



STEM WITH TODDLERS

OH, THE TERRIFIC TWOS!



INTRODUCTION

This handout is a companion to the two videos, [Exploring Scientific Concepts with One-Year Olds](#) and [Early STEM for Toddlers](#), created in collaboration with the Idaho STEM Action Center and the Boise State University College of Education. Young children explore scientific concepts every day through daily activities within early childhood classrooms. Most early childhood educators offer opportunities for one and two-year-olds to experiment without even knowing it. When teachers reflect on their students' interests, plan with intention, and wonder alongside their toddlers, all young learners, those with and without disabilities, investigate scientific concepts and engage in the scientific method by forming hypotheses and testing their theories. Early childhood educators looking to integrate STEM into their classroom can:

- Integrate STEM within existing activities and routines
- Present novel materials for exploration and discovery
- Encourage children's development of schemas
- Narrate when children test out their theories and encourage sharing with peers
- Reflect on ways that children with disabilities engage in STEM

INTEGRATE STEM WITHIN EXISTING ACTIVITIES AND ROUTINES

- Sensory tables: Sensory tables offer rich experiences in comparing how different substances feel and move in different ways. The video demonstrates water and water beads. Other recommendations would be to introduce rice, beans, and sand/kinetic sand. Please note that these materials can present choking hazards for young children, especially children that still mouth objects. Therefore, early childhood educators should supervise children closely when presenting small items for exploration.
- Don't be afraid of messes! Explorations are enhanced during messy play. It can also help children with sensory processing differences to participate more independently alongside their peers⁴.
- Block area: Offer opportunities to count and sort to nurture mathematical thinking.²

1: McClure, E.R., Guernsey, L., Clements, D.H., Bales, S., Nichols, J., Kendall-Taylor, N., & Levine M.H. (2017) *STEM starts early: Grounding science, technology, engineering, and math education in early childhood*. New York: The Joan Ganz Cooney Center at Sesame Workshop.

2: Chen, J.Q., Hynes-Berry, M., Abel, B., Sims, C., & Ginet, L. (2017). Nurturing mathematical thinkers from birth: The why, what, and how. *Zero to Three*.

3: Strasser, J. & Mufson Bresson, L. (2018). Big Questions for Young Minds: Extending Children's Thinking. NAEYC, Washington D.C.

4: Grzadzinski, R., Donovan, K., Truong, K. *et al.* Sensory Reactivity at 1 and 2 Years Old is Associated with ASD Severity During the Preschool Years. *J Autism Dev Disord* **50**, 3895–3904 (2020). <https://doi.org/10.1007/s10803-020-04432-4>

- Cooking activities: Invite young children to help prepare simple recipes by using different measuring tools such as cups and spoons.
- Outdoor exploration: Outdoor time offers young children opportunities to explore the natural world. Use open ended questions such as “I wonder where the ants live?”³ and “I wonder why the color of the leaves change when it gets colder?”³

PRESENT NOVEL MATERIALS FOR EXPLORATION AND DISCOVERY

- Provide young children novel materials and closely observe how they manipulate them.
- Expand on their explorations by offering opportunities to test materials in different ways. The teachers in the video hung different magnetic surfaces for their young toddlers to test their magnets within different areas of the classroom.
- Within the second video, the teacher took familiar items from the classroom, tubes and water beads, and combined them to create new ways for children to experiment.

ENCOURAGE CHILDREN'S DEVELOPMENT OF SCHEMAS

- Schemas are patterns of repeated behavior that help children explore and develop ideas through their play. This leads to deeper understandings, abstract ideas, patterns, and concepts⁵.
- Toddlers engage in research everyday to better understand the world. Therefore, allow children time and opportunities to repeat processes such as knocking over block towers or placing items in and out of containers, to explore schemas.
- During the Toddler years, children are busy creating and building upon eight different schemas during their play and explorations. These include:
 - Connecting
 - Orientation
 - Transporting
 - Trajectory
 - Positioning
 - Enveloping
 - Enclosing
 - Rotation
- Understanding schema theory helps to reframe toddlers' actions as research rather than misbehavior.

NARRATE WHEN CHILDREN TEST OUT THEIR THEORIES AND ENCOURAGE SHARING WITH PEERS

- Young children's engagement in science depends on the support of the adults around them. Point out what children are doing, especially when a child has an unexpected result: “What happened to the water?”
- Learning in early childhood is supported through building relationships and helping children form friendships. Encourage children to share their discoveries with each other, by prompting them to show, observe, and respect each other's creations.
- STEM in early childhood encourages collaborative inquiry and shared problem solving. As a result, STEM is a vehicle for the social emotional development of children with and without disabilities⁵.



REFLECT ON WAYS THAT CHILDREN WITH DISABILITIES ENGAGE IN STEM

Individuals on the autism spectrum (ASD) often seek and avoid certain sensory experiences³. Presenting a child with ASD with different materials to explore and examine, could help meet their needs to regulate sensory input. For instance, children with and without ASD could be encouraged by a teacher to compare how water and rice move down tubes differently. For a child with ASD, this experience could engage them in seeking both visual and tactile input and allow them to play alongside peers for longer periods of time.

ADDITIONAL RESOURCES TO EXPLORE

[Enhance STEM Learning and Participation for Young Children with Disabilities](#) (Campbell, P. 2020, STEM4EC Community Blog)

[Let's Talk About STEM Video Series](#) (Zero to Three, n.d.)

[Beyond the Chalkboard](#) (Boston Children's Museum, n.d.)

[Talking Is Teaching](#) (sponsored by Too Small to Fail)

[A Guide to Schema Play in Toddlers](#) (blog post by 100 Toys Founder Alexis Ralphs)

5: Curtis, D., & Jaboneta, N. (2019). *Children's Lively Minds: Schema Theory Made Visible*. Redleaf Press.

6: Meré-Cook, Y. & Ramanathan, G. (in press). We are engineers! Using the engineering design process to promote social emotional, language, and literacy development for preschool-aged children with and without disabilities. *Young Children*.