broader ecological milieu to critically explore how their personal, social, academic, and career success is impeded and enhanced by school, family, and community contexts. His work to date has focused heavily on the experiences of Black students formally identified as gifted/high-achieving while his latest projects focus more exclusively on developing, implementing, and evaluating in-and out-of-school interventions associated with developing Black students ready to succeed in college and careers.

Dr. Henfield was named an Emerging Leader by the Phi Delta Kappa (PDK) International Education Association, a Young Academic Fellow by the Institute for Higher Education and the Lumina Foundation, and was elected Chair of one of AERA's largest Special Interest Groups (SIG), the Critical Examination of Race, Ethnicity, Class, and Gender in Education (2018-2021).

Dr. Lauren Thomas Quigley

Research Scientist, Responsible & Inclusive Technology, IBM Research

Dr. Lauren Thomas Quigley's professional purpose has two goals: (1) change STEM education so that anyone can choose to be a scientist, engineer, technologist or mathematician and (2) ensure that all people have the technical literacy to be safe, healthy and participate in all aspects of society.

Dr. Quigley earned a Ph.D. in Engineering Education with a dissertation focused on identity-trajectory of graduate students in niche fields and used that research experience to lead STEM education programs in higher education, government, nonprofit and the tech industry. Her research interests and professional worldview converge in how she describes what she does and how: womanist, STEM fairy godmother, engineer for the people, social justice builder/maker/seeker and identity explorer. Dr. Quigley is currently a Research Scientist in IBM Research's Responsible & Inclusive Technology organization and an Affiliate Assistant Professor at the University of Washington in Human Centered Design & Engineering.

Dr. Rayvon Fouché

Professor of American Studies School of Interdisciplinary Studies, Purdue University

Rayvon Fouché is Professor of American Studies in the School of Interdisciplinary Studies at Purdue University. His work explores the multiple intersections among cultural representation, racial identification, and technological design. He has authored or edited *Black Inventors in the Age of Segregation* (Johns Hopkins University Press), *Appropriating Technology: Vernacular Science and Social Power* (University of Minnesota Press), *Technology Studies* (Sage Publications), *Handbook of Science & Technology Studies* (MIT Press), and *Game Changer: The Technoscientific Revolution in Sports* (Johns Hopkins University Press). Grants and awards from the Illinois Informatics Institute, Illinois Program for the Research in Humanities, University of Illinois' Center for Advanced Study, National Endowment for the Humanities, the National Science Foundation, and the Smithsonian Institution's Lemelson Center for the Study of Invention and Innovation have supported his research and teaching.

Dr. Wendy F. Smythe

Assistant Professor, American Indian Studies and Earth & Environmental Sciences, University of Minnesota Duluth

Wendy F. K'ah Skaahluwaa Smythe, Ph.D. is Alaska Native Haida, of the Xáadas Nation of the Sdast'as clan.

She is an Assistant Professor at the University of Minnesota Duluth, with a joint appointment in American Indian Studies and Earth & Environmental Sciences. In 2019 she was named Professional of the Year by the American Indian Science and Engineering Society (AISES) and was elected to the Board of Directors in 2020.

Dr. Smythe is a geoscientist whose research focuses on microbial ecology, biogeochemistry, and biomineralization in iron and manganese rich groundwater ecosystems. In addition, she conducts research and training of geoscience leaders to better understand, appreciate and respect diverse students, faculty, and communities, and is a signatory for the "Call to Action for an Anti-Racist Science Community from Geoscientists of Color. In 2021, She founded the Indigenous Geoscience Community, as a sustainable community of Indigenous geoscientists to come together and share knowledge.



Speaker Biographies Cont'd

Dr. Loretta H. Cheeks

Chief Executive Officer, Strong TIES

Dr. Loretta H. Cheeks is an Artificial Intelligence (AI) expert, research scholar, consultant, and speaker. She is founder and CEO of Strong TIES and DS Innovation. During her tenure, she has helped organizations gain dynamic data insights serving enterprises, governments, and nonprofits.

Dr. Cheeks is on a mission to create a better world with technology. Before earning a Ph.D. in Computer Science at Arizona State University, the science, technology, engineering, arts, and mathematics (STEAM) advocate was developing, deploying and leading various teams within the communications, avionics, instrumentation and control and chemical industries for Fortune 500 corporations. Her company, DS Innovation, is an independent research, training and consulting Artificial Intelligence and Machine Learning organization.

This Doctor of Philosophy isn't just paving the way for up-and-coming engineers, Dr. Cheeks is also committed to improving higher education for underserved and underrepresented communities to follow in her scientific footsteps. To do that, Dr. Cheeks created "Strong TIES," a non-profit that provides STEAM educational programs using culturally-centric, contextualized and relevant tools for engaging youth from underrepresented groups in STEAM education and career pathways.

Dr. Antwi Akom

Distinguished Professor & Founding Director, UCSF & SFSU Social Innovation and Universal Opportunity Lab; Founder, Digital Organizing, Power-Building and Engagement Labs; Co-Founder, Streetwyze

Dr. Antwi Akom is one of the leading data scientists, participatory technologists, and JEDI research methodologists in the world. President Obama recognized Dr. Akom as one of the world's top innovators for his work on community informatics, ground-breaking projects addressing systemic racism in biomedical research and building STEM college and career pathways. What makes his work unique is his extensive background in building collaborative, community-facing technology projects; designing for the public good; and developing new models of STEM and health innovation that make hospitals, healthcare providers, schools, neighborhoods, and communities more equitable, just, smart, and sustainable. As a Distinguished Professor and Founding Director of the Social Innovation and Universal Opportunity Lab, Dr. Akom's research focuses on developing better STEM tools, insights, technologies, and methodologies around the social, structural, and clinical determinants of health by integrating community-driven data with big data and predictive analytics.

Advisory Board



Brenda Darden Wilkerson

President & CEO
AnitaB.org



Dr. Claudia Rankins

Senior Research Associate
PRISSEM Academic Services, LLC



Dr. Chris Draper

Managing Director
Trokt



Dr. Philip Rubin

President-Elect
Federation of Associations in
Behavioral and Brain Sciences



Dr. James L. Moore, III

Vice President for Diversity and Inclusion
Chief Diversity Officer
The Ohio State University

Participants

Aminat Adebiji

Research Staff Member
IBM Research

Senay Agca

Professor
George Washington University
Program Director
NSF

Antwi Akom

Distinguished Professor &
Founding Director
UCSF/SFSU, SOUL

Adriana Alvarado Garcia

Ph.D. Research Intern
IBM

Daisyane Barreto

Associate Professor
University of North Carolina
Wilmington

Lisa Black

Qualitative Research Specialist
The PEER Group

Jeffrey Brown

Diversity and Inclusion
Research Fellow
Partnership on AI

Sarah Brown

Assistant Professor of
Computer Science
University of Rhode Island

Loretta Cheeks

CEO
Strong TIES

Prabhakar Clement

Professor
The University of Alabama

Nelson Colón

Entrepreneur In Residence
White House Presidential
Innovation Fellows

Margaret Cozzens

Distinguished Research
Professor and Education Director
DIMACS — Rutgers University

Charlotte Craff

Ambassador
re:3D, Inc.

Karen Crosby

Dean, Honors College
Professor, Mechanical
Engineering
Southern University

Tessa Cruz

Program Manager
Streetwyze

Chris Dede

Wirth Professor in
Learning Technologies
Harvard Graduate School
of Education

Chris Draper

Managing Director
Trokt

Trish Millines Dziko

Executive Director
TAF

Ana Echeverri

Expert Labs Learning
Program Director
IBM

Keyana Ellis Reynolds

Program Coordinator
USDA Forest Service

Rayvon Fouché

Professor
Purdue University

Ashok Goel

Professor
Georgia Tech

Casey Harris

Research Assistant
The PEER Group

Malik Henfield

Dean of Institute for
Racial Justice
Loyola University — Chicago

Illya Hicks

Professor
Rice University

Stacy Hobson

Research Scientist and Director
IBM Research

James Holly, Jr.

Assistant Professor —
Urban STEM Education
Wayne State University

Florence Hudson

Executive Director
Northeast Big Data
Innovation Hub
Columbia University

Geraldine Jackson

Training Coordinator
The PEER Group

Michael Jackson

Student
Rice University

Gemma Jiang

Director of Organizational
Innovation
University of Pittsburgh

Lauren Johnson

Math Teacher
Southern University/
Scotlandville High

Erick Jones

Professor & Associate Dean
Graduate Affairs, Engineering
University of Texas Arlington

Jumoke (Kemi) Ladeji-Osias

Program Director
NSF

Michael Lesiecki

Principal Consultant
CORD

Dan Losapio

Designer
The PEER Group

Charlotte Lysohir

Manager
IBM

Joel Mangan

Executive Director
IBM P-TECH

Linda Molnar

Program Director
NSF

Kathaleena Monds

Director, Center for
Educational Opportunity
Albany State University

Beronda Montgomery

Professor
Michigan State University

Errika Moore

Executive Director
National STEM Funders Network

James L. Moore, III

Vice Provost &
Chief Diversity Officer
The Ohio State University

Terrence Mosley

Program Development
Consultant
The PEER Group

Douglas Mupasiri

Department Head and Professor
University of Northern Iowa

Syreeta Nolan

Project Manager and
Graduate Student
University of California
San Diego

Tina Park

Research Fellow
Partnership on AI

Fay Cobb Payton

Program Director
NSF

Tamara Pearson

Director, Center of Excellence for
Minority Women in STEM
Spelman College

Yvette E. Pearson

Founder & Principal Consultant
The PEER Group

Kylie Pepler

Associate Professor
University of California, Irvine

Nancy Philippart

General Partner
Belle Michigan

Lauren Thomas-Quigley

Research Scientist
IBM Research

Claudia Rankins

Senior Research Associate
PRISSEM Academic
Services, LLC

Robby Robson

CEO
Eduworks Corporation

Philip Rubin

President-elect
Federation of Associations in
Behavioral and Brain Sciences

Marta Sánchez

Associate Professor
University of North Carolina
Wilmington

Lisa Sargent

Research Assistant
The PEER Group

Nora Savage

Program Director
NSF

Michael Smith

Operations Specialist
The PEER Group

Tori Smith

Program Director
National Science Foundation

Wendy Smythe

Assistant Professor
University of Minnesota Duluth

Jonathan Townes

Dean of Technology, Career
and Technical Education
Hinds Community College

Anina Tweed

Director of Development
Hack the Hood

Brenda Wilkerson

CEO and President
AnitaB.org





References

1. Biden, J.R. (2021). OSTP Appointment. Build Back Better. <https://buildbackbetter.gov/wp-content/uploads/2021/01/OSTP-Appointment.pdf> (January 16, 2021).
2. Biden (2021).
3. National Science Foundation, National Center for Science and Engineering Statistics. (2019). Women, Minorities, and Persons with Disabilities in Science and Engineering: 2019. Special Report NSF 19-304. Available online: <https://nces.nsf.gov/pubs/nsf19304/>
4. NSF, NCES (2019).
5. Crunchbase. (2020). Crunchbase Diversity Spotlight 2020: Funding to Black and Latinx Founders. Crunchbase. Available online: http://about.crunchbase.com/wp-content/uploads/2020/10/2020_crunchbase_diversity_report.pdf
6. American Society of Civil Engineers. (2019). Civil Engineering Education Summit: Mapping the Future of Civil Engineering Education. Dallas, Texas. Available online: <https://www.asce.org/education-summit/>
7. U.S. Department of Education Office of Career, Technical, and Adult Education. (2021). Tech Prep Education. <https://www2.ed.gov/about/offices/list/ovae/pi/cte/techprep.html>
8. Polgar, D.R. (2021). Unintended Consequences: We Need More Problem Finders, BuiltIn, <https://builtin.com/career-development/unintended-consequences-problem-finders>
9. Benjamin, R. (2019). Race After Technology: Abolitionist Tools for the New Jim Code. Polity: Cambridge.
10. Pearson, Y.E. (2019). Inclusion, Diversity Now Factor into Accreditation Standards. PE Magazine, 41(4).

