The National Academies of
SCIENCES · ENGINEERING · MEDICINE

BOARD ON SCIENCE EDUCATION

Call to Action for Science Education: Building Opportunity for the Future

Report Launch Webinar
July 13, 2021

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W.M. Keck Foundation Fund

Charge to the Committee

Call to action to advance science education programs and instruction in K-12 and post-secondary institutions in ways that will prepare students to face the global challenges of the future both as engaged participants in society and as future STEM professionals.

- Provide an argument for the **importance of science education** across K-16
- Identify the major **challenges** for implementing coherent science education K-16
- Discuss how science relates to the other **STEM** disciplines in K-16
- Describe the **approaches** to science education programs and instructional practices that have shown to be most effective
- Provide **recommendations for policy makers** at the state and federal level
- Identify areas where more information is needed about how best to advance science education K-16

Committee Membership

Margaret A. Honey *(Chair)*, New York Hall of Science
Rush D. Holt, American Association for the Advancement of Science (retired)
Nancy Hopkins-Evans, Instruction Partners
Tiffany Neill, Oklahoma State Department of Education
Stephen L. Pruitt, Southern Regional Education Board
Francisco Rodriguez, Los Angeles Community College District
Susan R. Singer, Rollins College
Felicia C. Smith, National Geographic Society
William F. Tate IV, University of South Carolina
Claudio Vargas, Sci-Lingual Education

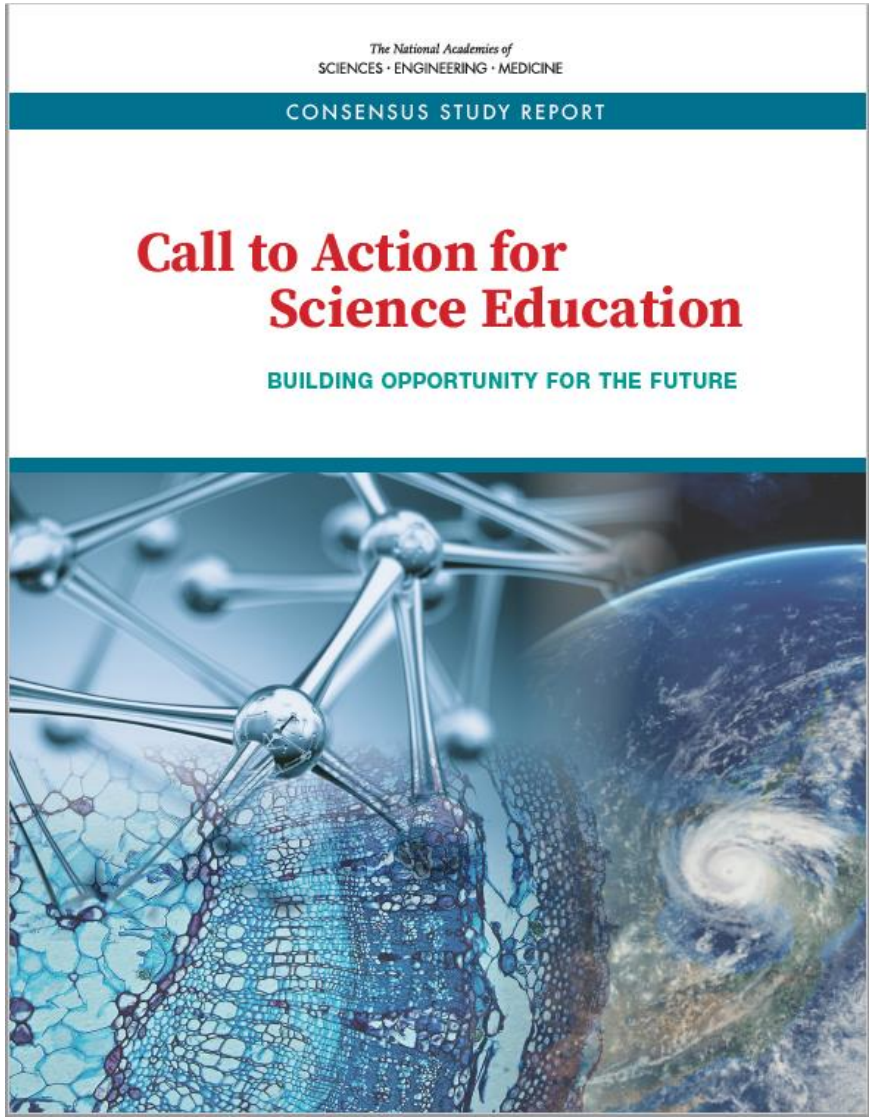
Committee Process

Public Sessions (virtual)

