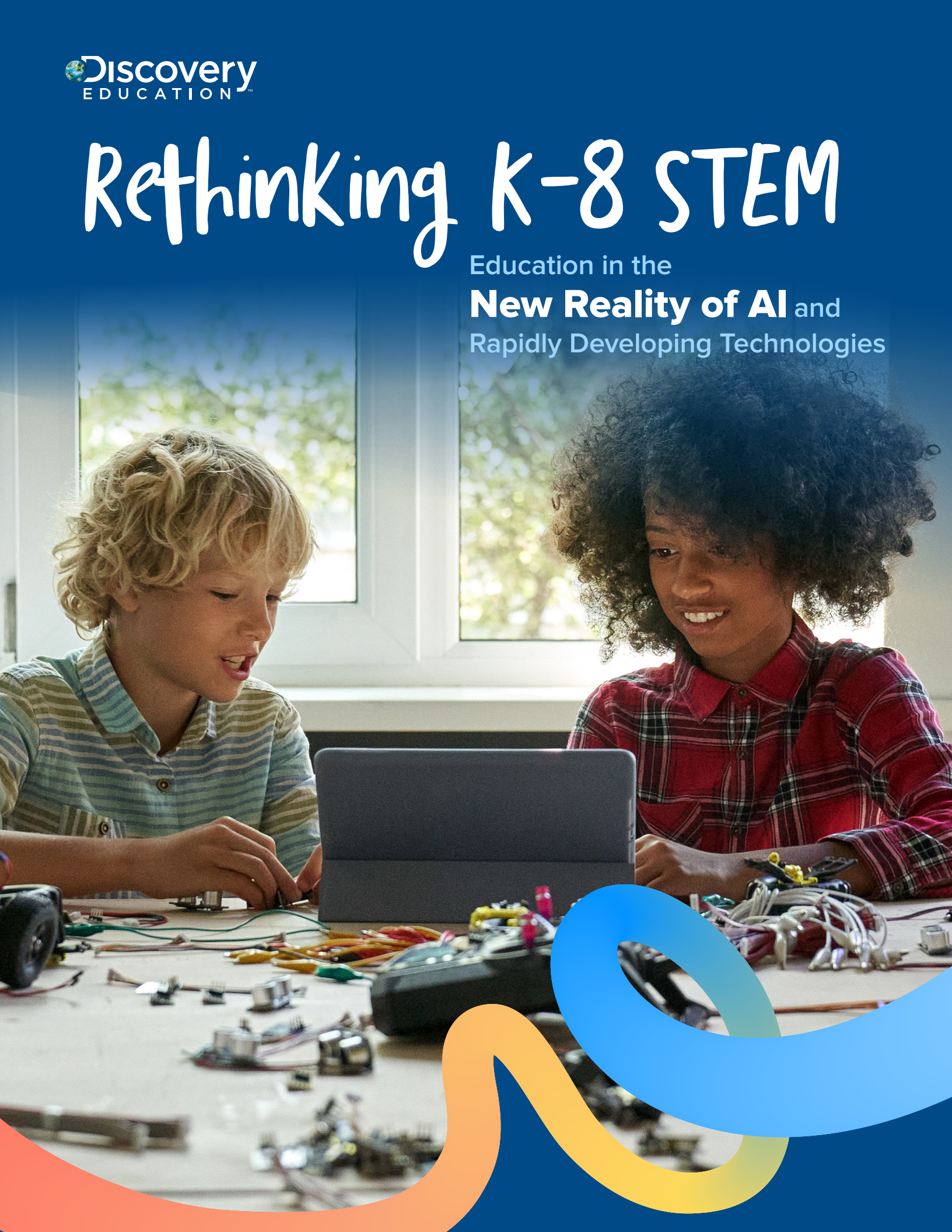
Discovery EDUCATION

Rethinking K-8 STEM

Education in the **New Reality of AI** and Rapidly Developing Technologies



We are experiencing rapid changes in society due to technological advances such as AI/machine learning and Big Data, cybersecurity and networked systems, and advanced automation, which bring new career possibilities and require a different set of skills that students need to compete for jobs (U.S. Department of Education, 2021; Fisher, 2025).