Appendices

Workshop 1 Agenda

Workshop 1: Support for Advancement of Underrepresented Groups in STEM

May 25, 2021

1:00 PM

Session Opening and
Introductions
Dr. Michael D. Smith
The PEER Group

1:10 PM

NSF Convergence
Accelerator Overview
Dr. Linda Molnar
National Science
Foundation

1:20 PM

RISE Context Setting
Dr. Lauren Thomas Quigley
Dr. Stacy Hobson
IBM Research

1:30 PM

Lessons from Plants –
Book Talk & Discussion
Dr. Beronda Montgomery
Michigan State University

1:45 PM

Breakout Session #1

2:35 PM

Report Out from Breakout
Session #1

2:50 PM

Break

3:00 PM

REDEFINE STEM Education
– Talk & Discussion
Dr. Yvette E. Pearson, PE
The PEER Group

3:15 PM

Breakout Session #2

4:10 PM

Advancement of
Underrepresented Groups
in STEM Discussion and
Activity
Dr. Lauren Thomas Quigley

4:20 PM

Wrap Up and Evaluation
Dr. Michael Smith

4:30 PM

Adjourn

5:00 PM

Virtual Terrarium Happy
Hour

Grab your kits and get ready
to join us as we create
physical models of our RISE
ecosystem.



Workshops 2 and 3 Agendas

| | | | |
|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Workshop 2: Social and Human Good Research Foundations May 27, 2021 | 1:20 PM Workshop Session #1 Recap Dr. Yvette E. Pearson The PEER Group | 2:35 PM Report Out from Breakout Session #1 | 4:15 PM Social Entrepreneurship Group Discussion and Activity Dr. Lauren Thomas Quigley |
| 1:00 PM Session Opening and Ground Rules Dr. Michael D. Smith The PEER Group | 1:30 PM Workshop Session #2 Context Setting Dr. Lauren Thomas Quigley Dr. Stacy Hobson IBM Research | 2:55 PM Break | 4:25 PM Wrap Up and Evaluation Dr. Michael Smith |
| 1:10 PM NSF Convergence Accelerator Recap Dr. Linda Molnar National Science Foundation | 1:40 PM Social Justice and STEM Dr. Lauren Thomas Quigley | 3:05 PM Social Sciences in STEM Education Dr. Malik Henfield Loyola University Chicago | 4:30 PM Adjourn |
| | 1:55 PM Breakout Session #1 | 3:20 PM Breakout Session #2 | |
| | | 4:00 PM Report Out from Breakout Session #2 | |

| | | | |
|----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Workshop 3: AI and Technology- Supported Education June 3, 2021 | 1:20 PM Workshop Session #2 Recap Dr. Yvette E. Pearson The PEER Group | 2:40 PM Report Out from Breakout Session #1 | 4:15 PM Technology Education Group Discussion and Activity Dr. Lauren Thomas Quigley |
| 1:00 PM Session Opening and Ground Rules Dr. Michael D. Smith The PEER Group | 1:30 PM Workshop Session #3 Context Setting Dr. Lauren Thomas Quigley Dr. Stacy Hobson IBM Research | 2:55 PM Break | 4:25 PM Wrap Up and Evaluation Dr. Michael Smith |
| 1:10 PM NSF Convergence Accelerator Recap Dr. Linda Molnar National Science Foundation | 1:40 PM Essential Approaches to STEM Education Dr. Rayvon Fouché Purdue University | 3:05 PM Intersectional, Place-Based STEM Education Dr. Wendy Smythe University of Minnesota Duluth | 4:30 PM Adjourn |
| | 1:55 PM Breakout Session #1 | 3:20 PM Breakout Session #2 | |
| | | 4:00 PM Report Out from Breakout Session #2 | |

Workshop 4 Agenda

| | | | |
|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Workshop 4: Data Trust Development June 8, 2021 | 1:20 PM Workshop Session #3 Recap Dr. Yvette E. Pearson The PEER Group | 1:55 PM Breakout Session #1 | 4:00 PM Report Out from Breakout Session #2 |
| 1:00 PM Session Opening and Ground Rules Dr. Michael D. Smith The PEER Group | 1:30 PM Workshop Session #4 Context Setting Dr. Chris Draper, PE Trokt | 2:35 PM Report Out from Breakout Session #1 | 4:15 PM Synthesis, Next Steps, and Wrap-Up Dr. Lauren Thomas Quigley Dr. Yvette E. Pearson |
| 1:10 PM NSF Convergence Accelerator Recap Dr. Linda Molnar National Science Foundation | 1:40 PM Advance People and Technology with Trust, Model Design, Entrepreneurship, and Training Dr. Loretta Cheeks Strong TIES | 2:55 PM Break | 4:25 PM Evaluation Dr. Michael Smith |
| | | 3:05 PM Data for Research and Opportunity Dr. Antwi Akom San Francisco State University Streetwyze | 4:30 PM Adjourn |
| | | 3:20 PM Breakout Session #2 | |

Workshop Breakout Sessions and Raw Data

Workshop 1: Support for Advancement of Underrepresented Groups in STEM

These exercises are intended to help participants REIMAGINE the future of STEM education and careers, eradicating boundaries and barriers to engagement of people from underrepresented groups.

Breakout Session 1: Groundskeeping for Representative Ecosystems in STEM Education

At the end of this session, groups should have collectively identified 10-15 ideas they believe are top priority and have the highest transformative potential along with the stakeholder groups to be impacted and engaged.

Participants self-select or are placed into one of three breakout rooms – Group A, Group B, and Group C – to achieve mixed personal, professional, and demographic identities in each room.

Step 1: Individual Points of View (5 minutes).

- Participants take **5 minutes** to write their own perspectives on STEM education on Sticky notes in Miro. Use the questions in Box 1 as prompts.
 - Type statements on sticky notes and place on the Points of View portion of the board in Miro. There is a board for each breakout group. **Column headings represent the questions in Box 1.**

BOX 1

1. What is the purpose of STEM education and who is it for?
2. What are the future focus areas of STEM for human and social good?
3. What are some curiosities you have for the future of STEM for human and social good?
4. What is the ideal state of the future of STEM?
5. What is at least one wild idea you have for STEM education and careers for human and social good?

*Questions adapted from ASCE Education Summit.

- Only one statement/idea per note.
- Try to generate as many thoughts as possible, pushing and eliminating traditional boundaries to challenge the status quo for STEM education and careers.
- Be sure to consider all facets of the STEM ecosystem – education, careers, stakeholders, etc.

Step 2: Sharing and Grouping (~15 minutes).

- Participants take turns briefly sharing the statement(s) from some of their sticky note(s) with the full group.
- As participants share, they **copy and paste** (use Control+D or Command+D to duplicate) their point of view statements and sort by stakeholder group.
 - If an idea applies to more than one stakeholder, duplicate it for each relevant stakeholder group.



Step 3: Emoji Voting (~10 minutes).

- Each participant votes on the **5 ideas/statements** they believe are top priority and have the highest transformative potential. In doing this, do not allow your votes to be limited by constraints or feasibility.
- To vote:
 - Click on a sticky. Select “add emoji” from the menu bar that pops up.
 - Select an emoji.
 - If there is already an emoji on the sticky, you can click that emoji to add your vote (the number of votes will show on the emoji).

Step 4: Report Out (Return to Full Group): The scribe from each group shares (1) the stakeholders that emerged through their efforts and (2) the top 3-4 ideas based on the emoji voting. Each scribe will have ~3 minutes to share.

Breakout Session 2: Ecosystem Building

At the end of this session, groups should have created “How can we...” questions derived from the previous activity, along with needed disruptions to overcome potential systemic barriers, and identified those ideas that are truly transformative, with the potential to revolutionize STEM education and careers.

Step 1: How Can We? – From Fruit to Root (15 minutes). Each group will focus on the point of view statements for the stakeholder group/room they are in. Using those statements as desired outcomes (i.e., “fruit”) do the following:

- Decide if the statements need editing/refinement for clarity or bolstered potential impact. Do not change the original stickies – we need to keep those intact.
- In your groups, reformulate the statements into “How can we...” questions and place them on the designated board.
- Identify what other stakeholder groups are involved/impacted and place “comments” on the stickies labeling those groups.

Next: Through group discussion, identify what current factor(s) need to be disrupted at the “roots” of the system(s) in order to produce the desired “fruit” identified in the “How can we...” questions. Place those (one per sticky) in the designated area of the board. Again, do not consider constraints/feasibility.

Step 2: Adding Perspectives (8 minutes). Everyone stays in their assigned Zoom breakout groups; however, this step is done independently. Browse the “comments” on the “How can we...” stickies on all three boards.

- For those that identify your identity/identities, add to the “roots” from the last bullet of Step 1.
- For those that **do not** identify your identity/identities, and you think they should, add a comment reflecting your stakeholder identity/identities; then add to the “roots” from the last bullet of Step 1.

Step 3: Categorization (12 minutes). While still in your breakout group rooms delineated by stakeholder identity, categorize the “How can we...” questions into one of the “bins” below by discussing and moving them into the appropriate areas of the designated Miro board. No borderlines allowed; you must pick one bin for each.

- **Been There, Done That:** These ideas align with the status quo. They may be effective to some degree, but have not yet proven to be impactful in effecting change at scale. They do not address convergence; they are not likely to yield deliverables in three years.
- **Boundary Pushing:** These ideas go above and beyond status quo, but are not radically different. They may potentially effect change, but not revolutionize STEM education and careers. They may address some, but not all, three of these key convergence accelerator criteria: require convergent approaches, have strong societal impacts, and produce tangible results realized in three years.
- **Reimagined:** These ideas re-create concepts from an entirely new perspective, having the potential to revolutionize STEM education and careers. They address all three of these key convergence accelerator criteria: require convergent approaches, have strong societal impacts, and can result in tangible deliverables in a three-year time frame.