- Creating Quality Science Learning Experiences for Post-Secondary Students
- Policies Related to Transitions into and within Higher Education
- Developing Professional Expertise for High Quality Science Learning Experiences in K-12
- Policies to Improve Science Learning in Grades K-12

Public Input

- NASEM (just over 700 submissions)
- NSTA (over 1,000 submissions)



Scientific thinking and understanding are essential for all people navigating the world, not just for scientists and other science, technology, engineering, and mathematics (STEM) professionals.

Report Overview

Why Better, More Equitable Science Education Should Be a National Priority

A Vision for Better, More Equitable Science Education

How Far Are We From This Vision for All Students?

How Do We Get There?

Recommendations

How Can We Learn From These Efforts?

What's New about the Call to Action?

- Looking at the full continuum K-16 –
  elementary, secondary, post-secondary

- Science education for participation in democracy and daily life (less emphasis on workforce)

- Strong emphasis on equity and opportunity

- Empowering local communities

Better, More Equitable Science
A National Priority

Science is

- an essential tool for solving the greatest problems and understanding the world around us.
- essential to a fully functioning democracy
- not just for scientists and STEM professionals; scientific habits of mind are essential for everyone
- crucial for the future and the pursuit of living wage jobs

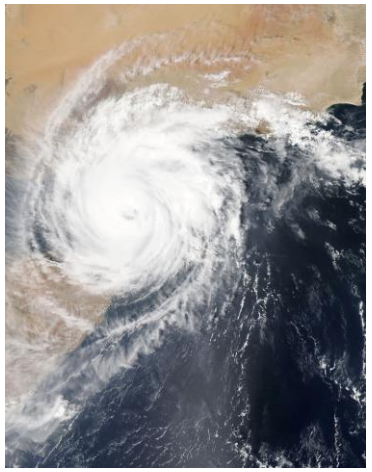
Vision for the Future

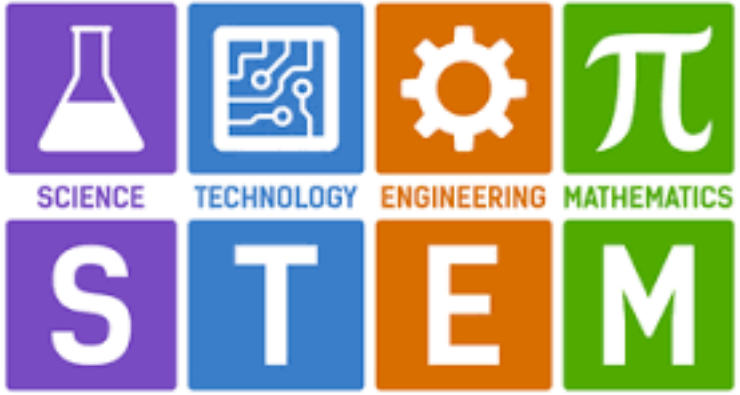
High-quality science teaching and learning

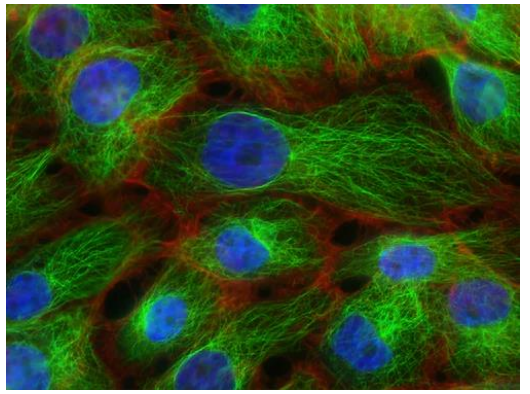
A strong, diverse science teaching workforce

