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The leader in PreK - 12 STEM education.

The Need for an Early Childhood STEM Curriculum

Many early childhood curricula are described as comprehensive across content areas. However, research shows that there is very little STEM happening in the preschool classroom. Most estimates indicate only 3-24 minutes of the school day is used to teach science (Connor, Morrison, & Slominski, 2006; La Paro et al., 2009). However, 87% of science activities labeled by early childhood educators as science were not related to science concepts (Tu, 2006). Taken together, these findings point to the possibility that, at most, 3 minutes is spent per day on concepts related to science.

The lack of time spent on math is also concerning. Estimates show that 1-18 minutes of the school day focuses on math (Farran, Lipsey, Watson, & Hurley, 2007; La Paro et al., 2009). In fact, a 2007 study examining a comprehensive curriculum that includes literacy and math found that, for every 360-minute school day teaching with this curriculum, only 58 seconds of the day (or less than 1%) was devoted to math (Farran et al., 2007).

In addition, preschool teachers report feeling unprepared to teach STEM and have difficulty finding time to teach these subjects, particularly compared to other domains such as language and literacy (Evangelou et al., 2010; Greenfield et al., 2009; Katehi, Pearson, & Feder, 2009; Yoon & Onchwari, 2006).

These findings portray the shortcomings of existing preschool curricula when it comes to STEM instruction and point to a critical need for high quality curricula and resources to support preschool teachers in implementing STEM in their classrooms (Gerde, Schachter, & Wasik, 2013; Piasta, Pelatti, & Miller, 2013). Given this need, Rice University, in partnership with Accelerate Learning Inc. (ALI), created a preschool STEM curriculum, STEMscopes Early Explorer to support the integration of STEM into existing preschool classrooms.

STEMscopes Early Explorer focuses on scientific inquiry to promote learning in science, technology, engineering, and math while fully integrating literacy support and instruction. The pedagogical model that underpins the Early Explorer is constructivism, which supports student-centered experiences in the classroom such as inquiry, in which students investigate phenomena about the natural world, ask questions, and test hypotheses to gain knowledge (Eick & Reed, 2002; Koch, 2013). Early Explorer is aligned to a comprehensive set of learning outcomes for Prekindergarten children including the Head Start child outcomes framework, Next Generation Science Standards (NGSS) Kindergarten Science and Engineering Practices and Cross-Cutting Concepts, and prominent preschool science standards from several states.

The primary goal of Early Explorer is to make STEM education accessible and easy for preschool teachers to implement so that time spent on STEM instruction in preschool increases significantly. Therefore, the curriculum is designed to be flexible to complement common preschool daily schedules and classroom structures (e.g., circle time, free play, small group, centers). Early Explorer is based on the 'Ups' Model adapted from the Biological Science Curriculum Study's 5E inquiry model of instruction, known as the 5E model (Bybee et al., 2006):

Element	Description
"Ramp Up!"	During this element, the teacher introduces the science concepts to the children in brief whole-group activities and helps students plan their course of action to be conducted in the next element. Teachers are provided with background information on the content covered by the module and question prompts to promote a discourse of inquiry during the activity.
"Round Up!"	Students interact with centers in the classroom that have had content, material, and activities from the module integrated into it. Activities and materials lists are available for 15 learning centers, so that teachers can select center-based activities based on their availability in the classroom. Teachers are provided with question prompts to continue discourse of inquiry during exploration.
"Wrap Up!"	Teachers meet with small groups of children to engage in discussion to gauge children's understanding of the key concepts for each module, and students create a product to display their understanding. The products created are sent home to parents and accompany a parent letter describing what the children are learning in science and provide suggestions for questions that parents can ask their children about their science exploration.
"Keep It Up!"	Teachers engage in small or whole-group activities that provide opportunities for sustained inquiry through stations or units that explore cycles and patterns that occur in the natural world. One sustained inquiry classroom activity is provided for each module. In addition, a parent newsletter is provided with a summary of concepts covered along with conversation starters to encourage children and parents to expand their science inquiry into the home.

Through Early Explorer, children have multiple opportunities for authentic learning of science content and process skills and to enhance their language and domain-general skills within the context of STEM learning. By accommodating the existing schedule and structure of the preschool classroom, STEMscopes Early Explorer significantly increases time spent on STEM instruction through scientific inquiry by embedding it into the preschool classroom.

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