Step 4: Report Out (Return to Full Group, 5 minutes): Each scribe shares:

- the stakeholder group they represent;
- one or two “How can we...” questions that fell into their “Reimagined” bin and one or two “roots” associated with those questions that need to be disrupted; and
- other stakeholders involved/impacted.

**RISE Workshop #1 Breakout 1 Group A
Points of View**

| What is the purpose of STEM education and who is it for? | What are the future focus areas of STEM for human and social good? | What are some curiosities you have for the future of STEM for human and social good? | What is the ideal state of the future of STEM? | What is at least one wild idea you have for STEM education and careers for human and social good? |
|-------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| The purpose should be to prepare every student for productive STEM careers. | social and educational equity | How can we help others to understand that the future of a US-born STEM workforce requires broadening participation for groups historically underrepresented in STEM? | Supporting educational equity and access | Support those institutions and schools that do well in educating ALL students |
| advance humanity | social equity | How do we get ahead of the tech companies in terms of the development of policies and regulations for the use of AI/ML and other emerging technologies | In some ways this is not revolutionary, but I don't see it happening so far. What if we allocated funding for broadening participation that better matches the amount it costs to do the work? Broadening participation dollars are always MUCH less than core research dollars. | Transdisciplinary |
| Learning to solve problems considering that we live in a connected world | circular economies, using research and tech to preserve, maintain and use the natural world for the preservation of mankind | How can we get more engaged? | STEM education and careers that are accessible to all | have majors specific to human and social good problems with concentrations related to specific STEM fields |
| enable people to develop skills to create their careers and outcomes that they wish | Convergence research | how do we use our use-inspired research to make a global society that serves the needs of all | open source | mentoring |
| Purpose? Create an atmosphere where innovation can soar. | social justice | How to reduce economic, educational, and health disparities | Supporting Industry needs without becoming vocational education | licensure to develop products, processes that impact people |
| Individual's to create value based on their individual interests and skills | STEM education is for all and we have to do a much better job to be inclusive and make it relevant to all. WE have to stop being so elitist about it | how can we reduce burnout and weathering | anyone can choose to be an engineer, scientist, technologist, mathematician, etc. | Degrees do not matter anymore |
| STEM for all persons, especially the most marginalized since STEM may have a larger, marginal benefit | AI-5G-IoT-Energy-Media and Migrations on Society | Community voices and knowledge about tech risk and consequences | Everyone benefits from STEM innovation and technology equitably | All STEM education is highly interdisciplinary and social justice focused |
| Also for the "New Americans," i.e.. new immigrants | Short-term certification programs in STEM | How do we solve for community - university partnerships that are truly reciprocal | people have the STEM literacy to navigate their personal lives safely with all the knowledge they need | Introduction courses for traditional and non traditional students with limited financial obligations |
| Learning to discovery in safe environments. | Food insecurity | How do students (and faculty) in STEM keep pace with emerging technologies, for that matter hope to employees keep pace. Yes II know lifelong learning.... | Recognition of human potential and encourage others to rise. | Wild Idea: Ensuring that education is not dis-aggregated by age and to find ways to partner students and parents and communities in learning pods |
| It should be for everyone. | The future focus on stem is AI and Coded Bias; Using STEM to help students via knowledge tracking algorithms | Who/what entities will put aside capitalism for human and social good? | We consider different ways of doing science and different viewpoints of what is science and how science should be conducted | bring steam education to people where they are. reduce barriers to access by making it more mobile and more accessible |
| | Explainable AI | I am curious about the role of government (or lack thereof) in data privacy and big data access. | | |
| | Social justice, communication of science to the public, food, water, environmental issues, improving peoples' lives | | | |
| | How can improve lives of our neighborhoods through STEM | | | |
| | eliminating/reducing harm | | | |

STAKEHOLDERS

| EDUCATION/RESEARCH | WORKFORCE | COMMUNITY | OTHER |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Further research on Coded Bias and K-12 Knowledge tracing | How can we help others to understand that the future of a US-born STEM workforce requires broadening participation for groups historically underrepresented in STEM? | Identify ways to further explore the work of Dr. Beronda Montgomery by understanding the connection to land, ancestry, identity, and economic prosperity | K-12 teacher preparation programs must engage parents-as-teachers so they can benefit from some form of 'certification' to ensure that families are prepared to support and educate their children when disruptions happen |
| how can we reduce burnout and weathering | How do students (and faculty) in STEM keep pace with emerging technologies, for that matter hope to employees keep pace. Yes II know lifelong learning.... | AI-5G-IoT-Energy-Media and Migrations on Society | Self-efficacy and Self- identity should be fostered |
| How can we help others to understand that the future of a US-born STEM workforce requires broadening participation for groups historically underrepresented in STEM? | open source | Community voices and knowledge about tech risk and consequences | |
| Learning to discovery in safe environments. | Apprenticeships add value to both students and industries | bring steam education to people where they are. reduce barriers to access by making it more mobile and more accessible | |
| circular economies, using research and tech to preserve, maintain and use the natural world for the preservation of mankind | | Everyone is involved | |
| Educational preparation, access, and opportunities | | Rural America matters! | |
| have majors specific to human and social good problems with concentrations related to specific STEM fields | | | |
| how do we use our use-inspired research to make a global society that serves the needs of all | | | |
| Learning to solve problems considering that we live in a connected world | | | |
| interdisciplinary and social justice focused | | | |

SHAREOUT SPACE

| |
|------------------------------------------------|
| Stakeholders |
| Education/Research |
| Workforce |
| Community |
| Parents (Education and Community intersection) |



**RISE Workshop #1 Breakout 1 Group B
Points of View**

| What is the purpose of STEM education and who is it for? | What are the future focus areas of STEM for human and social good? | What are some curiosities you have for the future of STEM for human and social good? | What is the ideal state of the future of STEM? | What is at least one wild idea you have for STEM education and careers for human and social good? |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| build capability in systematic and logic thinking | Ethical AI | A recognition of the breadth, diversity, and potential inclusiveness of STEM. Currently, it can be too restrictive. | Equitable & curiosity driven | Refocus STEM learning on what AI cannot do |
| STEM topics and prepare people for careers in STEM fields. It should be for EVERYONE! | Sustainability | How to increase access and inclusivity of STEM education | Accessible and equitable | We should have DSI - Disability Serving Institutions like HSIs and HBCUs |
| For everyone | Reciprocity | How will we leverage STEM to INFLUENCE human and social good | Diversity (thought, experience, & identity) | Diversity programs in research focused on disabled people |
| Environmental Justice | AI Ethics | Increased equity for disabled researchers | fueling innovation | focus on dispositions as well as content and skills |
| For all | Global impacts | how to get people to go beyond caring to action. | Focused on sustainable development fo all | Promotion based on social & collective impact rather than citation/\$ metrics |
| Purpose: Better understand the world & impacts. Who is it: Should be for everyone. | Equitable Education | Can we make meaningful change for equitable education | everyone has equitable access and opportunities | More STEM + Creativity or other "softer" skills (perceived as) |
| Solve human problems and improve quality of life for all | Ethical AI | Foundational changes in STEM education | Increased equity for disabled researchers | Creating an accessible, meaningful . inclusive, ecosystem for education. |
| STEM Education should be for everyone including disabled researchers | Sustainable development - UN SDGs good place to start | How will we create greater equity in STEM education and access | integrated across the curriculum rather than separated | STEM education using more then western world views |
| Learn how to think ... for everyone | AI (automation) | | Education for all from multiple cultural perspectives | Meaningful change in academia where diversity is the norm! |
| STEM education is for ALL students | sustainability, Environmental justice, equality / equity (individual, national and/or global level) | | Equitable and inclusive. | Change in academic tenure processes |
| | Ableism should be named and reduced | | Ubiquitous and not treated separately | More community focused hands on education in solving societal problems |
| | Food insecurity | | focus on those in positions of power and the environments they create to promote equitable participation and outcomes. Hold them accountable for the advancement of historically marginalized | |

Stakeholders

| EDUCATION/RESEARCH | WORKFORCE | COMMUNITY | OTHER |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|
| Learn how to think ... for everyone | How can we do more to include and value disabled researchers as much as any other group? | Diversity programs in research focused on disabled people | We should have DSI - Disability Serving Institutions like HSIs and HBCUs |
| How will we create greater equity in STEM education and access | Increased equity for disabled researchers | For all. | Creating an accessible, meaningful . inclusive, ecosystem for education. |
| Food insecurity | AI (automation) | For everyone | Global impacts |
| How do we help humans experience the world from others' perspectives | Diversity programs in research focused on disabled people | How will we leverage STEM to INFLUENCE human and social good | |
| STEM education using more then western world views | Ethical AI | Sustainability | |
| Change in academic tenure processes | | Accessible and equitable | |
| The purpose of STEM education evolves from exposure to skill development / content mastery | | Education for all from multiple cultural perspectives | |
| Can we make meaningful change for equitable education | | Ethical AI | |
| Meaningful change in academia where diversity is the norm! | | focus on those in positions of power and the environments they create to promote equitable participation and outcomes. Hold them accountable for the advancement of historically marginalized | |
| Ableism should be named and reduced | | AI Ethics | |
| Foundational changes in STEM education | | Ubiquitous and not treated separately | |
| Equitable Education | | Reciprocity | |
| Purpose: Better understand the world & impacts. Who is it: Should be for everyone. | | Diversity programs in research focused on disabled people | |
| Promotion based on social & collective impact rather than citation/\$ metrics | | A recognition of the breadth, diversity, and potential inclusiveness of STEM. Currently, it can be too restrictive. | |
| How to increase access and inclusivity of STEM education | | Environmental Justice | |
| Ethical AI | | Equitable & curiosity driven | |
| More STEM + Creativity or other "softer" skills (perceived as) | | Diversity (thought, experience, & identity) | |
| STEM education is for all students | | Sustainable development - UN SDGs good place to start | |
| | | Equitable Education | |
| | | Solve human problems and improve quality of life for all | |
| | | STEM Education should be for everyone including disabled researchers | |
| | | More community focused hands on education in solving societal problems | |
| | | How do we help humans experience the world from others' perspectives | |

SHAREOUT

| |
|-------------------------------------------------------------------------------|
| Diversity programs in research focused on disabled people |
| Promotion based on social & collective impact rather than citation/\$ metrics |
| More community focused hands on education in solving societal problems |
| Creating an accessible, meaningful . inclusive, ecosystem for education. |
| Increased equity for disabled researchers |
| Environmental Justice |
| Global impacts |
| How to increase access and inclusivity of STEM education |

