

STEM Education of the Future

A Visioning Report

Directorate for Education
and Human Resources

Robin Wright
(rowright@nsf.gov)

Alexandra Medina-Borja
(amedinab@nsf.gov)

National Science Foundation
WHERE DISCOVERIES BEGIN



NSF



2020
SPRING

A SUBCOMMITTEE OF THE ADVISORY COMMITTEE
OF THE EDUCATION & HUMAN RESOURCES DIRECTORATE

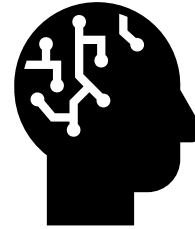
STEM Education in a rapidly changing scientific, social, virtual and physical landscapes



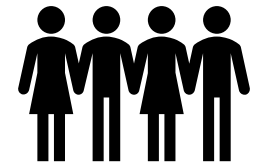
Nature of
STEM



Nature of
Work



Workforce
Skills



National
Demographics



EHR Advisory Committee: Subcommittee on STEM Education of the Future

Dr. Margaret Honey (Chair)

President & CEO
New York Hall of Science

Dr. Okhee Lee

Professor of Childhood Education, Department of Teaching
and Learning
New York University-Steinhardt

Dr. Bruce Alberts

Chancellor's Leadership Chair in Biochemistry and Biophysics
for Science and Education
University of California, San Francisco

Dr. Francisco Rodriguez (Ex-Officio Member)

Chancellor
Los Angeles Community College District

Dr. Hyman Bass

Samuel Eilenberg Distinguished University Professor,
Mathematics; Professor, School of Education
University of Michigan

Dr. Marilyn M. Strutchens

Emily R. & Gerald S. Leischuck Endowed Professor; Mildred
Cheshire Fraley Distinguished Professor, Department of
Curriculum and Teaching
Auburn University

Dr. Carlos Castillo-Chavez

Emeritus and Founding Director of the Simon A. Levin
Mathematical and Computational Modeling Sciences Center
Arizona State University