Supportive pathways through science

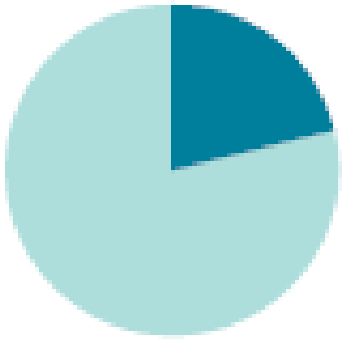
Science and STEM



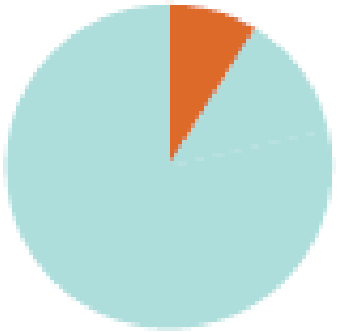




Equity



27%
people of color in
the U.S. population



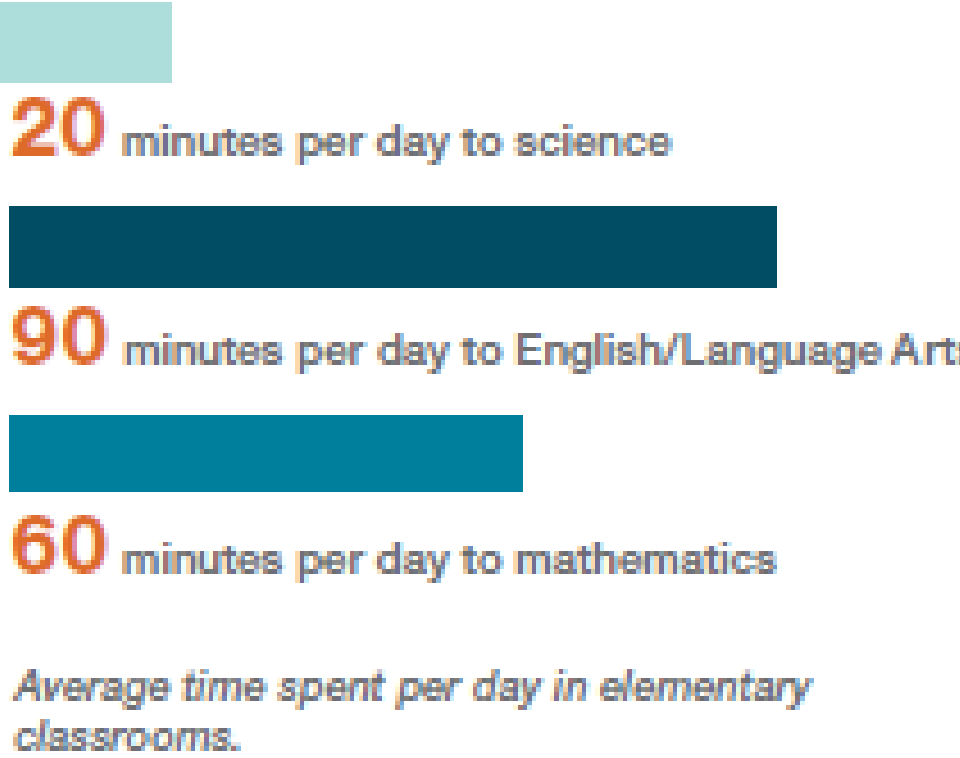
11%
people of color
in STEM professions

Systemic inequities make it harder for some students to have the opportunity to continue in science.

Equity

- Students in high poverty elementary and middle schools, are less likely than students in more affluent schools to do “hands-on” work every week.

- Science classrooms with the highest percentages of students of color and schools with the highest percentages of students living in poverty are more likely to be taught by inexperienced teachers and, in secondary schools are less likely to be taught by a teacher with a relevant degree or advanced courses in the subject taught



Average time spent per day in elementary classrooms.