**RISE Workshop #1 Breakout 1 Group C
Points of View**

| What is the purpose of STEM education and who is it for? | What are the future focus areas of STEM for human and social good? | What are some curiosities you have for the future of STEM for human and social good? | What is the ideal state of the future of STEM? | What is at least one wild idea you have for STEM education and careers for human and social good? |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conventional STEM education is designed for white, cis-hetero, male, western (value, social structure), English-speaking, upper/middle class, neurotypical, able-bodied, individuals | Lots of focus on the impact of AI driven decision making and the impact on specific groups | How will we ensure BIPOC folks are involved. | fully integrated, loop-school education model where students go in and out of work environments while engaged in life-long learning [draper] | Incorporate non-Western, non-positivist frameworks for inquiry |
| Introduce individuals to different concepts, approaches, and frameworks to understand and explain the world around them (natural, social, psychological, etc.) | Identifying systemic, equitable, and sustainable solutions that move us forward and lighten the load for those coming behind us | Who actually determines what's considered "social good" | More experiential vs theoretical | Experiential centers for communities to join and experience science |
| To prepare the workforce around the STEM field. It should be for all, but we know that it has been limited in terms of group representation. | AI, Using big data to support communities, citizen scientists | Who controls the information (collecting and dispersing) | STEM is looked at with passion not fear | Teach STEM educators how to teach students with different needs (and recognize this teaching ability/capacity for performance reviews, tenure, etc.) |
| Identifying systemic, equitable, and sustainable solutions that move us forward and lighten the load for those coming behind us | Using technology to scaffold and support teacher preparation, students' career and academic success, etc. | How can we stop the rapidly widening gap between socioeconomic classes, the global North/South, and the global reach of White supremacy | Not to be corporatized like it is today. | invert partnerships between cc/jc and 4 year schools so you flow from the 4 year college to cc/jc [draper] |
| To prepare people to manipulate nature and machines to address human problems; folks interested in techno-scientific investigation and manipulation | Education -- issues with rethinking higher education, connecting higher ed to workforce, and thinking through eliminating debt, etc. | how can we practically create space for students to both specialize and maintain breadth enough to consider humanity of what they're doing | People (researchers, communities affected by the research) have structures and policies in place to address any ethical concerns in meaningful ways | Welcome people's lived STEM experience (eg. Some students know how to fix a tractor engine, even though they are not engineer students) |
| To plan for a future in which the citizenry is able to use critical thinking and scientific knowledge to solve problems and build a better society for all | collaboratively developed;with social compabitlity highly valued | | STEM transitions from egocentric to ecocentric, disentangles from capitalism and Whiteness | Emphasize critical thinking and questions around social impact so individuals can navigate the ethics of scientific research and its relationship to social inequality |
| To teach kids to ideate, create, collaborate, solve problems, research and present findings/solutions | Seeing technology as an accelerant/ amplifier of human processes versus a separate silo/ solution [draper] | | well connected to social understanding so that foundations link well to technology and real world use | All schools change their pedagogy to project-based learning, centered on equity and student voice. Students work on things that mean something to them and their communities |
| For all | using STEM innovation to redress injustices within urban communities | | educators trained, empowered and held accountable to supporting students as complete humans and working for humans; not as workers serving abstract capitalist goals | Start as early as possible. Break out sets of skills into granular sets |
| What scientific questions serve and/or harm marginalized communities? Should these questions be pursued? | To build a more interdisciplinary way of thinking through the complex issues we face as a society, including but not limited to the inclusion of diverse folks in the conversation | | Balance between technical and cultural competencies | Bring science and technology centers to rural areas so that rural students do not have to come to city centers for STEM education and careers |
| STEM education is often designed for individuals who can maintain "objectivity" and distance from scientific inquiry due to their social privileges | | | STEM for everyone | a greater number of short, intense experiences in different forms; short courses, project sessions, consulting, interships, etc |
| | | | | formal incentives aligned to value humans and social good |
| | | | | future in which we openly talk about issues like sexism, racism, classism while we talk about the fundamentals of science |
| | | | | Black people being able to develop and enhance their own sustainable STEM institutions (e.g., entrepreneurial, non-profit, political, etc.) rather than aspiring to survive in big White companies |

STAKEHOLDERS

| EDUCATION/RESEARCH | WORKFORCE | COMMUNITY | OTHER |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|
| Identifying systemic, equitable, and sustainable solutions that move us forward and lighten the load for those coming behind us | fully integrated, loop-school education model where students go in and out of work environments while engaged in life-long learning [draper] | To plan for a future in which the citizenry is able to use critical thinking and scientific knowledge to solve problems and build a better society for all | For all |
| To teach kids to ideate, create, collaborate, solve problems, research and present findings/solutions | enhance their own sustainable STEM institutions (e.g., entrepreneurial, non-profit, political, etc.) rather than aspiring to survive in big White companies | Seeing technology as an accelerant/ amplifier of human processes versus a separate silo/ solution [draper] | STEM for everyone |
| Lots of focus on the impact of AI driven decision making and the impact on specific groups | invert partnerships between cc/jc and 4 year schools so you flow from the 4 year college to cc/jc [draper] | STEM transitions from egocentric to ecocentric, disentangles from capitalism and Whiteness | |
| Who controls the information (collecting and dispersing) | | using STEM innovation to redress injustices within urban communities | |
| To build a more interdisciplinary way of thinking through the complex issues we face as a society, including but not limited to the inclusion of diverse folks in the conversation | | How can we stop the rapidly widening gap between socioeconomic classes, the global North/South, and the global reach of White supremacy | |
| students to both specialize and maintain breadth enough to consider humanity of what they're doing | | Who actually determines what's considered "social good" | |
| Teach STEM educators how to teach students with different needs (and recognize this teaching ability/capacity for performance reviews, tenure, etc.) | | Experiential centers for communities to join and experience science | |
| a greater number of short, intense experiences in different forms; short courses, project sessions, consulting, interships, etc | | Education/Research | |
| Welcome people's lived STEM experience (eg. Some students know how to fix a tractor engine, even though they are not engineer students) | | Workforce | |
| Emphasize critical thinking and questions around social impact so individuals can navigate the ethics of scientific research and its relationship to social inequality | | Community | |
| Balance between technical and cultural competencies | | Parents (Education and Community intersection) | |
| That we rewrite some of the paradigms/ a future in which we openly talk about issues like sexism, racism, classism while we talk about the fundamentals of science | | | |



RISE Workshop #1: Breakout 2 Group A
Education / Research

| Fruit | Refinement/Clarity | How Can We? | Roots | Been There, Done That | Boundary Pushing Ideas | Reimagined |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| Self-efficacy and Self-identity should be fostered | All STEM education is highly interdisciplinary and social justice focused | How can we make STEM courses more relevant to students? | Disability is seen more as a liability and broadly denied as a part of DEI transformation in thought has not occurred. | | how can we use our use-inspired research to make a global society that serves the needs of all | How can we establish majors specific to human and social good problems with concentrations related to specific STEM fields |
| how can we reduce burnout and weathering | have majors specific to human and social good problems with concentrations related to specific STEM fields | How can we change temporal format of education to better support deep engagement, still compatible with constraints of life? | social justice issues and concerns are viewed as nontechnical and nonscientific concerns. | | How can we incorporate critical thinking and questions around social impact in STEM education to begin to openly about issues like sexism, racism, classism and ableism with respect to research and reducing the impact of social inequality | How can we change school curricula and pedagogy to prioritize project-based learning, centered on equity and student voice? |
| How can we help others to understand that the future of a US-born STEM workforce requires broadening participation for groups historically underrepresented in STEM? | Programs that mention diversity as a goal | How can we expand educational preparation, access and opportunity? | "Expertise" is limited to a very few set of people (usually white, male, cis-hetero, able-bodied individuals from elite educational backgrounds with formal training) | | How can we use qualitative research methods to dig deeper in understanding beyond the quantitative numbers | How can we redefine STEM domains and participation in more inclusive /equitable ways that reflect a broader culture? |
| K-12 teacher preparation programs must engage parents-as-teachers so they can benefit from some form of 'certification' to ensure that families are prepared to support and educate their children when disruptions happen | | How can we create reflective institutions that think about changing the context as the primary method of helping individuals/institutions thrive? | Acknowledge even "scientific knowledge" is "socially constructed" and recognize that scientific disciplines have histories of oppression and marginalization (e.g., psychology's history with eugenics, misogyny, homophobia) | | How can we speak openly about issues like sexism, racism, classism and ableism as well as the fundamentals of science | How can we bring steam education to people where they are to reduce barriers to access by making it more mobile and more accessible? |
| Parents as a stakeholder group | | How can we reduce burnout and weathering? | Paradigm - Only a very specific set of skills ("hard science") is useful for society and everything else is viewed as essentially useless or window dressing. | | how can we support students in engaging their support systems for learning in a higher ed context? | |
| Further research on Coded Bias and K-12 Knowledge tracing | | How can we restructure STEM education to be integrative area of practice with social sciences? | STEM (hard sciences) is "objective" and everything else is "subjective" | | How can we engage parents as a support group? | |
| Learning to solve problems considering that we live in a connected world | | these seem connected | | | How can we help others to understand that the future of a US-born STEM workforce requires broadening participation for groups historically underrepresented in STEM? | |
| a greater number of short, intense experiences in different forms: short courses, project sessions, consulting, internships, etc | | How can we practically create space in degree granting environments for students to both specialize and maintain breadth enough to consider humanity of what they're doing | | | How can we balance between technical and cultural competencies | |
| Learning to discover in safe environments. | | How can we incorporate critical thinking and questions around social impact in STEM education (so individuals can navigate the ethics of scientific research and its relationship to social inequality)? | | | How can we determine which scientific questions serve and/or harm marginalized communities? Should these questions be pursued? | |
| Emphasize critical thinking and questions around social impact so individuals can navigate the ethics of scientific research and its relationship to social inequality | | | | | | |
| All schools change their pedagogy to project-based learning, centered on equity and student voice. Students work on things that mean something to them and their communities | | | | | | |
| circular economies, using research and tech to preserve, maintain and use the natural world for the preservation of mankind | | | | | | |
| Educational preparation, access, and opportunities | | | | | | |
| how can we practically create space for students to both specialize and maintain breadth enough to consider humanity of what they're doing | | | | | | |
| That we rewrite some of the paradigms/ a future in which we openly talk about issues like sexism, racism, classism while we talk about the fundamentals of science. | | | | | | |

