

Using Indicator Data to Drive K–12 STEM Improvements in States and Districts: Implications and Recommendations for Leaders and Policymakers

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Drawing on his experience as a STEM education leader for Chicago Public Schools and the U.S. Department of Education, Michael Lach explores how district and state education leaders might use data from an indicator system to improve K-12 STEM education performance overall and to reduce inequities in the opportunities available to different student subgroups and communities. Lach argues that new metrics, coupled with appropriate support, can improve education.

Indicators and measures have long served a critical role in the U.S. education system. For district and state education leaders, monitoring data describe current initiatives and support informed decision-making.

In *Monitoring Progress Toward Successful K-12 STEM Education*, the National Research Council (NRC) argues for new and

enhanced indicators in science, technology, engineering, and mathematics (STEM) education (see table below). This set of STEM-specific indicators would expand education monitoring beyond the mathematics and English language arts performance concerns of No Child Left Behind to address issues associated with STEM education and its improvement.

Access to Quality STEM Learning	1. Number of and enrollment in different types of STEM schools and programs in each district	Policy and Funding Initiatives	9. Inclusion of science in federal and state accountability systems	
	2. Time allocated to teach science in grades K-5		10. Inclusion of science in major federal K-12 education initiatives	
	3. Science-related learning opportunities in elementary schools		11. State and district staff dedicated to supporting science instruction	
	4. Adoption of instructional materials in grades K-12 that embody rigorous, research-based standards		12. States' use of assessments that measure the core concepts and practices of science and mathematics disciplines	
	5. Classroom coverage of content and practices in rigorous, research-based standards		13. State and federal expenditures dedicated to improving the K-12 STEM teaching workforce	
Educators' Capacity	6. Teachers' science and mathematics content knowledge for teaching		Policy and Funding Initiatives	14. Federal funding for the research that disentangles the effects of school practice from student selection, recognizes the importance of contextual variables, and allows for longitudinal assessments of student outcomes
	7. Teachers' participation in STEM-specific professional development activities			
	8. Instructional leaders' participation in professional development on creating conditions that support STEM learning			

Source: *Monitoring Progress Toward Successful K-12 STM Education: A Nation Advancing?* National Research Council, 2013.

Note: Indicator statements 1, 4, 5, 10, and 14 have been edited slightly to enhance clarity when presented outside the context of the full *Monitoring Progress* report.

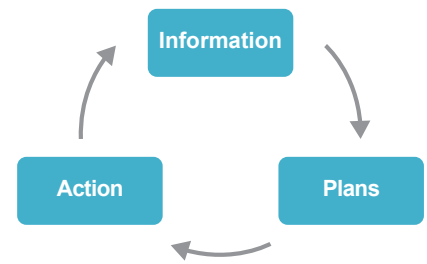
Several of the NRC-proposed STEM education indicators can be used by district and school leaders to drive improvement. Specifically,

- **STEM Instructional Materials (Indicator 4).** District strategies that focus on the adoption and implementation of robust instructional materials have been shown to lead to sizable student learning gains. However, many STEM instructional materials are not aligned with rigorous, research-based standards, such as the Next Generation Science Standards, that require more than memorization of vocabulary and rote procedures. This indicator would signal the importance of adoption and alignment of high-quality STEM instructional materials and the importance of drawing on research to measure the quality of materials considered for adoption.
- **Leadership for Principals (Indicator 8).** School leaders have a significant impact on the learning that occurs in their schools. These leaders must have STEM-specific content knowledge if they are to help shape the school's climate and allocation of resources to promote high-quality STEM learning. Data for this indicator would provide an impetus to provide professional development that helps principals become effective STEM education leaders.
- **Time Allocated to Teach Science (Indicator 2).** It has been a challenge for schools and school systems to make science a focus of improvement efforts when accountability systems address language arts and mathematics almost exclusively. Nationally, little time is devoted to science education in elementary school, despite the facts that it is a national priority and interest in science needs to be developed early. Achievement in science, as in other subject areas, is a function of instructional time. Indicator data would enable districts and schools to know how much time teachers are spending on science and to make informed decisions about whether to adjust the balance of instructional time across subject areas.

These indicators would be a means to improvement, not the ends in themselves. America's challenges with STEM education are numerous, and they will not be solved overnight. However, the STEM education indicators point to a thoughtful path forward: robust indicators that focus on what matters, used by schools and districts that have the trust and mechanisms to learn from and iterate based on indicator data over time.

Implications for Policy and Practice

A set of regularly measured indicators in STEM education could assist district and school leaders in making decisions about education policies, helping redirect efforts to practices that are well supported by the



research literature. Common indicators could also facilitate cross-district sharing and learning partnerships.

Districts should adopt STEM curricula that are aligned with rigorous, research-based learning standards. Unfortunately, many curricula do not meet this criterion. Policymakers should invest in research and development of instructional materials that are well aligned with research-based learning standards.

States and districts should support principals in obtaining professional development on STEM education leadership. Content-specific professional development remains a low priority for many leadership development efforts, despite principals' significant role in students' learning. Policymakers should invest in professional development for principals on STEM education leadership.

Schools and districts should devote adequate instructional time to science education. Accurate measures of the time elementary school classrooms spend on science would enable research on what constitutes adequate time and would help school and district administrators make time allocation decisions.



This material is based upon work supported by the National Science Foundation under Contract No. NSF DACS12C1299. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation

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