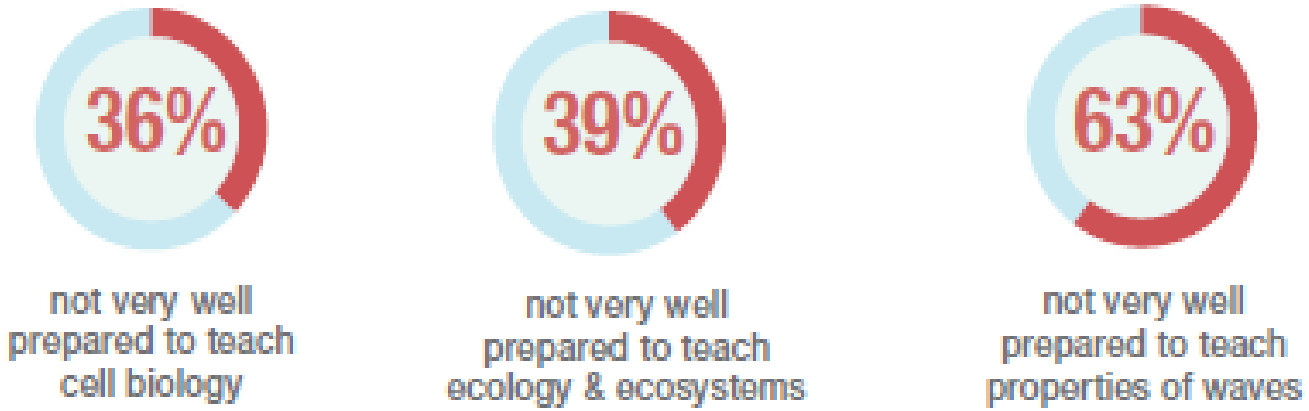
Elementary teachers frequently have to modify their investigations because they lack the prerequisite materials and supplies.

Elementary students spend an average of less than 20 minutes per day on science.

How far are we from the vision?

Need for high quality instruction

- Lecturing is still prominent in undergraduate STEM courses.
- One study reported it was used on average 75% of the time.
- Students spent an average of 87% of their class time listening to instructors.



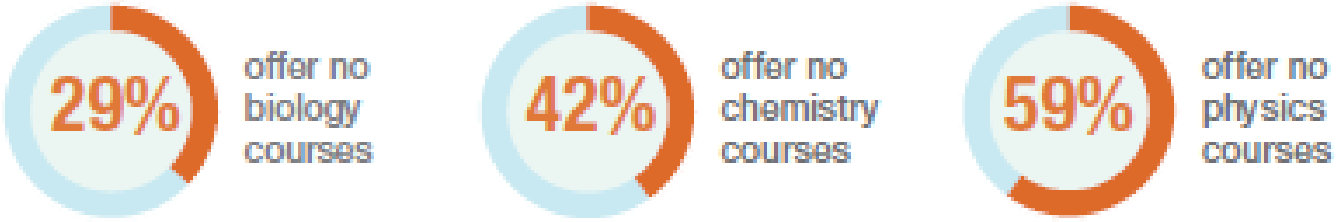
K-12 Teachers' perceptions of their preparation to teach key science topics

How far are we from the vision?

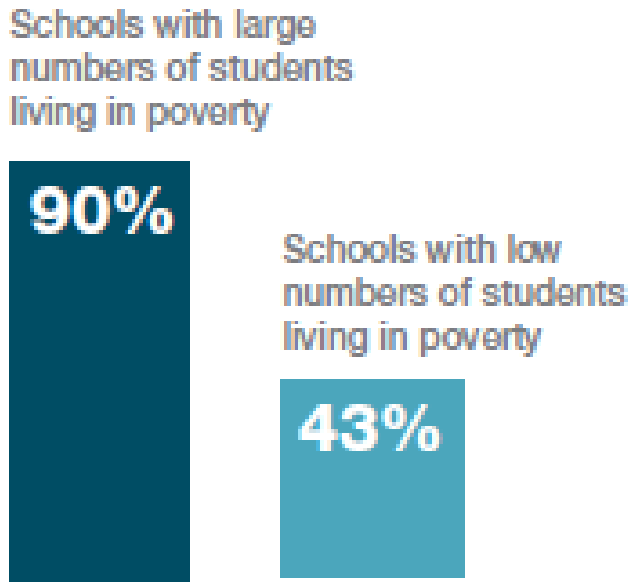
Need for access

- Weed out culture persists. It is expected that many students will fail introductory science courses.