While we have recognized science, technology, engineering, and mathematics (STEM) education as critical to the country's success for over 20 years, the speed of the changes associated with maturing AI and associated implications for student learning and careers mean that **STEM education is more relevant than ever.** For example, a "strong foundation in STEM fosters curiosity, innovation, and confidence in tackling real-world challenges" and develops critical-thinking, problem-solving, and collaboration skills that translate to any profession (Fisher, 2025).

*"With AI automating so much, the human skills fostered by STEAM—**creativity, empathy, judgment**—will be the skills that matter most. STEAM will shift from being a nice-to-have to a must-have."*

Burroughs 2025

For schools, the STEM focus will differ according to student grade band:

Elementary	Middle School	High School
Establishing a foundation for critical thinking and curiosity	**Introducing and/or broadening career awareness and nurturing STEM interest**	**Connecting STEM learning directly to career readiness**

What may not be apparent from this list is that **STEM education in elementary and middle school is critical for shaping the interest, confidence, and skills** that support student success in a world where AI is ubiquitous. In this paper, we will examine STEM education's evolution into STEAM, the ways in which it positively affects student outcomes, how schools can implement STEAM learning in K–8, and current thinking on STEAM and careers. We will also provide **two sets of actionable strategies for schools:** starting STEAM education early and preparing students for high-growth fields.

What Is STEM/STEAM Education?

Defined in 2001, STEM is most likely familiar to anyone involved in K–12 education, but many educators and leaders are incorporating the arts too, resulting in a different acronym: STEAM (Burroughs, 2025). Providing a clue to the unique value that adding arts to STEM instruction offers, STEAM education may be defined as "an approach to teaching in which students demonstrate critical thinking and creative problem-solving at the intersection of science, technology, engineering, arts, and math" (Dell'Erba, 2019).

Education leaders believe that STEAM education gives students key skills that can transfer across high-wage, high-growth, and high-demand jobs (Burroughs, 2025):



Defining Problems



Generating Ideas



Transforming and Synthesizing

As an example of a STEAM versus STEM approach, a student project that involves building a robot would also consider the robot's design, ethical implications, and interface. If they have not already, educational leaders should support the development of STEAM initiatives that incorporate "standard from multiple disciplines, focusing on creative problem-solving and real-world applications" (Burroughs, 2025).

Early STEAM Learning's Importance

As young children enter formal schooling, educators can direct their natural curiosity and enthusiasm for learning into **engaging science and engineering experiences, building a foundation that leads to success in later learning** (National Academies of Sciences, Engineering, and Medicine, 2021). However, many elementary classrooms have only been able to offer limited opportunities for these experiences for different reasons:

- Research on high-quality STEM education has mostly focused on middle and high school
- Primary emphasis on ELA and mathematics instruction
- Minimal or no science and engineering experience for educators and leaders
- Limited related professional learning available
- Lack of time and resources (National Academies of Sciences, Engineering, and Medicine, 2021)

Inconsistent or absent science education in the early grades can lead to achievement gaps appearing as early as fourth grade, and those gaps may widen over time (WestEd, 2023). By the time students reach high school, a critical window for building STEM interest may have closed because students lack foundational skills, are unaware of career options, and/or do not see themselves represented in real-world jobs.

*"Children, even at very young ages, are **deeply curious** about the world around them and eager to investigate the many questions they have about their environment."*

(National Academies of Sciences, Engineering, and Medicine, 2021)



Why K–8 May Be a Critical Window

By starting STEAM instruction with younger learners, schools can **spark interest in STEM subjects and give students more time to develop these fundamental skills** needed for success in later grades and the workplace (Burroughs, 2025). Early STEM connections also support districts' renewed interest in career and technical education (CTE) (Burroughs, 2025) and make sense given expectations that the fastest-growing job opportunities in the near future will come in rapidly developing fields: AI, Big Data, networking, and cybersecurity (World Economic Forum, 2025).

In its *Future of Jobs Report 2025*, the World Economic Forum noted that employers are seeking employees with the following core skills, ranked in order of importance:

1. 

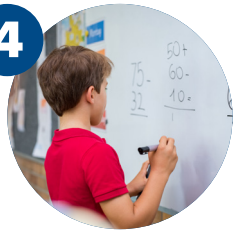
   Analytical thinking

2. 

   Resilience

3. 

   Flexibility

4. 