**RISE Workshop #1 Breakout 2 Group B
Workforce**

| Fruit | Refinement/Clarity | How Can We? | Roots | Been There, Done That | Boundary Pushing Ideas | Reimagined |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| How can we help others to understand that the future of a US-born STEM workforce requires broadening participation for groups historically underrepresented in STEM? | | How can we ensure that STEM competencies built into our education system are culturally responsive, impactful and relevant? | Disrupt the current isolationist philosophy and mental models | | Why the separation between Industry and Education in Workforce development ---Create co-capacity building models between industry and Education; inversion of education: send students out to the world (industry), and invite real world challenges to the classroom | |
| Increased equity for disabled researchers | | How do students (and faculty) in STEM keep pace with emerging technologies, for that matter hope to employees keep pace. Yes II know lifelong learning.... | Examples of successful engineering need to be from Global South as well as Global North | | Use virtual environments to cross boundaries | |
| Black people being able to develop and enhance their own sustainable STEM institutions (e.g. entrepreneurial, non-profit, political, etc.) rather than aspiring to survive in big White companies | | How can we do more to include and value disabled researchers as much as any other group? | (Root Cause) What needs to be disrupted? | | | |
| Diversity programs in research focused on disabled people | | How can we help others to understand that the future of a US-born STEM workforce requires broadening participation for groups historically underrepresented in STEM? | Non-transparency and lack of adoption of ethical guidelines in AI | | | |
| Ethical AI | | How can we ensure that those academic-industry learning partnerships are appropriately aligned for student-centered, life-long learning? | The idea that education and workforce are separate | | | |
| AI (automation) | | How can we ensure that Apprenticeships are an integral part of STEM education and designed with equity in mind? | Entry level jobs for people not coming from an academic background should have a career path | | | |
| fully integrated, loop-school education model where students go in and out of work environments while engaged in life-long learning [draper] | | How can we respond to Global impacts of globalization on our workforce? | Differences in when we collaborate and when we compete between academia and industry | | | |
| How can we do more to include and value disabled researchers as much as any other group? | | How can our workforce have a global impact? | The idea that the completion of an educational course is an objective in itself (e.g. that the paper means something on its own) | | | |
| Invert partnerships between cc/jc and 4 year schools so you flow from the 4 year college to cc/jc [draper] | | How do we ensure that AI increases Equity and does not decrease it? | The value of student labor when evaluating internship purpose. | | | |
| Global impacts | | How can we provide a respected pathway to completing "skilled STEM" careers for those in a traditional bachelor program? | The protectionist approach to IP being developed in an academic institution | | | |
| open source | | How can we engage with industry to learn from them and share with them, models to create a more representative STEM workforce? | The idea that successfully completing higher degrees are more valuable in STEM that succeeding in something that earns an Associated Degree | | | |
| How do students (and faculty) in STEM keep pace with emerging technologies, for that matter hope to employees keep pace. Yes II know lifelong learning.... | | | | | | |
| Apprenticeships add value to both students and industries | | | | | | |

**RISE Workshop #1: Breakout 2 Group C
Community**

| Fruit | Refinement/Clarity | How Can We? | Roots | Been There, Done That | Boundary Pushing Ideas | Reimagined |
|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| What scientific questions serve and/or harm marginalized communities? Should these questions be pursued? | We should refine and clarify systemic barriers that exist. | How can we identify ways to further understand the environments surrounding students by understanding the connection to land, ancestry, identity, and economic prosperity? | Understand the geography of opportunity | | Make an aggressive push to counter systemic bias in AI | How can we prepare K-12 teachers to engage parents-as-teachers so to ensure that families are prepared to support and educate their children when disruptions happen? |
| work with local service organizations | | How can we determine which scientific questions serve and/or harm marginalized communities? Should these questions be pursued? | Enable local voices. They know their issues and what works best. | | | How can we identify ways to further understand environments surrounding students by understanding the connection to land, ancestry, identity, and economic prosperity? |
| Parents as a stakeholder group | | How can we make sure that rural America is involved in the process? | Culture and community are connected. | | | |
| Self-efficacy and Self-identity should be fostered | | How can we make sure that parents and other potentially under-represented groups are included as stakeholders? | Listen to marginalized communities to understand what the needs are - bottom up not top down | | | |
| AI-SC-IoT-Energy-Media and Migrations on Society | | How can we get everyone involved? | | | | |
| Rural America matters | | How can we use qualitative research methods to dig deeper in understanding beyond the quantitative numbers | | | | |
| bring STEM education to people where they are . Reduce barriers to access by making it more mobile and more accessible. | | How can we bring steam education to people where they are to reduce barriers to access by making it more mobile and more accessible? | | | | |
| Community voices and knowledge about tech risk and consequences. | | How can we create accountability measures to ensure a ROI | | | | |
| Everyone is involved. | | how can we work with local service organizations to advance STEM in rural areas? | | | | |
| | | How can we foster and encourage Self-efficacy and Self- identity? | | | | |



Workshop 2: Social and Human Good Research Foundations

These exercises are intended to help participants gain deeper insights into the needs of the STEM stakeholder communities and to recognize and “own” their roles in meeting those needs using convergence to move along the spectrum from education to research to society.

Breakout Session 1: Sociotechnical Problems from Education to Research to Society

At the end of this session, groups should have collectively identified perspectives, pains, and gains from stakeholder identities with respect to the prompts in Box 2 below.

Step 1: Understanding the Stakeholders (15 minutes). The Miro board has individual empathy maps for 6 stakeholder groups:

- University Faculty and Administrators
- K-12 Teachers
- Employers
- Students (K-12, Undergraduate, Graduate)
- Community Members/Community-based Organizations
- Funders

For the next 15 minutes, you will browse the empathy map(s) of your choice based on stakeholder identities you serve/support – **not the one(s) you represent.**

- For each stakeholder, think about (1) who they are and what you’re trying to understand about them (what their situation is, what their role is in the situation) and (2) what their needs are (what they need to do, know, or understand; what they need to do differently) relative to STEM for social and human good.
- Place sticky notes in each quadrant of the board (one thought/idea per sticky) noting what the stakeholder:
 - **Sees**
 - What do they see in their immediate environment?
 - What do they see others doing?
 - What are they watching and reading?
 - **Hears**
 - What are they hearing from people closest to them?
 - What are they hearing second-hand?
 - **Says and Does**
 - What have we heard them say? What can we imagine them saying?
 - What do they do today? What can we imagine them doing?
 - What behavior have we observed?
 - **Thinks and Feels**
 - What are their needs, hopes, and dreams?
 - What are their fears, frustrations, and anxieties?

Step 2: Pains and Gains (10 minutes). For the maps you completed in step one, identify at least one pain and one gain from the persona’s/stakeholder’s perspective. Consider questions like these:

BOX 1

1. What are the future focus areas of STEM for human and social good?
2. What role does social justice play in STEM for social and human good?
3. What is the stakeholder’s/persona’s concept of convergence as it applies to education and research for human and social good?

- Pains
 - What hurdles/barriers do they experience in that role?
 - What does a bad day look like for them?
 - What are they afraid of?
 - What keeps them awake at night?
 - What are they responsible for?
 - What obstacles are in their way?
 - How have I been a barrier to them?
- Gains
 - What benefits can they attain in that role?
 - What does the person want and aspire to?
 - How do they measure success?
 - What can I offer them?

Step 3: Adding Personal Perspectives (10 minutes). Participants will browse the boards again, this time focusing only on the stakeholder group(s)/persona(s) with which they personally identify (or have personally identified).

- Add “comments” or emojis to stickies on the empathy maps as needed to question, correct, clarify, etc. what others perceive of your stakeholder group. This could be a “thumbs up” to validate the perspective on the sticky, a “thumbs down” to disagree, a comment to question or correct misperceptions, etc.
- Add stickies that reflect your points of view if something is not represented. If time is too limited, focus first on the **pains and gains.**

Step 4: Report Out (15 minutes): The meeting facilitator leads volunteers from the full group through sharing their inputs on the empathy maps.

- One volunteer is solicited per empathy map based on their identities. Two minutes is allowed per volunteer.
- The volunteer will share their perspectives on where the empathy map “hit” and “missed” with regard to the four quadrants and the pains and gains.

Breakout Session 2: Educational Opportunities for Interdisciplinary Framing

At the end of this session, groups should have created pitches for products, processes, systems, services, etc. that are aligned with convergence accelerator priorities and are derived from pain points from the previous activity.

Each breakout group will focus on two Empathy Maps based on the group members' identity/identities. The groups are mixed so that not all participants match the group labels. The goal of this exercise is for participant groups to define a product, service, system, or whatever you can imagine, to address a pain point/pain points identified in the first session. Each group will ultimately develop a pitch for that product/system/service as if they were trying to get a venture capitalist to invest in their idea. Think Shark Tank!

Each breakout group (A, B, C) will divide into two subgroups (A/A1, B/B1, C/C1), as close to equal size as possible.

Step 1: Picking a Pain (10 minutes).

- One subgroup from each breakout room will go to a separate breakout (A1, B1, or C1).
- Once separated, each subgroup will identify a pain point from the Excel spreadsheet provided by the facilitators.
 - The pains should be picked based on their potential to address/incorporate three key elements for convergence accelerators:
 - require convergent approaches,
 - have strong societal impacts, and
 - can result in tangible deliverables in a three-year time frame.

- If there are related pain points, a group may choose to address more than one.
- Each subgroup will then define a product, system, service, etc. they will develop a pitch for in the next step.

Step 2: Developing the Pitch (10 minutes). Each subgroup spends 10 minutes formulating their pitches. They can use any electronic tools at their disposal to write, draw, present, etc. Then pick one or two subgroup members to present the pitch to the combined breakout group. Pitches must be no longer than **3 minutes**, and only **one pitch** is allowed per subgroup.

Step 3: Presenting the Pitch (15 minutes). The subgroups reconvene in their assigned breakout rooms, and their designees **present the pitches to each other** (3 minutes presentation, 3 minutes Q&A).

- The full group decides which of the two subgroup's pitches will be presented during the breakout session (3 minutes). **Note: This does not mean the idea that was not chosen does not have merit; we only have time for one group to present.**

Step 4: Report Out (15 minutes): The "winning" pitch from each group is presented to the full workshop audience. Each pitch will be 3 minutes followed by 2 minutes Q&A.

RISE Workshop #2 Breakout 1 & 2: Empathy Maps Stakeholders plus Pains & Gains

| | Hear? What are they hearing from people closest to them? What are they hearing second-hand? | Think and feel? What are their needs, hopes, and dreams? What are their fears, frustrations, and anxieties? | Say and do? What have we heard them say? What can we imagine saying? What do they do today? What can we imagine them doing? What behavior have we observed? | See? What do they see in their immediate environment? What do they see others doing? What are they watching and reading? | PAINS | GAINS |
|---------------|--------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| K-12 Teachers | Special education doesn't prepare disabled students to go to college and to explore their identity as disabled children. | How can they incorporate anti-ableism into the classroom that never spoke about it? | Teachers of color: Our experience is not valued | There is no inclusion of disability history in K-12 | Lack of leadership at school level to create equitable environment for teachers | More districts offering racial equity training, with some making it mandatory |
| | Current curriculum focus on high stakes tests and doesn't prepare students for the next level | How can they incorporate social good within the curriculum? | White teachers say: Students of color don't come to school ready to learn | Teachers of color: See white teachers stifling the capabilities of students of color | Unwillingness to move from focus on standardized tests | More districts created "technical" solutions to getting students of color in high level classes, forcing teachers to acknowledge their presence |
| | students won't be admitted to college for STEM majors without enough advanced math and science classes | Every teacher needs to have a pedagogy that is equitable and gives students voice and choice | white teachers say: Even students of color who are "high achieving" aren't ready for rigor | universities providing requirement for preparation without support to develop teachers to meet those expectations | introduction of legislation to prevent the very education needed (i.e., race-conscious historical analysis) | More districts seeing teachers of color and working on retention efforts |
| | We have to focus on getting students to pass state tests, so anything that's additional isn't worth the time | | Teachers of color: We cannot augment the curricular content to be culturally relevant | Pre-service teachers resistant to making necessary shifts, teacher education programs not retaining faculty best qualified to train students for this work | Pedagogy is pretty much the same sit and get with a few variations. No incentive to teach differently | Talking about disability and ableism early, we create a more compassionate future generation |
| | | | | Disabled children are essentially segregated away from non-disabled children unless the disabled child is mainstreamed | Disabled students don't receive the same K-12 education, but they will receive the same education in higher ed. How do I prepare them? | |
| | | | | Some movement on resources allocated to address inequities | | |



Workshop 3: Artificial Intelligence and Technology-Supported Education

These exercises are intended to help participants REIMAGINE how advanced technologies like Artificial Intelligence can shape new models of education, evaluate and potentially correct traditional education models and make connections from initial technology entry points (e.g., social/human good contexts) to applications to other technology challenges.

