INTRODUCTION
As people engage in real-life situations, they draw from their full knowledge base and skills. Integrating science, engineering, mathematics, computational thinking, and literacy within educational experiences for pre-college students can better prepare them for real-world situations, while allowing teachers to add engineering and computing to the school day without diminishing their focus on mathematics and literacy. At the same time, we know children only spend about 18% of their waking hours in formal school environments - thus we can promote learning by capitalizing on time spent in out-of-school settings and making connections across school and out-of-school settings.

PROJECT OVERVIEW

Resources
- Computational thinking was integrated into the PictureSTEM curriculum (a research-based integrated STEM curriculum that makes extensive, authentic connections across STEM subjects while also connecting language arts).
- In development are extension activities to further support computing learning, science center exhibits for learning in informal settings, and resources for parents to help K-2nd grade students learn engineering design and computational thinking skills while also developing proficiency in mathematics, science, and literacy.

Research
- Assessment frameworks, tools, and approaches are being developed, while research is conducted on student learning that takes place in school, home and science center settings.

INTRODUCTION
In what ways (if at all) do students make connections across school and science center (and potentially other) settings?

LESSONS 1A HENRY’S MAP & 1B ROBOT MOUSE

Students learn how to use flowcharts and mapping to help solve problems and illustrate their ideas in a step-by-step manner.

LESSONS 2A INSECT SIMULATION & 2B PROBLEM DECOMPOSITION

• Create, test, and refine a toy box organizer

Educatior Workshops
• Twenty-eight educators were trained in Year 1
• Sixty-three educators were trained in Year 2

Student Learning Research
• Year 1: Twenty-two educators from seven elementary schools across four school corporations participated in data collection
• Year 2: Twenty-six educators from seven schools & 2 homeschooling families

COMPUTATIONAL THINKING

Computational thinking (CT) is a systematic problem-solving process that involves identifying, formulating, and solving problems in a way that enables us to use tools such as computers to more efficiently address complex, real-world situations. Computational thinking can be used across disciplines (e.g., mathematics, science, engineering, and literacy).

The CT core competencies the project is focusing on are:
- Abstraction - identifying and utilizing the structure of concepts/main ideas
- Algorithms & procedures - following, identifying, using, and creating an ordered set of instructions (i.e., through selection, iteration and recursion)
- Problem decomposition - Breaking down data, processes or problems into smaller and more manageable components to solve a problem
- Debugging/Troubleshooting - Identifying and addressing problems that inhibit progress towards task completion

DATA SOURCES
Research data used to understand student learning

Curriculum Revision
- Reviewed PictureSTEM curriculum to identify existing computational thinking
- Content analysis of two PictureSTEM units
- Coded for computational thinking
- Analyzed classroom video observation data to identify students engaged in computational thinking
- Interaction analysis
- Case studies
- Identified an area in each unit that could be strengthened by a lesson focused on a computational thinking competency
- Wrote a new literacy and STEM+C lesson for each unit
- Developed new introductory lessons that allowed students to do age appropriate problem solving