   Agility

How the Arts Amplify Early Learning

Adding the arts to STEM instruction in the early grades provides **cognitive and developmental benefits that strengthen science learning.** For example, drawing activities help young students observe more accurately: kindergarteners who drew animals noticed more details than those who only observed them (Fox & Lee, 2013). And when students create models and use multiple forms of representation, like drawing, writing, and digital simulations, they retain more scientific knowledge and develop deeper conceptual understanding (Samarapungavan et al., 2017; Palincsar et al., 2020).

STEAM education boosts early student engagement while building durable skills like creativity, communication, collaboration, and innovation, skills that will remain essential in an AI-driven world.

At the primary school level, STEAM education has been shown to increase student motivation and engagement in STEM topics (Yim et al., 2024). The arts also build transferable skills that will be especially in demand for the foreseeable future: creativity, communication, collaboration, and innovation. These are "durable skills" that AI and automation cannot replace (Weld, 2024).

Integrating Science and Literacy Instruction for Greater Success

Literacy skills like reading comprehension, evidence-based thinking, and effective communication make it possible for students to not only learn deeply in school but also thrive in a variety of professions. In fact, research over the past 20 years shows that when science and literacy are taught together, students make gains in both areas—dual instruction as a multiplier rather than a trade-off (Palincsar et al., 2020).

How can educators set aside time and resources for science when reading and math instruction are the primary emphases in the schedule? The key is to use **well-designed, standards-aligned curriculum materials that intentionally weave science and literacy together** rather than treating them as competing priorities. Real-world results show that integrating science and literacy in the pre-K through grade 2 years builds vocabulary, science content knowledge, and science practices while increasing motivation and engagement, even among students with low-income and English-learning backgrounds (Palincsar et al., 2020).

Reaching All Learners

Integrated science-literacy approaches have shown exciting promise for all students, even those from low-income families, who are learning English, or with disabilities. In studies of English learners, curricula that intentionally combine science investigation with language development have helped those students make significant achievement gains in both science and writing (Lee et al., 2008; Lee et al., 2009; Palincsar et al., 2020).



What Schools Can Do: Strategies for Starting STEAM Early

Based on the research, schools and districts can take practical steps to build strong STEAM foundations in elementary and middle school.



Dedicate instructional time for science. Even 45 minutes daily in grades 1–2 can yield meaningful results, particularly when science and literacy are integrated (Palincsar et al., 2020).



Adopt high-quality, standards-aligned curriculum materials that intentionally integrate science, literacy, and the arts. Look for programs aligned to the Next Generation Science Standards (NGSS) and designed to support simultaneous content learning and literacy development (WestEd, 2023; National Academies of Sciences, Engineering, and Medicine, 2021).



Invest in sustained, science-specific professional development. Ongoing professional development produces the largest improvements in both teacher practice and student outcomes (Palincsar et al., 2020; Paprzycki et al., 2017).



Support out-of-school contexts. Family engagement packs, museum partnerships, and after-school STEM programming can extend and reinforce classroom learning. Plus, home-school science collaboration increases parental involvement and student learning (Shymansky et al., 2000; Strickler-Eppard et al., 2019; Palincsar et al., 2020).



Connect learning to the broader STEM ecosystem. Even in the elementary grades, age-appropriate career exposure through classroom visits from a variety of STEM professionals, field trips, and community partnerships helps students begin to see themselves in STEM futures (Fisher, 2025; Weld, 2024).

Implications of New, High-Growth STEM Fields for Students Today

Recent Federal Strategic Plans have noted that STEM workers earn more than non-STEM workers regardless of whether their field is STEM or not (Committee on STEM Education of the National Science and Technology Council, 2018) and that the U.S. continues to see significant need for workers to fill STEM jobs (Committee on Science, Technology, Engineering, and Mathematics of the National Science and Technology Council, 2024).

Numbers that stand out

Between 2023 and 2033, **STEM occupations are projected to grow** by **10.4%**, significantly outpacing the 4% growth rate for all occupations (Watson, 2025).

The median annual wage for STEM workers in 2023 was **$101,650**, more than double the median for all occupations.

The fastest growth is expected in science and engineering occupations—projected to be **12%** (National Science Board, National Science Foundation. 2026).