Breakout Session 1: Lessons from the Pandemic and Opportunities to Innovate

At the end of this session, groups should have collectively identified 10-15 ideas to address tech education gaps and help bridge the educational, aspirational and financial gaps caused and exacerbated by the COVID-19 pandemic.

Participants self-select or are placed into one of three breakout rooms – Group A, Group B, and Group C – to achieve mixed personal, professional, and demographic identities in each room.

Step 1: Individual Points of View (5 minutes).

- Participants take **5 minutes** to write their own perspectives on Sticky notes in Miro. Use the questions in Box 1 as prompts (these are listed across the top of the first Miro frame).
 - Only one statement/idea per note.
 - Try to generate as many thoughts as possible, pushing and eliminating traditional boundaries to challenge the status quo.
 - Be sure to consider a wide range of stakeholders (students, educators, employers, communities, policy makers, etc.)

Step 2: Sharing and Grouping (~20 minutes).

- Participants take turns briefly sharing the statement(s) from some of their sticky note(s) with the full group.
- As participants share, they **copy and paste** their point of view statements and sort by stakeholder group.
- If an idea applies to more than one stakeholder, duplicate it for each relevant stakeholder group.

Step 3: Emoji Voting (~10 minutes).

- Each participant votes on the **5 ideas/statements** they believe are top priority and have the highest transformative potential. In doing this, do not allow your votes to be limited by constraints or feasibility.
- To vote:
 - Click on a sticky. Select “add emoji” from the menu bar that pops up.
 - Select an emoji.
 - If there is already an emoji on the sticky, you can click that emoji to add your vote (the number of votes will show on the emoji).

BOX 1

1. What lessons has the covid-19 pandemic taught us about technology-supported education?
2. What are some curiosities you have for the future of technology-supported education?
3. What is the ideal state of the future of advanced technologies like Artificial Intelligence in STEM education?
4. What is at least one wild idea you have for AI and Technology-Supported Education?

Step 4: Report Out (Return to Full Group~15 minutes): The scribe from each group shares (1) the stakeholders that emerged through their efforts and (2) the top 3-4 ideas based on the emoji voting. Each scribe will have ~3 minutes to share.

Breakout Session 2: How, What Content, and Through What Means Can STEM Education be Restructured?

In this session, we will start with the top ideas that emerged from breakout session 1. It is broken down into three parts that your facilitators will walk you through.

Step 1: How Can We? – Start with the Fruit (10 minutes). Each group will focus on the point of view statements for the stakeholder group/room they are in. Using those statements as desired outcomes (i.e., “fruit”) do the following:

- In your groups, reformulate the statements into “How can we...” questions and place them on the designated board.
- Identify what other stakeholder groups are involved/impacted and place “comments” on the stickies labeling those groups.

Step 2: Categorization (10 minutes). While still in your breakout group rooms delineated by stakeholder identity, categorize the “How can we...” questions into one of the “bins” below by discussing and moving them into the appropriate areas of the designated Miro board. No borderlines allowed; you must pick one bin for each..

- **Been There, Done That:** These ideas align with the status quo. They may be effective to some degree, but have not yet proven to be impactful in effecting change at scale. They do not address convergence; they are not likely to yield deliverables in three years.
- **Boundary Pushing:** These ideas go above and beyond status quo, but are not radically different. They may potentially effect change, but not revolutionize STEM education. They may address some, but not all, three of these key convergence accelerator criteria: require convergent approaches, have strong societal impacts, and produce tangible results realized in three years.
- **Reimagined:** These ideas re-create concepts from an entirely new perspective, having the potential to revolutionize STEM education. They address all three of these key convergence accelerator criteria: (1) require convergent approaches, (2) have strong societal impacts, and (3) can result in tangible deliverables in a three-year time frame.



Step 3: Changing the Roots (10 minutes): Through group discussion, identify what current factor(s) need to be disrupted at the “roots” of existing system(s) in order to produce the desired “fruit” identified in the “How can we...” questions. Place those (one per sticky) in the designated area of the board. Again, do not consider constraints/feasibility.

Step 4: Report Out (Return to Full Group, 5 minutes): Each scribe shares:

- the stakeholder group they represent;
- one or two “How can we...” questions that fell into their “Reimagined” bin and one or two “roots” associated with those questions that need to be disrupted; and
- other stakeholders involved/impacted.



**RISE Workshop #3 Breakout 1 Group A
Points of View**

| What lessons has the covid-19 pandemic taught us about technology-supported education? | What are some curiosities you have for the future of technology-supported education? | What is the ideal state of the future of advanced technologies like Artificial Intelligence in STEM education? | What is at least one wild idea you have for AI and Technology Supported Education? |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>There are 3 considerations for AI and Tech supported Ed - 1) hardware and platforms to support regular education paths (e.g. items supporting remote learning for COVID-19), 2) AI or Technology specifically developed as a means to educate (e.g. in place of traditional education and/or teachers or at a minimum supplementing/enhancing their efforts and 3) technology used to help educate people outside of normal K-12, undergrad and graduate settings (e.g. education for individuals or workforce training)</p> | <p>How do we balance privacy with the quality of tech assistance</p> | <p>AI should be invisible to other participants - a useful tool that is there the same way that heating systems, whiteboards, and computers are today.</p> | <p>AI should be an extension of the student - the way Google and smartphones have become</p> |
| <p>Teaching during COVID was just a low fidelity version of teaching before COVID - technology was not really used differently</p> | <p>How do we ensure people do not get pigeonholed by the sum of their data points</p> | <p>Focus of AI or Tech supported education is on better outcomes for students or end-users, not on profit or uptake</p> | <p>This shouldn't be considered wild, but it probably is: how about putting the voices of those upfront who are least heard, in the case of higher education, the HBCUs, TCUs, community colleges.</p> |
| <p>It is useless unless we take the time to prepare the educators on how to use a communication culture that is appropriate for the technology</p> | <p>males tend to engage in technology differently than females.</p> | <p>The ideal state would be one where the developers include every groups.</p> | <p>Flip it around - think about how we teach AI and other technologies rather than how they teach us.</p> |
| <p>The 'haves', i.e. well funded schools were not nearly as impacted as lesser funded schools,. The pandemic ripped apart the concept that there is equality in society as a whole, in this case education..</p> | <p>Who were the subjects used to develop the technology</p> | <p>Ideal state: Education that is driven by individualized, knowledge predictive software Ideal state: Education that connects interests + aptitude + societal needs</p> | <p>Wild idea: Each citizen having autonomy and access to their personal databases to track individual data points and make individual decisions on how, when, and when that data is shared.</p> |
| <p>Recognition of what the possibilities are for distance learning</p> | <p>Will everyone have the same access?</p> | <p>Not sure ... but it's not just replicating what we do now.</p> | |
| <p>Access and impact are not equitable. Some children were negatively impacted by transition to remote learning and reliance. We need to think of ways to ensure that tech supported education benefits all.</p> | <p>How do we increase equity and not make it worse?</p> | <p>engaging with the tools from a human-focused, solution orientation versus a focus on what the tech "could" do</p> | |
| <p>Lesson 1: Self-Determination is germane Lesson 2: Bottom-up solutions are essential Lesson 3: Parents are more agile in finding solutions to education than government.</p> | <p>There is a huge gap between leading-edge research (AI, XR, etc.) and current practice. What will be the "killer app" that closes that gap?</p> | | |

**RISE Workshop #3 Breakout 1 Group B
Points of View**

| What lessons has the covid-19 pandemic taught us about technology-supported education? | What are some curiosities you have for the future of technology-supported education? | What is the ideal state of the future of advanced technologies like Artificial Intelligence in STEM education? | What is at least one wild idea you have for AI and Technology Supported Education? |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| parents and families are critical but rarely get support | how do we technology to help parents help children | Creating reflective tools to help monitor equity in the classroom | use AI to help parents learn so that they can teach their children |
| The importance of attending to the needs of children and their families due to Covid-related learning slide. | How might be technology be leveraged to bridge instead of dividing? | Black people have the same liberties to possess, use, and develop technologies as White people, also technology is used to support all of humanity | Use AI to help English Language learning families navigate the system |
| the pandemic demonstrated how imperative internet access is for student success and how we must work for universal connectivity | How can we define a baseline of tech configuration (home and school) that will enable every stakeholder to effectively use tech as a tool? | AI for families to work and learn together | Effective and appealing social robotics. |
| Elementary school children are affected from technology more adversely - affects organization skills and focus. Human contact is impottant. | How can we continue to use tech to increase educational accessibility for the disabled | using AI for enabling connections to different communities to teach empathy and understanding of different cultures | Classroom as a natural user interface / a holodeck of experiences |
| The younger the students, the harder it is to engage with technology supported education | Countering bias and noise in AI and machine learning approaches. | People of color should be at least 50% of the teams working on curriculum and curricular content. | How might AI enable individualized education, meeting every student where they are, leading them to the highest future potential? |
| Most stakeholders (students, families, educators, districts) were (and still are) not equipped with the necessary tech and/or how to use it. | will equitable policy measures be taken for access and quality of internet | Might AI be leveraged to "augment" human capabilities, instead of replacing or diminishing human capabilities? | Decision-making that prioritizes the potential harms |
| effects of racism further exposed, despite popular belief of technology as equalizer | What role can AI have in invisible assessments? | | Citizen inclusion in design and application. |
| Equity is paramount and inequities are persistent | How can we define a baseline of tech configuration (home and school) that will enable every stakeholder to effectively use tech as a tool? | | AI creates more equitable access to dangerous/ expensive technologies for innovation and learning |
| Health and wellness need to be central to education | | | |

