Reimagining Advanced Research for Human Good through Industry and Educational Partnerships

Advanced research in artificial intelligence, quantum computing, cloud computing and other science and technology related areas have 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. We seek to create a consortium of public education programs, minority serving institutions (MSIs), community 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, we have an opportunity to reimagine the future of science and the potential for its impact 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. We 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.

As part of the National Science Foundation's (NSF's) Convergence Accelerator (CA) program, IBM is planning to host a series of workshops titled "Reimagining Innovation in STEM Education" (RISE). The workshops will bring together practitioners 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, along with current college students to focus on a convergence approach in discussing and addressing four areas:

- Support for advancement of underrepresented groups in STEM
- Social and human good research foundations
- AI and technology supported education
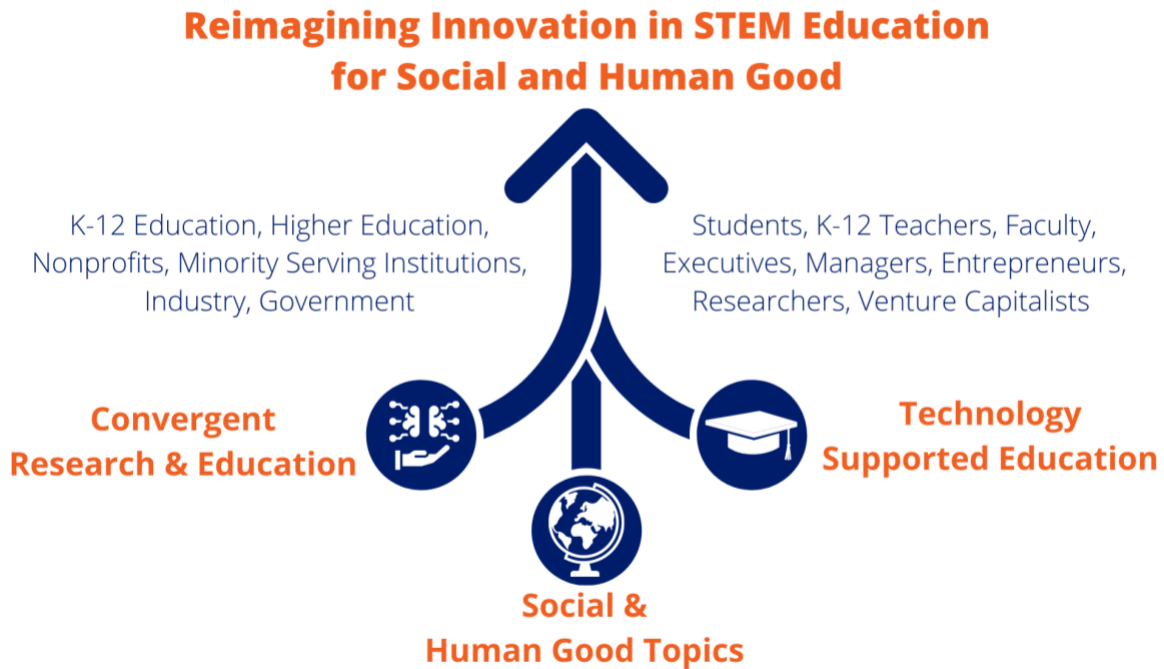- Data trust development

The workshops are designed to explore each topic and identify the actions needed to inform the next decade of STEM education and research. Here, we summarize initial ideas on outcomes, which we expect workshop participants to expand and potentially transform with the aim of generating innovative ideas for topics the NSF can consider for upcoming CA 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 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 and technology will meet and exceed the public's requirements for science and technology.

Convergence Idea: Building an Ecosystem for Science and Technology Research to Address Human Good Topics through Education

As the Office of Science and Technology Policy begins to explore how "the fruits of science and technology are fully shared across America and among all Americans"[i] 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.

We envision three focus areas within an ecosystem model to move rapidly toward a future of science 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. We focus on human good topics as the motivation for STEM endeavors. With this, we prioritize issues that spark passion in learners and emphasize social justice impact. Our ability to implement solutions is delivered through scientific and technology-supported education.

Reimagining Innovation in STEM Education for Social and Human Good

K-12 Education, Higher Education, Nonprofits, Minority Serving Institutions, Industry, Government

Students, K-12 Teachers, Faculty, Executives, Managers, Entrepreneurs, Researchers, Venture Capitalists

Convergent Research & Education

Technology Supported Education

Social & Human Good Topics

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

The constituents of our ecosystem share leadership and implementation of an inclusive, human-focused, science and tech future. This leadership must be representative in a disciplinary way including scientists, technologists, social scientists, humanists, activists and students. These contributors will come from industry, higher education – including MSIs – nonprofits and government entities. We value these

collaborations and expect that they will offer unique perspectives to the work at hand. An inclusive future for technology requires that those who have often had less access to leadership and influence in the technology and policy space have equal footing with recognized leaders in this space. We value both experiential expertise and research expertise as both are required to solve these difficult human facing problems.

Workshop Leadership and Partner Organization

The workshop Principal Investigators are Dr. Lauren Thomas Quigley and Dr. Stacy Hobson. Dr. Hobson is the Director of Responsible and Inclusive Technology at IBM Research and Dr. Quigley is a Data Science and AI Educator at IBM Cloud and Cognitive Software. 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 have 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 IBM PIs are fortunate to partner with an organization with deep knowledge, expertise and experience in STEM education research, evaluation and practice in higher education and non-profit contexts. Dr. Michael D. Smith serves as the project director; Dr. Yvette E. Pearson is the co-project director and subject matter expert. The PEER group's expertise in these areas and goal to "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.

Workshop Details and Engagement Process

RISE will be organized into four small workshops to support meaningful virtual engagement for participants primarily located in the US. The dates are:

- Tuesday, May 25
- Thursday, May 27
- Thursday, June 3
- Tuesday, June 8

Each day will focus on one of the four workshop topics, with connections and framing for the full convergence approach throughout. Workshops are estimated to take place between 1:00 and 5:00 p.m. Eastern Time on a virtual meeting platform. A small advisory board will be engaged to provide insight to the project team, meeting in advance of the workshop. A pre-invitation engagement will be distributed to identified stakeholders to identify RISE participants whose expertise and organizations can substantially contribute to the workshop activities and future related work.

Please direct all inquiries about the workshop to Dr. Michael Smith at The PEER Group.

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[i] A Letter to Dr. Eric S. Lander, the President's Science Advisor and nominee as Director of the Office of Science and Technology Policy, January 20, 2021. Available on whitehouse.gov.