Millions of STEM positions are projected to go unfilled due to a shortage of workers with the necessary skills.

These projections lend urgency to the **need for schools to focus on building key skills (problem-solving, collaboration, analysis, etc.)** as soon and as early as possible since it takes years of effort for students to reach the skill level that employers desire.

The qualifications landscape is shifting, however, with workers in STEM fields finding success without taking the traditional bachelor's and higher degrees route. They are earning credentials through nondegree training such as CTE and apprenticeships. The three main types of credentials STEM workers possess are educational certificates, professional certifications, and licenses, and 2024 data shows that 45% who had a credential did not have a bachelor's or advanced degree while 44% had both (National Science Board, National Science Foundation, 2026).

AI, Data Science, and Cybersecurity

As noted earlier, the *Future of Jobs Report 2025* identifies AI and Big Data as the fastest-growing skill areas globally, followed by cybersecurity and technology literacy (World Economic Forum, 2025). Nearly every industry and occupation is affected in some way. In the next 8–10 years, estimations show that 3.5 million cybersecurity positions will remain unfilled globally and data science roles will grow 36%.

While the National Security Commission on AI has urged prioritizing STEM education investment due to insufficient AI-knowledgeable workers to meet demand, schools do not necessarily need standalone AI courses to begin preparing students. (Crawford & Wu, 2024). General STEM foundations like basic statistics, computer science, and computational thinking can prepare students for exploration of AI as a discipline or career. Districts are already on the move: Nearly one-third of CTE educators surveyed nationally said they expect their district to introduce **CTE offerings in AI, cybersecurity, and digital technology** in the next few years (Langreo, 2025).

Why 'Durable Skills' Matter as Much as Technical Skills

The more automated and AI-driven the economy becomes, the more value distinctly human capabilities offer.

As technology continues to evolve at an accelerating pace, we are seeing a paradox: **the more automated and AI-driven the economy becomes, the more value distinctly human capabilities offer.** Employers increasingly seek workers who can think critically, collaborate across disciplines, communicate effectively, and adapt to changing circumstances. These "durable skills" are irreplaceable (Weld, 2024).

This is where STEAM education can play a life-changing role. By integrating the arts with STEM, schools can cultivate both the technical and human skill sets that are essential in today's work landscape. Students who can develop divergent thinking—a way of solving problems that generates innovative and creative ideas by exploring many possible solutions—alongside the analytical skills that are traditional strengths of STEM instruction have a competitive advantage (Dell'Erba, 2019).

Career-Connected Learning:

Building the Bridge from Classroom to Workforce

Students can and certainly do learn to apply what they are learning during STEAM instruction and projects to the real world outside of school. However, research has consistently shown that middle school students' **career knowledge is limited** and that many do not know the math and science requirements for STEM careers or the range of career options available (Blotnicky et al., 2018).

How can leaders and educators address this type of challenge at every grade level? Career-connected learning!

For elementary, consider inviting STEM professionals into the classroom or taking field trips to local industry partners.

For middle school, consider mentorship programs, project-based challenges based on real industry problems, and out-of-school STEM experiences that build skills and career awareness.

For high school, consider CTE pathways, internships, work-based learning, and industry certifications to create direct on-ramps to the workforce (Weld, 2024; Fisher, 2025).

STEAM careers span a wide range, including animation, architecture, product design, sound engineering, healthcare, and video game development (Dell'Erba, 2019). By introducing possible pathways, schools can engage students whose interests and talents might not fit a purely technical curriculum.

What Schools Can Do: Strategies for Preparing Students for High-Growth Fields

Leaders and educators can take concrete steps to ensure their students are ready for tomorrow's careers:



Build computational thinking across the curriculum. Integrate coding, data literacy, and algorithmic thinking into existing math, science, and STEAM instruction.



Introduce AI literacy early and build progressively. Follow frameworks like AI4K12's "5 Big Ideas of AI" to scaffold AI concepts across grade bands.



Expand CTE pathways in emerging fields. Provide career and technical education options in AI, data science, cybersecurity, and related fields starting in middle school.



Establish school-industry partnerships. Connect students with local STEM employers through mentorship programs, job shadowing, and classroom challenges based on real problems. Offer teacher externships that bring current industry knowledge back into the classroom.