Stakeholders

| EDUCATION/RESEARCH | WORKFORCE | COMMUNITY | OTHER |
|----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| effects of racism furhter exposed, despite popular belief of technology as equalizer | How can we continue to use tech to increase workforce accessibility for the disabled | The importance of attending to the needs of children and their families due to Covid-related learning slide. | Black poeple have the same liberties to possess, use, and develop technologies as White people, also technology is used to support all of humanity |
| How might AI enable individualized education, meeting every student where they are, leading them to the highest future potential? | Decision-making that prioritizes the potential harms | How to balance education with human to human interaction? Human interaction is important, especially at young age. | The younger the students, the harder it is to engage with technology supported education |
| Most stakeholders (students, families, educators, districts) were (and still are) not equipped with the necessary tech and/or how to use it. | People of color should be at least 50% of the teams working on curriculum and curricular content. | The whole community should be involved with the design and purposes of the educational technology. Local service organizations can be at the heart of thiis | Effective and appealing social robotics. |



**RISE Workshop #3 Breakout 1 Group C
Points of View**

| What lessons has the covid-19 pandemic taught us about technology-supported education? | What are some curiosities you have for the future of technology-supported education? | What is the ideal state of the future of advanced technologies like Artificial Intelligence in STEM education? | What is at least one wild idea you have for AI and Technology-Supported Education? |
|------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|
| keeping students engaged is difficult | Will more remote courses be taught | personalized learning | personalized learning that is explainable and unbiased in terms of race/ethnicity/gender |
| Leveraging it wasn't as "innate" for students as presumed | What opportunities can we provide that are not or broadband required? | Design must consider diverse students, ways of knowing | Providing greater support for students with learning disabilities |
| Will academia better support remote learning infrastructure? | How will we continue to leverage/optimize it? | Mapped learning to connect learners to opportunities to work and/or further education | personal educator tools to support learning and expand horizons of learners |
| remote learning has provided great opportunities for those traditionally not served by education | What are better ways to enable remote education than synchronous lectures? | | |
| Remote teaching STEM is possible | Will we be able to move past "widgety" education solutions to meaningful solutions? | | |
| Students can be supported outside the class, however its a different way of doing business. | | | |
| There are a lot of features of student's learner's lives that we ignored or did not see until school was at home | | | |
| Educators need support leveraging technology to use it effectively | | | |

STAKEHOLDERS

| EDUCATION/RESEARCH | WORKFORCE | COMMUNITY | OTHER |
|--------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------|
| Will academia better support remote learning infrastructure? | What opportunities can we provide that are not or broadband required? | What opportunities can we provide that are not or broadband required? | |
| Will we be able to move past "widgety" education solutions to meaningful solutions? | Mapped learning to connect learners to opportunities to work and/or further education | Design must consider diverse students, ways of knowing | |
| What opportunities can we provide that are not or broadband required? | | personalized learning that is explainable and unbiased in terms of race/ethnicity/gender | |
| What are better ways to enable remote education than synchronous lectures? | Design must consider diverse students, ways of knowing | Mapped learning to connect learners to opportunities to work and/or further education | |
| personalized learning that is explainable and unbiased in terms of race/ethnicity/gender | personalized learning that is explainable and unbiased in terms of race/ethnicity/gender | remote learning has provided great opportunities for those traditionally not served by education | |
| Mapped learning to connect learners to opportunities to work and/or further education | How will we continue to leverage/optimize it? | Providing greater support for students with learning disabilities | |
| Design must consider diverse students, ways of knowing | | How will we continue to leverage/optimize it? | |
| Providing greater support for students with learning disabilities | | Leveraging it wasn't as "innate" for students as presumed | |
| Leveraging it wasn't as "innate" for students as presumed | | | |
| How will we continue to leverage/optimize it? | | | |
| remote learning has provided great opportunities for those traditionally not served by education | | | |

RISE Workshop #3: Breakout 2 Group A
Education / Research

| Fruit | How Can We? | Been There, Done That | Boundary Pushing Ideas | Reimagined | Roots |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|
| It is useless unless we take the time to prepare the educators on how to use a communication culture that is appropriate for the technology | how can we use AI to teach empathy? | How can we provide opportunities we can provide that are supported by, but don't require broadband? | How might AI enable individualized education, meeting every student where they are, leading them to the highest future potential? | how can we use AI to teach empathy? | Dismantle caste system |
| Access and impact are not equitable. Some children were negatively impacted by transition to remote learning and reliance. We need to think of ways to ensure that tech supported education benefits all. | How can we use smart technology that is not driven by consumer data but is utilized by consumers? Use data about myself to improve life - not have others use data about me | | How can we use smart technology that is not driven by consumer data but is utilized by consumers? Use data about myself to improve life - not have others use data about me | How can we move past "widy" education solutions to meaningful solutions? | Dismantle silos: DE-Silo education, research, practice, etc. |
| Ethically aligned | How might AI enable individualized education, meeting every student where they are, leading them to the highest future potential? | | How can we create personalized learning that is explainable and unbiased in terms of race/ethnicity/gender/disability? | how can we engage all - incarcerated and other non-traditional learners - in lifelong learning? ALL have access to knowledge | Must no longer 'dismiss' parents |
| Wild idea: AI would be used to provide incarcerated, disabled, and homeless populations with opportunities to see graphical models of their 'life stories' in a way that allows them to dissect their own lives and find solutions across systems and resources around them. | How can we use our own experiences to create customized learning? | | How can we use our own experiences to create customized learning? | How can we use AI to measure individual impacts on the environment | Dismantle "norms" and the culture of standardization |
| using AI for enabling connections to different communities to teach empathy and understanding of different cultures | How can we move past "widy" education solutions to meaningful solutions? | | how can we improve learning infrastructure for all students? | How can we create education that can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit | Destroy belief that things must happen top down instead of bottoms up |
| How can we continue to use tech to increase educational accessibility for the disabled | How can we create education that can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit | | | How can we...use AI to measure grit | Dismantle belief that it's someone else's problem |
| Removal of what were previously barriers to engaging and accommodating people with disabilities and people who need flexible arrangements for engaging | How can we create personalized learning that is explainable and unbiased in terms of race/ethnicity/gender/disability? | | | | Dismantle perceptions about who is worthy to learn |
| Countering bias and noise in AI and machine learning approaches | how can we engage all in lifelong learning? | | | | Must create accountability measures |
| Ideal state: Education that can be driven by connecting societal and individual needs with solutions that create the greatest mutual benefit | How can we...use AI to measure grit | | | | |
| How can we define a baseline of tech configuration (home and school) that will enable every stakeholder to effectively use tech as a tool? | How can we ensure designs consider diverse students, ways of knowing? | | | | |

RISE Workshop #3 Breakout 2 Group B
Workforce

| Fruit | How Can We? | Been There, Done That | Boundary Pushing Ideas | Reimagined | Roots |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| How can we continue to use tech to increase workforce accessibility for the disabled | How can we make the workforce be ethically aligned? | How can we continue to use tech to increase workforce accessibility for the disabled? | How can we engage with tools from a human-focused, solution orientation versus a focus on what the tech "could" do? | Mapped learning to connect learners to opportunities to work and/or further education | We need to create education initiatives around understanding the history and nature of disability and ableism |
| Student created AI - they have amazing ideas. | How can we engage with tools from a human-focused, solution orientation versus a focus on what the tech "could" do? | How can we engage learners with technology and help them stay current when broadband is not available? | How can we personalize learning that is explainable and unbiased in terms of race/ethnicity/gender? | How can we design tech solutions that consider diverse students, ways of knowing? (includes community, education/research) | Not including the community that is being served in the decision making process, eg the disability community |
| Decision-making that prioritizes the potential harms | How can we ensure the development of technology used in STEM education is ethically aligned? | | How can we make AI invisible to other participants as a useful tool that becomes second nature? | How can we decrease the disparity between well funded schools that were not nearly as impacted as lesser funded schools during the pandemic to create a more equitable education system? | Get comfortable with being uncomfortable |
| Ethically aligned | How can we codify Decision-making that prioritizes the potential harms? | | How can we ensure the development of technology used in STEM education is ethically aligned? | How can we ensure the development of technology used in STEM education is ethically aligned? | We need to stop thinking of disability as purely accessibility and accommodations |
| engaging with the tools from a human-focused, solution orientation versus a focus on what the tech "could" do | How will we continue to leverage/optimize it? | | How can we ensure students have the instructional resources, trained teachers and tools to support developing their AI ideas? This includes internship opportunities and teaching them how to bring their ideas to market? | How can we create personalized learning that is explainable and unbiased in terms of race/ethnicity/gender | Develop shared understanding of AI and technical capabilities |
| Mapped learning to connect learners to opportunities to work and/or further education | How can we continue to use tech to increase workforce accessibility for the disabled? | | How can we remove barriers to engaging and accommodating people with disabilities and people who need flexible arrangements for engaging? | How can we codify Decision-making that prioritizes the potential harms? | Definition of who a worker is in xx, yy zz field to be revised/changed |
| Design must consider diverse students, ways of knowing | How can we remove barriers to engaging and accommodating people with disabilities and people who need flexible arrangements for engaging? | | | How can we go beyond use tech increase workforce accessibility for the disabled to enhance diversity in tech? | Apply "nothing for us without us" to solution design and development. |
| What opportunities can we provide that are not or broadband required? | How can we engage learners with technology and help them stay current when broadband is not available? | | | | We need to create education initiatives around understanding the history and nature of disability and ableism |
| The 'haves', i.e. well funded schools were not nearly as impacted as lesser funded schools.. The pandemic ripped apart the concept that there is equality in society as a whole, in this case education.. | How can we ensure students have the instructional resources, trained teachers and tools to support developing their AI ideas? This includes internship opportunities and teaching them how to bring their ideas to market? | | | | Not including the community that is being served in the decision making process, eg the disability community |
| Removal of what were previously barriers to engaging and accommodating people with disabilities and people who need flexible arrangements for engaging | How can we decrease the disparity between well funded schools that were not nearly as impacted as lesser funded schools during the pandemic to create a more equitable education system? | | | | Get comfortable with being uncomfortable |



