

## **STEM STARTS EARLY: GROUNDING SCIENCE, TECHNOLOGY, ENGINEERING, AND MATH EDUCATION IN EARLY CHILDHOOD BY E.R. MCCLURE, L. GUERNSEY, D.H. CLEMENTS, S.N. BALES, J. NICHOLS, N. KENDALL-TAYLOR AND M.H. LEVINE.**

No child develops in a vacuum. Instead, children are profoundly affected by home and school and the complex relationships between all. This comprehensive study offers an extensive list of recommendations intended to help guide STEM integration into early childhood.

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This comprehensive study by multiple researchers at the Joan Ganz Cooney Center at Sesame Workshop and New America explore the barriers to STEM learning for young children and offers tangible solutions for overcoming them. The identified barriers included “education standards, disconnects between preschool and elementary school practices, and an underprepared workforce.” The NSF-funded study seeks to fully understand the challenges to and opportunities in STEM learning and offers recommendations for research and policy agendas; and encourages collaboration among key sectors to bring and maintain needed changes. The study included interviews with STEM researchers, policy makers, and teachers as well as focus groups with parents, educators and child care providers. The research also informed a national action agenda at a two-day meeting at New America in Washington, DC in 2017. The overarching message from the report is that “no child develops in a vacuum.” Instead, children are profoundly affected by home and school. And additionally, they are strongly influenced by policies and practices and the cultural values of home and school as well as the complex relationships between all. In examining the STEM landscape, researchers concluded that: Parents and teachers are enthusiastic and capable of supporting early STEM learning but need additional knowledge and support to do it well;

It is common for parents and teachers to be anxious and have little confidence about STEM topics. Many also carry gendered assumptions about STEM topics. All of this negative messaging can transfer to their children and students;

- Parents and teachers benefit by reimagining STEM in the context of developmentally-informed, playful learning, including block play, gardening, and exploring puzzles. These types of activities are far more likely to captivate their own curiosity and wonder as well as their children’s;
- Teachers need a deeper understanding of children’s developmental learning progressions that can then translate to properly pitched instruction;
- In order to be effective, teacher trainings must be substantive, interconnected, and ongoing. Instruction must include STEM content, child developmental learning progressions in STEM, and practiced pedagogy;
- STEM learning opportunities already exist in all classrooms and can be re-engineered as teachers think of STEM as inclusive of their other teaching domains and play times;
- To combat teacher anxiety and negative attitudes about STEM topics, teachers must experience the very same hands-on, engaging learning environments and practices we hope to see for America’s young children;
- Teachers should be able to encourage intrinsic curiosity and joy, and model sensitivity to developmental trajectories and best pedagogical practices;
- Parents and technology play a critical role in helping to connect school, home, and other learning environments like libraries and museums to support early STEM learning;
- Students’, parents’ and teachers’ Immersion in the interconnected web of STEM learning leads to STEM fluency and confidence;
- Parents help activate a child’s in-school learning by engaging in related activities at home or outside the home and even brief parental instruction can have an important impact on how students respond to STEM learning.
- Museums and other learning environments are effective engagement points for both parents and children;

- Various high-quality educational media, including the Bedtime Math app and other products developed by the PBS Ready to Learn initiative, are important supports that extend school learning into the home and beyond and also help improve parents' confidence with supporting STEM learning;
- Research and public policies can drive the presence and quality of STEM learning in young children's lives;
- Education policies must ensure alignment and continuity across the early grades, starting with preschool;
- Researcher-practitioner partnerships play a key role in supporting the iterative process of education reform;
- Strategic communications are critical for delivering an accurate understanding of developmental science to the public, which will, in turn lead support for meaningful policy change around early STEM learning;
- It is important to dispel various misconceptions about STEM learning, including that it is only for older students and that it is only important for those with a demonstrated aptitude;
- This report offers a one-page Communications Guide for accurate and impactful messaging;

Recommendations for how to successfully integrate STEM learning into early childhood education involved a consideration of all of the systems surrounding children:

- Engage parents by supporting their confidence and efficacy as their children's first and most important STEM guides;
- Parent educators, advocates, and researchers should reach out to parents about early STEM learning in engaging ways, through blogs, child care centers, pediatricians, parenting magazines, and publications like Zero-to-Three and Young Children;
- Those communicating about early STEM learning should use a variety of clear and accessible examples of early STEM exploration (e.g., participating in a community garden, testing which bath toys float and sink) that make it clear that STEM can happen anytime, anywhere, even with minimal resources;
- Resources for parents should go beyond simple early STEM tip sheets and should involve long-term training and the use of technology to make tools more accessible to parents through such venues as mobile technology;
- Teacher training and institutional support for teaching early STEM must be enhanced;
- Efforts to improve the workforce must include interconnected and ongoing STEM training and support that is meaningfully woven into teachers' existing classroom practices;
- Museum and library exhibits should engage children, and equally importantly, provide direct instruction to parents on engaging with their children around STEM;
- Education and technology leaders should ensure digital equity by providing access to high-speed Internet and other Digital Age infrastructure for all families with young children and the professionals who work with them;
- Public and private funders should continue to fund initiatives like Ready to Learn, which support family engagement in STEM learning.
- The media should carry out initiatives that build public interest in early STEM and form a bridge for home-school learning connections.

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