Prioritize "durable skills" alongside technical skills. Ensure that creativity, collaboration, communication, and adaptability are explicitly taught using STEM content.



Use STEAM to broaden the workforce pipeline. Use arts integration and culturally responsive instruction to engage students who may not see themselves in traditional STEM pathways. Highlight the full range of STEAM careers to expand students' sense of what is possible.

A Call to Action for Schools and Districts

STEAM education is not merely a trend or an enrichment add-on. Rather, it is a foundational investment in students' success beyond school and a critical step in meeting existing and growing workforce needs in the U.S. When planning the direction their school or district will take, educational leaders should keep the following in mind:

STEAM education is valuable in multiple ways: When science, literacy, and the arts are taught together with intentionality and high-quality materials, students gain in every area, including reading, science content, vocabulary, motivation, and engagement. And integrated approaches are effective across student demographics.

Timing matters: The window for shaping students' STEM awareness, confidence, and foundational skills is narrower than it may seem. Starting STEAM education in elementary and middle school is the ideal time to start building critical foundational interest and skills.

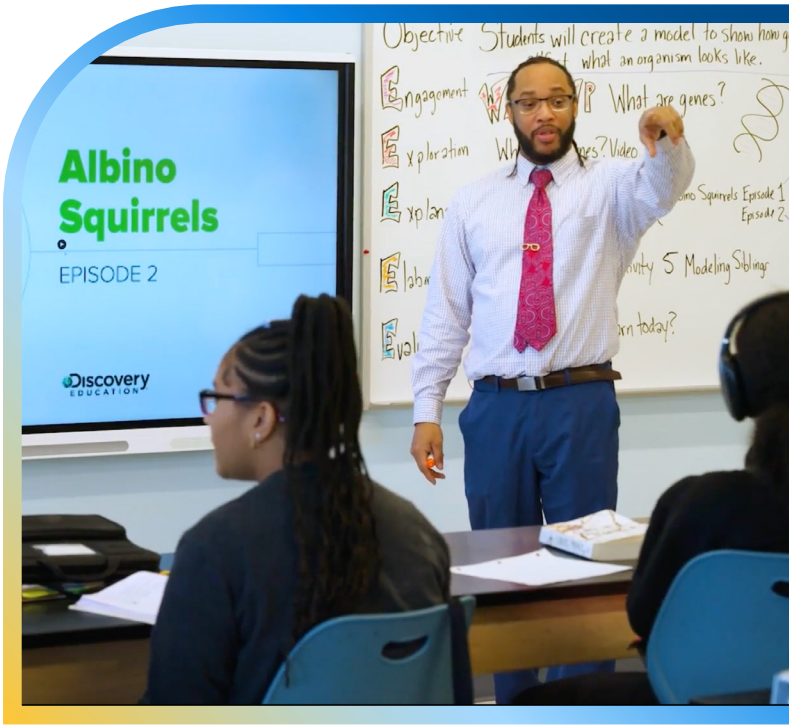
Meeting STEM workforce demands will not be easy: The fields expanding fastest—AI, data science, cybersecurity—require the combination of technical knowledge and human skills that STEAM education develops, but this takes years of study.



Besides ensuring that science and engineering are included in instructional time as early as possible, leaders must build teacher capacity with sustained, STEM-oriented professional learning. They must also support connections between the classroom and careers partnerships, career exposure, and CTE pathways that start before high school. And they must acquire or set aside high-quality resources that can open up STEAM learning opportunities for students of any background. If educational leaders can do this, they will see students—who today are doing activities like building with blocks, making inquiries, experimenting with code, or sketching designs—become the innovators, problem-solvers, and workplace leaders the U.S. needs. There is no time to waste.

K–12 Curricula That Bring Science to *Life*

Whether you're looking for core science curriculum, supplemental, or both, Discovery Education has what you need to **engage curious learners, empower educators, and measure impact:**



- Our phenomena-based elementary core curriculum, *Science Techbook*, brings science learning to life for today's classrooms.
- Cross-curricular companion *Experience* enhances daily instruction with new alignments to core science curricula.
- K–5 supplemental curriculum Mystery Science helps students think like scientists through hands-on lessons and investigations.
- Science supplement Pivot Interactives lets students actively explore real phenomena, collect data, and analyze results.

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