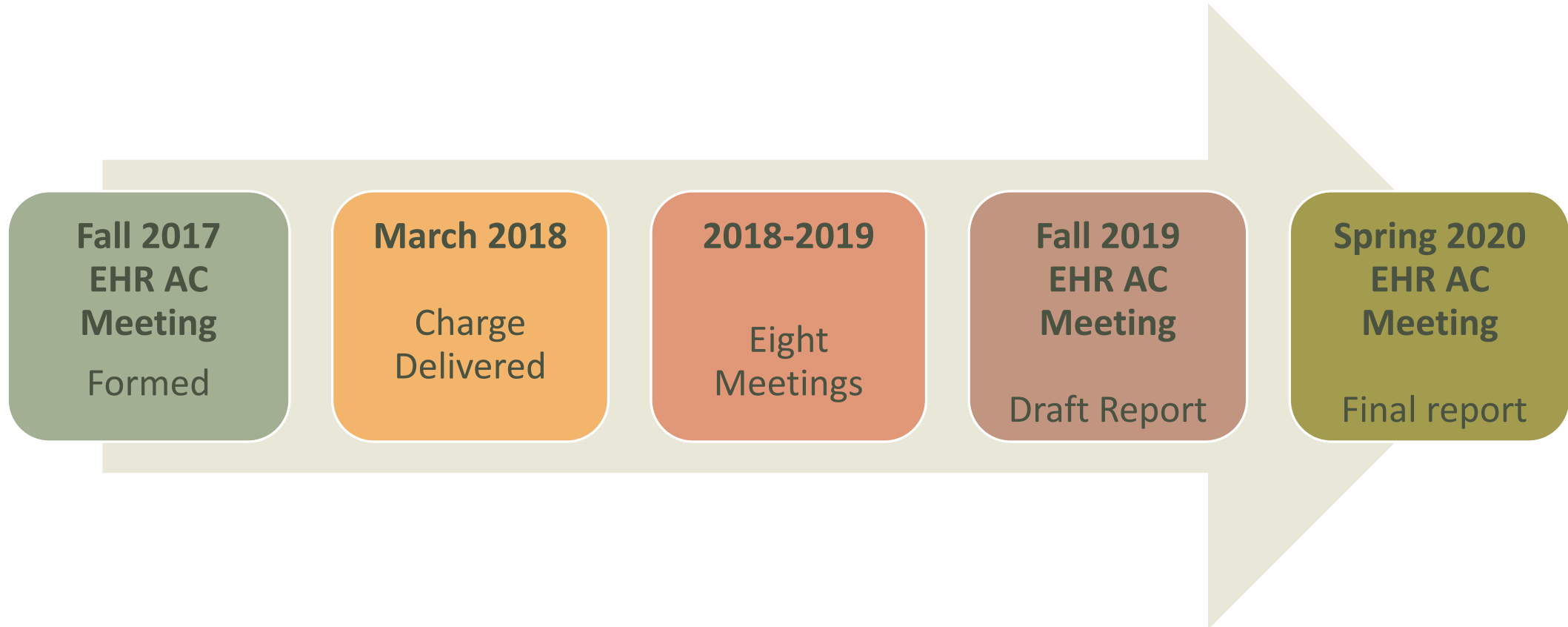
Dr. Laurel Vermillion

President
Sitting Bull College



EHR Liaisons: Alexandra Medina-Borja (Executive Secretary); Robin Wright (DUE)

Subcommittee Timeline



Contributors and Thought Partners

Dr. Jim Spohrer

Director of Cognitive OpenTech at IBM
The future of technology and impact on Education (April 25, 2018)

EHR/NSF Program Officers

INCLUDES, CYBERLEARNING, ATE, IGE, FW-HTF, IUSE, CS-FOR-ALL (May 31, 2018)

Dr. Christine Ortiz

Graduate Dean at MIT; Founder of Station 1
The Future of the Research University: Promise and Peril (May 31, 2018)

STEM Education Innovators (September 10-11, 2019)

- Dr. Larry Rosenstock – Emeritus & Founding CEO, High-Tech High
- Dr. Mark Somerville – Dean of Faculty, Olin College
- Dr. Josh Fost - Vice Provost of Academic Innovation, Minerva Schools
- Dr. Arthur Heinrichler – Dean of Undergraduate Studies, Worcester Polytechnic Institute
- Dr. Ann Mckenna - Vice Dean of Strategic Advancement, Arizona State University

Panel: Designing Higher Education Systems Founded on Access and Equity (October 16, 2019)

- Dr. Maria Klawe – President, Harvey Mudd College
- Dr. Claude M. Steele – Professor, Stanford University
- Mr. Antonio Perez, Engineering Student, Olin College
(see <https://www.youtube.com/watch?v=ywAliVKkhbs>)



Vision for STEM Education of the Future



https://www.nsf.gov/news/mmg/media/images/PF7224_flate_h.jpга

Priority 1: Provide pathways into STEM careers for learners at all stages of their education.

Challenge	Actions
Uneven access to high quality STEM education	Create opportunities for all students to receive high-quality STEM education
Persistent, complex dynamics of bias in STEM	More research to determine interventions that promote access, equity, and inclusion
Changing pathways into STEM jobs	Students acquire core 21st century competencies (adaptability, flexibility, collaboration, learning, etc.)
STEM education needed across the lifespan	Educators need to understand how people learn from Pre-K through adulthood
Lack of diversity of thought and human capital in U.S. STEM graduate programs	Graduate education should enable students to acquire core 21st century research; increased entry of domestic students into research careers



Priority 2: Build an Ethical STEM workforce with future-proof skills.

Challenge

Advances in 21st century technologies present ethical issues and require new creative thinking.

Actions

STEM education must prepare our workforce to innovate and work with modern technologies, and also to consider their societal effects.



Priority 3a: Enhance the use of technological innovations in both in-person and virtual learning spaces.

Priority 3b: Prepare educators to provide rich learning experiences for all students.

Challenge

Understand how virtual distance learning environments affect cognition and learning.

Actions

Research is needed to build a deeper understanding of the possibilities of virtual and hybrid distance learning environments, from how they affect the development of skills and abilities, to the pedagogies and curriculum that work best.



