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BUYER'S GUIDE
HOW TO FIND EVIDENCE-BASED STEM PROFESSIONAL DEVELOPMENT

While other countries have made dramatic improvements in science and math education over the last decade, the performance of U.S. students on international exams has remained relatively flat in these subjects. As Julia Phillips of the National Science Board notes: "*This is not something we can be comfortable about. Our economy depends on math and science literacy.*"

STEM professional development was already important for educators, but the pandemic has added even greater urgency. As teachers grapple with pandemic-related disruptions, including COVID learning loss, the social-emotional health of students and residual burnout, high-quality STEM professional development is critical.

This guide aims to help K-12 leaders find evidence-based professional learning opportunities focused on STEM education. It describes the key characteristics of high-quality STEM professional development, reveals questions to ask of providers and highlights examples of programs to consider.

FACTORS DRIVING THE NEED

Data from the National Science Foundation's *Science and Engineering Indicators report* show:

While U.S. 15-year-olds rank seventh out of 37 OECD countries in science, they rank 25th in math literacy

There was no measurable improvement in math scores for U.S. fourth and eighth graders from 2007 to 2019

Differences persist in the STEM achievement scores of U.S. students by socioeconomic status and race/ethnicity

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Additionally, the pandemic has unveiled opportunities to support teachers in the following areas:

Effectively leading remote/hybrid instruction: The American Federation of Teachers says educators need access to more professional development focused on remote teaching

Making up for STEM learning loss: Students from low-income households or those with disabilities may have lost up to a year of learning in math

Addressing students' social-emotional needs: As many as 40 percent of students have struggled with their mental or social-emotional health during the pandemic

ELEMENTS TO LOOK FOR

Decades of research confirms that a highly skilled teacher has a huge impact on student success — and evidence-based professional development can give teachers the content and pedagogical knowledge they need to improve STEM achievement.

Here are five important aspects to look for in a high-quality STEM professional development program.

DEEP CONTENT KNOWLEDGE

Teachers should have a thorough understanding of the concepts being taught, so they can transfer this understanding to their students. High-quality professional learning should give teachers a deeper knowledge of STEM concepts and how they apply within real-world scenarios.

PEDAGOGICAL INSTRUCTION

Beyond content knowledge, teachers must be skilled at imparting this knowledge to their students. High-quality STEM professional development should prepare teachers with strategies and techniques for delivering instruction in a variety of ways to reach a broad range of learners across multiple environments.

OPPORTUNITIES TO APPLY THE LEARNING IN CONTEXT

Teachers should have a chance to apply what they're learning in the context of the classes they're teaching. This brings the professional learning from theoretical to practical knowledge, while making it more relevant to teachers' immediate needs. Ideally, teachers should have opportunities to collaborate with colleagues in creating engaging lessons, so they have a built-in support network and can learn from others who are acquiring the same skills and experiencing the same training.

ONGOING FEEDBACK AND SUPPORT

Simply attending a workshop or training session isn't enough for the learning to "stick." To transform their practice, teachers need ongoing coaching, mentoring and support. They should also receive feedback on how well they're applying their new knowledge within their classes.

CLEAR EVIDENCE OF SUCCESS

The gold standard for STEM professional development is a program that has been evaluated by independent researchers and found to have made a positive impact on teacher effectiveness and student success.

KEY QUESTIONS TO ASK

Who is providing the instruction? What experience and credentials do they have?

The instructors providing professional learning should be experienced K-12 educators with a deep understanding of STEM concepts and extensive knowledge of how to teach these concepts in engaging and effective ways.

Does the program use modern tools and pedagogies that have been proven effective?

Teachers should learn how to deliver STEM instruction using modern tools and methods that engage students in active, collaborative and hands-on learning, rather than rote learning, to foster a deeper understanding of STEM topics.

Was the program's evaluation effectively designed?

Measures of program efficacy should be rigorously designed and carried out according to best practices in scientific research.

Does the program prepare educators to teach in multiple environments?

