



Early STEM Learning at EDC

How do we grow children's sense of wonder about their world?

From birth to age eight, children take the first steps in a lifelong learning journey. Promoting STEM learning during early childhood—using new research-based approaches in varied settings, such as in school, at home, and in afterschool programs—capitalizes on young children's natural curiosity and desire to understand their world. The early years also provide a key window of time to address STEM learning opportunity gaps for children from high-poverty communities and to ensure they have the foundational STEM skills and knowledge they need to succeed in school and life.



Research indicates that building on children's natural inquisitiveness takes careful attention to their motivation and persistence, as well as to the cognitive factors that affect learning. With support from the National Science Foundation and the Heising-Simons Foundation, we are studying the relationship between math learning and mastery motivation, and are helping expand the research base of effective inter-

ventions to promote preschool children's early math learning. Through this work, EDC will impact over 2,000 low-income preschoolers by providing professional development to Head Start programs on the use of mathematics- and persistence-related games, and by supporting families' at-home participation in mathematics-related activities.



What do educators need to support early STEM learning?

Teachers are crucial to young children's learning. Unfortunately, research shows that many teachers are not well prepared to teach STEM to young children in developmentally appropriate ways.

Teachers may lack an adequate grounding in STEM knowledge and effective instructional strategies. They may have difficulty discerning how to help all students achieve standards-based STEM learning outcomes in a rapidly changing educational landscape. They may lack confidence in their ability to teach STEM. Or, they may underestimate what young children are capable of learning. As a result, teachers may not provide opportunities for children to make sense of numbers, patterns, and relationships, or to interact with the scientific phenomena or practices that set the stage for later learning.

To some extent, these issues reflect a gap between what researchers are discovering and what practitioners are able to implement in their classrooms. EDC is committed to strengthening and reframing the relationship between research and teacher practice in STEM education in formal and informal settings. As a major partner in the Research + Practice Collaboratory, EDC is working with educators in Auburn, Maine to develop and study a model of research practice collaboration to improve learning of math in the early grades using interactive mobile technologies. The initiative is contributing to the research base about what works in early STEM learning, in supporting elementary school teachers with STEM pedagogy and content knowledge, and in supporting children from low-income families who may have less access to STEM experiences.

EDC also is committed to helping teachers apply curriculum and educational standards that reflect the growing body of evidence on

what very young children are capable of learning and how best they learn. For instance, in Chicago we are providing professional development to general education and special education teachers in grades K–5 to significantly increase their capacity to help all students achieve standards-based learning outcomes in mathematics. In Massachusetts—in response to the state's new K–12 Digital Literacy/Computer Science Standards—we are working with teachers across the state to integrate computational thinking (CT) into science and mathematics learning in Grades 1–6. In a second project, we are exploring how to build teacher capacity so that young children in urban and rural preschools can learn CT concepts and practices in the context of math instruction.

EDC draws upon interactive audio instruction (IAI) to support educators and community mentors in using high-quality curriculum to improve STEM outcomes for children who are on the margins due to poverty, language minority status, mobility, ethnic or political identity, and situations of crisis.

In Paraguay, our Tikichuela (Mathematics in My School) IAI program used audio CDs to help 400 teachers engage preschool children in high-quality standardized lessons. After only five months, a rigorous evaluation found that the students of pilot program teachers who received training and in-class tutoring achieved an average of a 16-point increase in their mathematics scores over those not in the program. The program has continued to show effects and has been sustained and expanded into Grade 1 by the government of Paraguay.



What can be done to support STEM learning for *all* children?

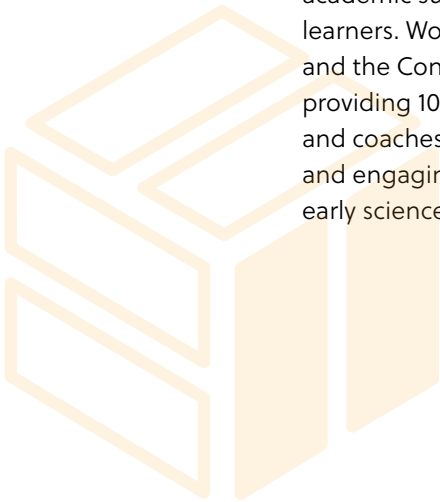
As early as kindergarten and the early grades, there are painfully real opportunity and achievement gaps between children from higher and low-income households, but we need not accept these gaps as inevitable.

It is essential to build school-home-community partnerships that give all children the opportunity to engage in authentic science explorations and mathematical thinking.

Our organization has a special focus on meeting the needs of children from disadvantaged communities and of dual language learners, on engaging and supporting families, and on building capacity to sustain improvements. In the U.S., a federal i3 development grant is giving us the opportunity to use the engaging context of science to support the literacy and academic success of young English language learners. Working with Hartford Public Schools and the Connecticut Science Center, we are providing 100 pre-K and first-grade teachers and coaches with professional development, and engaging 2,000 families in their children's early science and literacy learning through

classroom explorations, family events, and family "toolkits" to extend science exploration at home.

Likewise, with federal grants and with funding from private foundations, EDC has committed more than \$5 million to identify developmentally appropriate strategies and tools for using technology and media to support STEM learning among children in low-income communities that historically have had less support for early engagement with STEM content and practices. We are achieving this in formal and informal settings in partnership with researchers, media producers, and educators who are using iterative co-design processes to inform the development of evidence-based curricular programs and professional development resources.





Can technology make a difference in young children's STEM learning?

Yes, but technology alone is not enough.

Interactive Audio Instruction and digital resources, such as narrative-rich videos, mobile apps, and online games with built-in assessments, can play pivotal and productive roles in preschool teaching and learning, but they require thoughtful planning to integrate, use, and sustain. Even the best-designed tools can never replace human interaction or good teaching. Young children need caring and knowledgeable adults to help them navigate and learn about the world, and this includes the world of technology.

Much of our work emphasizes the role that adults play in using technology to engage children in rich STEM learning and to mediate children's use of digital games and videos.



We try to reflect this approach to technology in our research, and in guidance we provide to educators. Through the U.S. Department of Education's Ready To Learn Program and a \$15 million program of research, for example, we have the opportunity to help PBS and the Corporation for Public Broadcasting create better services for children and families, especially in communities where there are high concentrations of poverty.

Who is needed to create long-lasting early STEM programs?

Everyone—from those living in the White House to those living with the support of local housing authorities.

Promoting STEM knowledge and skills during early childhood requires a systematic approach and the combined efforts of many committed partners. In the U.S. and around the world, we work to create strong, coherent pre-K–Grade 3 systems and to advance knowledge of how to improve early learning. In partnership with federal and state agencies, private founda-

tions, ministries of education, and community-based and direct service organizations, we implement innovative early childhood programs that build numeracy, science, and literacy skills, that excite interest in learning, and that help educators, volunteers, mentors, and parents enrich early learning.