STEM Education Research Agenda

Diversity, equity, inclusion

Online/virtual learning

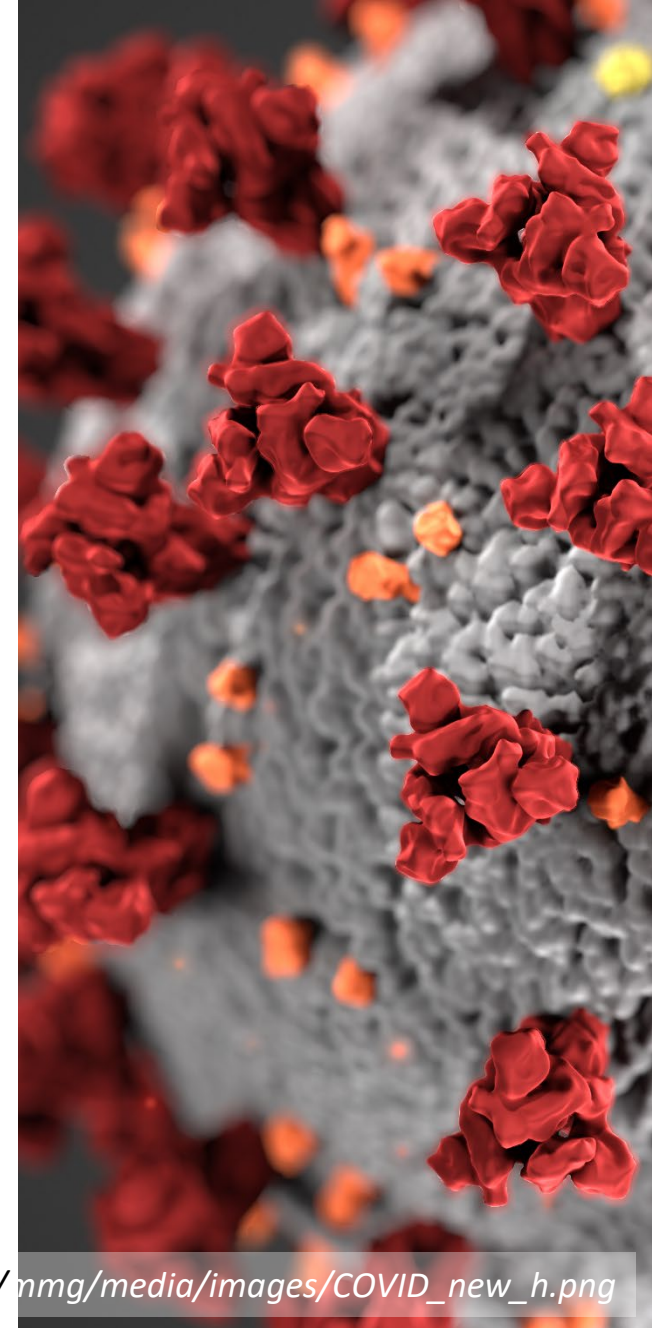
Lifelong learning

Professional development for faculty
and teachers



https://www.nsf.gov/news/mmg/media/images/COVID_new_h.png

Subcommittee on STEM Education of the Future



A Vision for STEM Education of the Future

Equitable and Inclusive

Powered by evidence-based instruction and technology

Across all life stages and key transitions

Personalized, project-based, and learner-centered

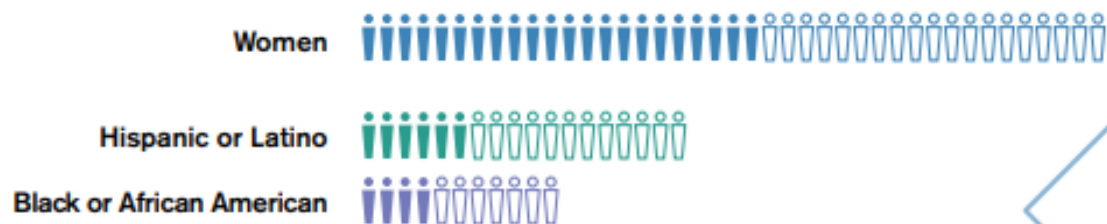
21st century skills oriented





FIGURE 2: MISSING MILLIONS: FASTER PROGRESS IN INCREASING DIVERSITY NEEDED TO REDUCE SIGNIFICANT TALENT GAP

While the number of people from under-represented groups in the S&E workforce has grown over the past decade, much faster increases will be needed for the S&E workforce to be representative of the U.S. population in 2030. To achieve that goal, the NSB estimates that the number of women must nearly double, Black or African Americans must more than double, and Hispanic or Latinos must triple the number that are in the 2020 U.S. S&E workforce. These estimates are based on projections from the U.S. Census and Bureau of Labor Statistics, together with data from the National Center for Science and Engineering Statistics, and assume that participation of these groups in the S&E workforce increases at current rates.

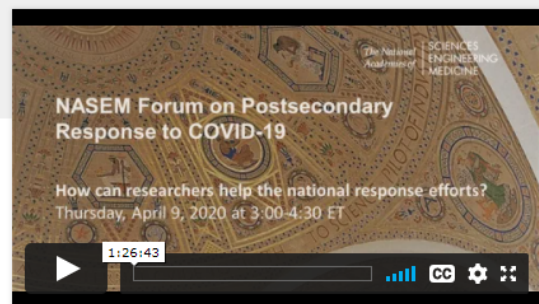


Legend

- x 100,000 people in 2020 S&E workforce
