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STEM starts early: Grounding science, technology, engineering, and math education in early childhood [1]

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Full report PDF [2]

Executive summary

Watch a group of very young children engaged in planting a community garden. What are they learning? They are starting to grasp fundamental concepts about science and the natural world—how much water is needed, what roots are for, how a plant's growth changes with the seasons, and so forth. These are ideas that lay the groundwork for deeper learning about environmental science and plant biology, critical thinking skills, problem solving, and trial and error. Whether it is gardening, building forts, stacking blocks, playing at the water table, or lining up by height in the classroom, children demonstrate a clear readiness to engage in STEM learning early in life. And research from several disciplines is converging to show the importance of a new national commitment to early learning generally. Brain and skills-building experiences early in life are critical for child development, and high-quality early STEM experiences can support children's growth across areas as diverse as executive function and literacy development.

In fact, just as the industrial revolution made it necessary for all children to learn to read, the technology revolution has made it critical for all children to understand STEM. To support the future of our nation, the seeds of STEM must be planted early, along with and in support of the seeds of literacy. Together, these mutually enhancing, interwoven strands of learning will grow well-informed, critical citizens prepared for a digital tomorrow.

So why is science, technology, engineering, and math (STEM) learning not woven more seamlessly into early childhood education? An examination of the environments and systems in which children live reveals that it is not due to a lack of interest or enthusiasm on the part of children, teachers, or parents. The barriers to STEM learning for young children are more complex, subtle, and pervasive than decisionmakers currently realize. For example, in December 2013, the National Science Foundation (NSF), the Smithsonian Institution, and Education Development Center cohosted a STEM Smart workshop to reach early childhood practitioners. Participants were delighted to learn of evidence-based practices and tools, but many declared that they felt too constrained by current school structures and policies to apply what they were learning. They voiced concerns about the misapplication of new education standards, disconnects between preschool and elementary school practices, and an underprepared workforce.

In response to these concerns and the growing scientific consensus about the importance of early STEM learning, the Joan Ganz Cooney Center at Sesame Workshop and New America embarked on an exploratory project, funded by the NSF, to: (a) better understand the challenges to and opportunities in STEM learning as documented in a review of early childhood education research, policy, and practice; (b) make recommendations to help stimulate research and policy agendas; and (c) encourage collaboration between pivotal sectors to implement and sustain needed changes. We also accounted for new research on widely held public assumptions about what young children need and how they learn, assumptions that may be barriers to progress. This report is the culmination of those efforts.

To gain perspectives from stakeholders in each of the early childhood areas—research, policy, and practice—we invited their input. First, we interviewed prominent early STEM researchers, policy makers, and teacher educators. Second, we conducted two focus groups with teachers, one with child care and preschool educators and one with early elementary school teachers. The insights we gained from the interviews and focus groups shaped the focus of this report; quotes from them are featured throughout.a Third, we commissioned experts to contribute to an early draft of this report, and their work is evident throughout this paper. Once a working draft of the report was complete, we invited experts from research, policy, and practice to discuss it and to help inform a national action agenda at a two-day meeting at New America in Washington, DC.

The multiple perspectives that shape this report are a reminder that no child develops in a vacuum. Children are affected by their home and school environments, the policies and practices that inform those environments, the cultural values that scaffold them, and the complex relationships between these factors. Many of the experts we consulted during this project were eager to see these factors considered more often in concert, and to see leaders from multiple sectors engaged in more consistent dialogue and collaboration. For this

reason, we have presented the evidence and our recommendations using Urie Bronfenbrenner's ecological systems theory.
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