**RISE Workshop #3 Breakout 2 Group C
Community**

| Fruit | How Can We? | Been There, Done That | Boundary Pushing Ideas | Reimagined | Roots |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|
| personalized learning that is explainable and unbiased in terms of race/ethnicity/gender | How to balance education with human to human interaction? Human interaction is important, especially at young age. | How can we define equity in an implementable manner (i.e. we can calculate inequity, but how do we define when we have reached equity)? | How can we create Ethically aligned technologies and spaces | How can we ensure fairness and explainability in AI? | View social and technological development as two wings of the same bird, and enable mutually beneficial relationships between them |
| AI should be invisible to other participants - a useful tool that is there the same way that heating systems, whiteboards, and computers are today. | How can we define equity in an implementable manner (i.e. we can calculate inequity, but how do we define when we have reached equity)? | how can we support all educators in becoming technologically adaptive and confident in accurately communicating about technology | How can we balance education with human to human interaction? Human interaction is important, especially at young age? | How can we create effective and appealing social robotics? | Overhaul how we identify / accept competence-based assessment |
| The importance of attending to the needs of children and their families due to Covid-related learning slide. | How can we ensure fairness and explainability in AI? | How can we adequately support families and parents? | how can we use AI to help parents learn so that they can support their children's learning | how can we support each individual having autonomy and access to their personal databases to track individual data points so that they can provide informed consent for its use? | Engage inclusive stakeholders in sense-making before decisions are made |
| use AI to help parents learn so that they can teach their children | how can we use AI to help parents learn so that they can support their children's learning | How can we include citizens in the design and application of new educational technologies? | how can AI better support collaboration in nonspecialized, nonexpert settings? | How can we use AI to provide self-leveling competency-based evaluation? | asset based thinking in education: we have innate capacity, and education is to provide enabling conditions |
| What opportunities can we provide that are not or broadband required? | How can we Design technologies for diverse students and use traditional, ways of knowing | | how can we better design technology that supports multiple ways of knowing and helps students and teachers from disparate backgrounds interact productively? | How can we fully integrate AI into STEM education so that it becomes a valuable tool for all stakeholders (and not something separate, frightening, or magical)? | Overcome the fear of change - embrace discomfort |
| The 'haves', i.e. well funded schools were not nearly as impacted as lesser funded schools. The pandemic ripped apart the concept that there is equality in society as a whole, in this case education... | how can we better design technology that supports multiple ways of knowing and helps students and teachers from disparate backgrounds interact productively? | | How can we ensure that efforts to build large, inclusive datasets with ed and workforce do not violate privacy/confidentiality expectations? | How can we ensure people do not get pigeonholed by the sum of their data points? | Ethically aligned |
| Mapped learning to connect learners to opportunities to work and/or further education | How can we adequately support families and parents? | | | | Engaging rather than dismissing family service organizations |
| Citizen inclusion in design and application. | How can we create Ethically aligned technologies and spaces | | | | Competency over degrees and credentials |
| parents and families are critical but rarely get support | How can we ensure that efforts to build large, inclusive datasets with ed and workforce do not pigeon hole an individual's potential? | | | | |
| the pandemic demonstrated how imperative internet access is for student success and how we must work for universal connectivity | How can we provide greater support for students with learning disabilities? | | | | |
| Design must consider diverse students, ways of knowing | | | | | |
| AI for families to work and learn together | | | | | |
| How do we ensure people do not get pigeonholed by the sum of their data points | | | | | |

Workshop 4: Data Trust Development

These exercises are intended to capture insights on data trust development to gather details on student demographics as well as educational and career outcomes and how data trusts can be used to connect students with opportunities that have

Breakout Session 1: Mechanisms and Requirements for Data Trusts

At the end of this session, groups should have collectively identified perspectives, pains, and gains from stakeholder identities with respect to the prompts in Box 1.

Participants will start this exercise on their own; no breakout groups are needed. This will be equivalent to moving around a physical room with Post-It Notes on the walls.

Step 1: Understanding the Stakeholders (15 minutes). The Miro board has individual empathy maps for 6 stakeholder groups:

- University Faculty and Administrators
- K-12 Teachers
- Employers
- Students (K-12, Undergraduate, Graduate)
- Community Members/Community-based Organizations
- Funders

For the next 15 minutes, you will browse the empathy map(s) of your choice based on stakeholder identities you serve/support – **not the one(s) you represent.**

- For each stakeholder, think about (1) who they are and what you're trying to understand about them (what their situation is, what their role is in the situation) and (2) what their needs are (what they need to do, know, or understand; what they need to do differently) relative to data trusts.
- Place sticky notes in each quadrant of the board (one thought/idea per sticky) noting what the stakeholder:
 - **Sees**
 - What do they see in their immediate environment?
 - What do they see others doing?
 - What are they watching and reading?
 - **Hears**
 - What are they hearing from people closest to them?
 - What are they hearing second-hand?
 - **Says and Does**
 - What have we heard them say? What can we imagine them saying?
 - What do they do today? What can we imagine them doing?
 - What behavior have we observed?
 - **Thinks and Feels**
 - What are their needs, hopes, and dreams?
 - What are their fears, frustrations, and anxieties?

Step 2: Pains and Gains (10 minutes). For the maps you completed in step one, identify at least one pain and one gain from the persona's/stakeholder's perspective. Consider questions like these:

- Pains
 - What hurdles/barriers do they experience in that role?

BOX 1

1. What do we need to understand about collecting, analyzing, sharing, and disseminating people's data?
2. What role do data trusts play in STEM for social and human good?
3. How can a convergent approach to data trusts help industry and academia realize diversity, equity, and inclusion goals at scale?

- What does a bad day look like for them?
- What are they afraid of?
- What keeps them awake at night?
- What are they responsible for?
- What obstacles are in their way?
- How have I been a barrier to them?
- Gains
 - What benefits can they attain in that role?
 - What does the person want and aspire to?
 - How do they measure success?
 - What can I offer them?

Step 3: Adding Personal Perspectives (10 minutes). Participants will browse the boards again, this time focusing only on the stakeholder group(s)/persona(s) with which they personally identify (or have personally identified).

- Add "comments" or emojis to stickies on the empathy maps as needed to question, correct, clarify, etc. what others perceive of your stakeholder group. This could be a "thumbs up" to validate the perspective on the sticky, a "thumbs down" to disagree, a comment to question or correct misperceptions, etc.
- Add stickies that reflect your points of view if something is not represented. If time is too limited, focus first on the **pains and gains.**

Step 4: Report Out (15 minutes): The meeting facilitator leads volunteers from the full group through sharing their inputs on the empathy maps.

- One volunteer is solicited per empathy map based on their identities. Two minutes is allowed per volunteer.
- The volunteer will share their perspectives on where the empathy map "hit" and "missed" with regard to the four quadrants and the pains and gains.

Breakout Session 2: Participatory Methods for STEM Education Research for RISE

At the end of this session, groups should have created pitches for products, processes, systems, services, etc. that are aligned with convergence accelerator priorities and are derived from pain points from the previous activity.

Each breakout group will focus on two Empathy Maps based on the group members' identity/identities. **The groups are mixed so that not all participants match the group labels.** The goal of this exercise is for participant groups to define a prod-



uct, service, system, or whatever you can imagine, to address a pain point/gains identified in the first session. Each group will ultimately develop a pitch for that product/system/service as if they were trying to get a venture capitalist to invest in your idea. Think Shark Tank!

Each breakout group (A, B, C) will divide into two subgroups (A/A1, B/B1, C/C1), as close to equal size as possible.

Step 1: Picking a Pain/Gain (5 minutes).

- One subgroup from each breakout room will go to a separate breakout (A1, B1, or C1).
- Once separated, each subgroup will identify a pain point and/or gain from the Excel spreadsheet provided by the facilitators.
 - The pains/gains should be picked based on their potential to address/incorporate three key elements for convergence accelerators:
 - require convergent approaches,
 - have strong societal impacts, and
 - can result in tangible deliverables in a three-year time frame.
 - If there are related pain points/gains, a group may choose to address more than one.

- Each subgroup will then define a product, system, service, etc. they will develop a pitch for in the next step.

Step 2: Developing the Pitch (15 minutes). Each subgroup spends **15 minutes** formulating their pitches. They can use any electronic tools at their disposal to write, draw, present, etc. Then pick one or two subgroup members to present the pitch to the combined breakout group. Pitches must be no longer than **3 minutes**, and only **one pitch** is allowed per subgroup.

Step 3: Presenting the Pitch (15 minutes). The subgroups reconvene in their assigned breakout rooms, and their designees **present the pitches to each other** (3 minutes presentation, 3 minutes Q&A).

- The full group decides which of the two subgroup’s pitches will be presented during the breakout session (3 minutes). **Note: This does not mean the idea that was not chosen does not have merit; we only have time for one group to present.**

Step 4: Report Out (15 minutes): The “winning” pitch from each group is presented to the full workshop audience. Each pitch will be 3 minutes followed by 2 minutes Q&A.

RISE Workshop #4 Breakout 1&2: Empathy Maps Stakeholders plus Pains & Gains

| | Hear? What are they hearing from people closest to them? What are they hearing second-hand? | Think and feel? What are their needs, hopes, and dreams? What are their fears, frustrations, and anxieties? | Say and do? What have we heard them say? What can we imagine saying? What do they do today? What can we imagine them doing? What behavior have we observed? | See? What do they see in their immediate environment? What do they see others doing? What are they watching and reading? | PAINS | GAINS |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
| K-12 Teachers | First hand: Mostly focused on how to use student data to inform practices. | The need to learn about using data to present research and ideas so they can teach their students how to do it | More, money, money, money | Education is less about the 'kids' and more about money | Sharing of student data, even de-identified data, can be very difficult, making it very hard to track impact of strategies to encourage STEM students | We have more data to measure progress |
| | The only important data point is/are test scores | Overwhelmed with additional responsibility. | Heard: No time to review data and craft lessons to help students improve | Science teachers understand the importance of data in their content area | Little autonomy or agency over my person | Data will create time to focus on the areas of learning where the students need to most support. We like sharing with other teachers in a collective way. |
| | | They fear presenting student data to the students' families - particularly when students aren't doing well. | | They see opportunities to teach better research and information synthesis, but there's no PD available to support incorporating it in curriculum | The digital interface and data collection tools create a greater divide socially | Data Trust will give teachers a voice |
| | | Data should improve how they teach | | | Lack of collaboration | Culturally-Relevant Data Importance |
| | | Why is my performance being determined by data? You're messing with me and my money. | | | | |
| | Hear? What are they hearing from people closest to them? What are they hearing second-hand? | Think and feel? What are their needs, hopes, and dreams? What are their fears, frustrations, and anxieties? | Say and do? What have we heard them say? What can we imagine saying? What do they do today? What can we imagine them doing? What behavior have we observed? | See? What do they see in their immediate environment? What do they see others doing? What are they watching and reading? | PAINS | GAINS |
| Students (K-12/Undergraduate/Graduate) from Underrepresented Groups | Nothing is private. | I need to be perfect, like the imagery I see online. | I don't have any control over my data. | Trusted adults sharing their information without student consent | blocking access to my data gets in the way of living my life | data is community |
| | More data being shared makes them 'better of' | Data is my identity | All my friends are on social media, so I need to be. | Data examples are optimistic | my data could "out" me | shared data can enact change |
| | "Give up your data to get this reward!" | Even in the presence of data, adults ignore the data depending on their biases | Share data indiscreetly | | helpful/informative data is ignored | helps me protect my interests now and in the future |
| | | | | | Data perpetuity | data trusts can reinforce student led efforts for social good |
| | | | | | my data is used to penalize me (e.g. cheerleader scotus case) | Data is reflective |
| | | | | data lasts forever and is only partially representative of who I am and what I can do | Data can be used as a support tool | |



NSF-Funded Convergence Accelerator Workshop

**Reimagining Advanced Research
for Human Good through Industry
and Educational Partnerships**

NSF Award Number OIA-2119846
May-June 2021
Hosted by IBM
Developed and Facilitated by The PEER Group
<https://bit.ly/RISECAWorkshops>