- x 100,000 additional people needed in 2030 for the S&E workforce to be representative of the U.S. population

NASEM Forum on Postsecondary Response to COVID-19

Share



How can researchers help the ...

The National Academies

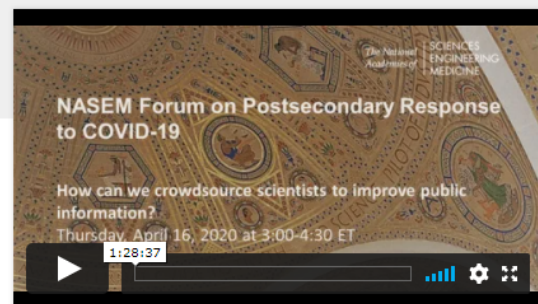
Part of the NASEM Forum on Postsecondary Response to COVID-19 series Thursday, April 9, 2020 at 3:00-4:30 ET



How can and are laboratories ...

The National Academies

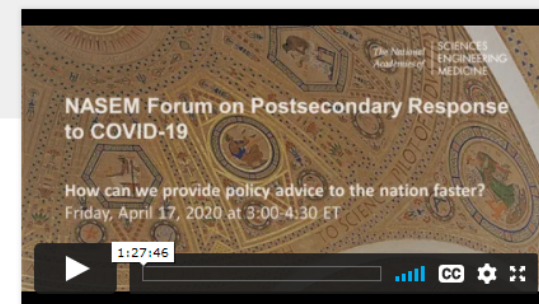
Part of the NASEM Forum on Postsecondary Response to COVID-19 series. Wednesday, April 15, 2020 at 3:00-4:30 ET



How can we crowd-source sci...

The National Academies

Part of the NASEM Forum on Postsecondary Response to COVID-19 series. Wednesday, April 16, 2020 at 3:00-4:30 ET



How can we provide policy ad...

The National Academies

Part of the NASEM Forum on Postsecondary Response to COVID-19 series Friday, April 17, 2020 at 3:00-4:30 ET



Imagining the Future of Undergraduate STEM Education Symposium

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Help Shape the Vision and Priorities for STEM Education in the Future

REGISTER 

DATE(S)
Nov 12 - 19, 2020
11:00AM - 5:30PM ET

PROJECT
Imagining the Future of Undergraduate STEM

What should our ambitions be for 2040?

What should we do to achieve them?



“...we must consider the entire education ecosystem so that children of all backgrounds, race, ethnicity, gender, religion and income levels can learn the wonders and possibilities of STEM and maintain that interest and passion throughout their lives.”