The pandemic has demonstrated the need for educators to be highly skilled at teaching across multiple environments, such as in person, online, and in hybrid learning scenarios.

Does the program include opportunities for addressing students' social-emotional needs?

The pandemic has also shown how critical students' social-emotional health is to their achievement. When evaluating a professional learning program, consider whether it helps educators understand and respond to students' social-emotional needs as well.

STEM PROFESSIONAL DEVELOPMENT: PROGRAMS TO CONSIDER

To support the decision-making process, we compiled the following list of STEM-specific professional development and coaching opportunities.

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NMSI, a nonprofit organization that creates increased opportunities and better outcomes for all students, offers two evidence-based STEM professional development programs for K-12 educators: Laying the Foundation and the College Readiness Program.

Laying the Foundation empowers teachers in grades 3-12 to build and maintain subject matter expertise, enhance their leadership of diverse classrooms and propel students' confidence, creativity and problem-solving skills. Students whose teachers use Laying the Foundation materials and instruction score significantly better on ACT Aspire™ math and reading assessments than their peers.

The College Readiness Program empowers sustainable changes at the district, school and classroom levels to better prepare all students for college and beyond. To date, the College Readiness Program has reached more than 1,400 public high schools across 36 states and D.C. and produced positive student outcomes across a variety of settings. After one year of the program, partner schools see an average 41% increase in Advanced Placement® participation and an average 35% increase in college readiness for all students — with similar increases for female, Black and Latino students.

Both programs provide year-round and holistic support for school systems, teachers, students and communities. Both also specifically address the academic needs and disproportionate impact of COVID-19. In addition, embedded training to help teachers address students' social-emotional needs is available.

GLOBAL STEM ALLIANCE

A subsidiary of the New York Academy of Sciences, the Global STEM Alliance offers professional development for K-12 STEM educators. All of its training aligns with the STEM Education Framework, a research-based framework for STEM teaching and learning developed by the New York Academy of Sciences and SRI International. The Global STEM Alliance provides professional development workshops for educators and administrators to help them implement the framework within their schools and districts, and the organization also offers online and in-person training for individual educators.

STEMSCOPES

Developed by Accelerate Learning Inc. in partnership with Rice University, STEMscopes is a suite of results-oriented STEM curriculum and professional development solutions. In partnership with the National Institute for STEM Education, STEMscopes provides professional learning services focused on evidence-based instructional strategies for individuals, schools and districts. These services include assessing current needs and practices through data analysis and surveys and then creating a system-wide professional development plan to address these needs.

REINFORCE STEM EDUCATION THROUGH RELEVANT PROFESSIONAL DEVELOPMENT

There has always been a need for STEM professional development, but the pandemic has brought this need into sharper focus. Since the start of the pandemic, educators have had to assume a variety of new responsibilities — from trying to teach in new modalities to addressing widening learning gaps, all while navigating students' growing social-emotional needs.

Even when the pandemic is over, remote or hybrid learning is likely to continue in some form or another. Evidence-based professional development can introduce teachers to more efficient tools and make technology a welcome enhancement to instruction instead of another hurdle to overcome. Ongoing professional learning can also help teachers attend to students' emotional needs more effectively.

Because professional development plays a critical role in curtailing STEM learning loss and helping educators overcome pandemic-related challenges, it qualifies for funding under the American Rescue Plan Act and other pandemic relief aid. K-12 leaders have a unique opportunity to invest in sustained professional learning that can help teachers transform their practice and close STEM achievement gaps — and this guide can help schools identify the right resources to help.

Ready to take a closer look at your school or district's STEM PD needs? Contact us to begin a personalized evaluation with NMSI.

ABOUT NMSI

The National Math and Science Initiative works with communities and local school systems to increase access and achievement in rigorous education, particularly in STEM and especially for students most often underserved and underrepresented in STEM careers. Our evidence-based program swraps our school partners in continuous support to build inclusive mindsets and practices that ensure long-lasting success for educators, students and communities.

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