- Only 43% of Latino/a students and 34% of Black students persist to earn a STEM undergraduate degree compared to 58% of White students



Science course offerings in schools where at least 80% of students are Black, Latino/a, or Indigenous.



High schools not offering a physics course

Priorities for Local and Regional Science Education

1) Provide time, materials and resources for science instruction,
2) Develop a strong, diverse science teaching workforce,
3) Design supportive pathways for students in science,
4) Employ well-designed assessments and accountability systems for science, and
5) Use evidence to document progress and inform on-going improvement efforts.

Action Areas for State and National Policymakers

1: Elevate the Status of Science Education

2: Establish Local and Regional Alliances for STEM Opportunity

3: Document Progress Toward Better, More Equitable Science Education

Action Area 1: Elevate the Status of Science Education

Recommendation 1: The White House, with leadership from the Office of Science Technology Policy (OSTP), should act to raise the profile of science education and elevate the importance of access to high quality science learning opportunities for all students across K-16. Specifically, OSTP should encourage national stakeholders, including federal agencies, along with those in the education, business, non-profit, scientific, and philanthropic sectors, to focus resources and leverage their assets to increase the quality of and accessibility to K-16 science education.

Action Area 1: Elevate the Status of Science Education

Recommendation 2: Congress should include science as an indicator of academic achievement when it next reauthorizes the Elementary and Secondary Education Act. Accountability for science should focus on students gaining conceptual understanding of science and should not be based on single tests. It should involve a system of assessments and indicators that together provide results that complement each other and provide information about the progress of schools, districts and states.

Action Area 1: Elevate the Status of Science Education

Recommendation 3: State Departments of Education should act now to include science in their accountability systems for K-12 education. A state accountability system for science needs to include assessments that support classroom instruction, assessments that monitor science learning more broadly (at the school, district and state levels), and indicators that track the availability of high-quality science learning opportunities.

Action Area 1: Elevate the Status of Science Education

Recommendation 4: National stakeholders in STEM education should undertake coordinated advocacy to improve science education K-16 with particular attention to addressing disparities in opportunity. These stakeholders (including professional organizations, advocacy groups, scientists, and business and industry) will need to balance advocacy for STEM broadly with attention to the importance of high-quality learning experiences in science as well as in each of the other STEM disciplines.

Action Area 2:
Establish Local and Regional Alliances for STEM Opportunity

Recommendation 5: Leaders of local and regional K-12 systems and post-secondary institutions should work together to form Alliances for STEM Opportunity that involve key stakeholders in STEM education, such as informal education organizations, nonprofits, afterschool and summer programs, business and industry, and the philanthropic sector. Each alliance should develop an evidence-based vision and plan for improving STEM education that includes specific attention to high quality science learning opportunities and addresses disparities in opportunity. Plans should include, at minimum, strategies for:

1) providing access to high quality science learning experiences across K-16 and addressing existing disparities in access;

2) providing high quality instructional materials and other resources to support these experiences;

3) building a high quality, diverse workforce for teaching science to include provisions for professional development and ongoing support;

4) creating pathways for learners in science across grades 6 through 16 with supports for learners who want to pursue STEM careers.

Action Area 2:
Establish Local and Regional Alliances for STEM Opportunity

Recommendation 6: The federal government, philanthropic organizations, and business and industry should provide funding to support the work of local and regional Alliances for STEM Opportunity. Funding should be targeted first to communities where a significant number of students live in poverty. Funds should support coordination and management of the alliances, programmatic efforts, and research and evaluation.

Action Area 3: Document Progress Toward Better, More Equitable Science Education

Recommendation 7: States should develop and implement data driven state-level plans for providing equitable K-16 STEM education with specific attention to science. These plans should include "STEM Opportunity Maps" that document and track where opportunities are available, where there are disparities in opportunity, and how much progress is being made toward eliminating disparities and achieving the goals of the state STEM education plan. The STEM Opportunity Maps should incorporate documentation from local and regional STEM Opportunity Alliances.

Action Area 3: Document Progress Toward Better, More Equitable Science Education

Recommendation 8: The federal government should develop an annual "STEM Opportunity in the States" report card that documents the status of K-16 STEM education across each of the states and territories and tracks equity of opportunity for students in science and the other STEM disciplines.

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