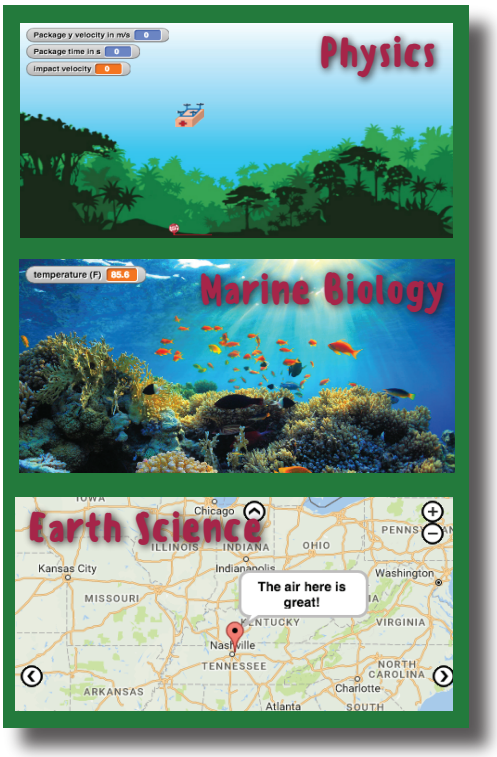
C²STEM

Funded By: NSF
STEM+C #1640199

C2STEM is a multi-institutional project that employs Evidence-Centered Design (ECD) Principles to design and develop a Collaborative, Computational STEM (C2STEM) learning environment. C2STEM employs a novel learning-by-modeling paradigm that combines visual programming with domain specific modeling languages (DSMLs) to promote disciplinary (e.g., Physics, Earth Science) computational modeling, while providing synergistic learning of discipline-specific and CS (CT) concepts and practices.

Current STEM Domains



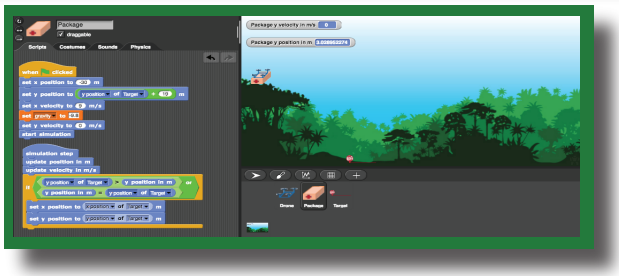
C2STEM Highlights

- **Challenge-based, ECD of STEM curricula** to meet NGSS & state science standards.
- **Low threshold, wide walls, high ceiling:** accomplished through domain-specific block structured languages to support learning.
- **Coupled multi-level representations to support learning:** conceptual modeling & inquiry components offer new forms of decomposing & exploring STEM domain.
- **Synergistic Learning:** emphasis on integrating CT with existing science curricula - complementary approach to CSforAll!
- **Integrated assessment of STEM & CT:** Utilize ECD & Preparation for Future Learning assessments for measuring learning gains & characterizing learning processes.
- **Collaborative model building** for enhancing interpersonal & problem-solving skills.
- **Teacher collaboration** to align with classroom curricula & activities.

For More Information, Contact:

PI: Gautam Biswas, Vanderbilt University
gautam.biswas@vanderbilt.edu

Co-PIs: Akos Ledeczi, Vanderbilt University
Kevin McElhaney, SRI International
Dan Schwartz, Stanford University
Shuchi Grover, Independent Researcher
Luke Conlin, Salem State University



Learning-By-Modeling

C2STEM equips students with the ability to build computational models of STEM phenomena, simulate these models to understand behaviors, & apply them to problem solving tasks. Programming the step-by-step process of a model may not only support deeper learning in the STEM domain, but also help students develop CT skills as well!

Enhancing Inquiry

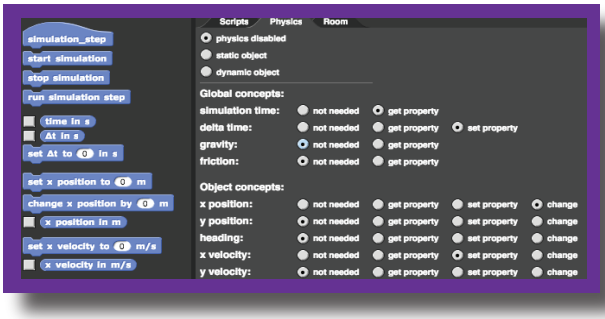
From racing sloths to conducting experiments on the effects of gravity, we have added unique inquiry tools for engaging and motivating STEM learning. Prior to building their own simulations, students can run tests, experiment to understand the relations between variables, use scientific tools, and compare results with expert model code to inspire powerful ideas!

Domain Specific STEM Programming Blocks Promote Synergistic Learning of STEM+C!

Real-Time Graphing!

Collaborative Problem Solving

Not only is our learning environment equipped with collaborative tools to support the development of interpersonal skills, our problem-solving tasks are challenging and promote teamwork and communication in applicable, real-world scenarios.



Conceptual Modeling Before Computational Modeling for Planning, Problem Formulation, and Problem Decomposition!

Preparation for Future Learning

We utilize PFL assessments to provide opportunities to learn during the assessment. PFL measures focus on students' ability and propensity to apply computational constructs and CT practices while learning new STEM topics within and outside of kinematics.

Evidence-Centered Assessment Design

To establish effective synergistic learning opportunities, integrative assessment tasks have been created using the ECD Assessment Framework (the same used for the Exploring Computer Science curriculum) - making our process easy to adapt and align with established educational frameworks.

PI: Gautam Biswas. Co-PI: Akos Ledeczi, Kevin McElhaney, Dan Schwartz, Shuchi Grover, Luke Conlin
Team: Miklos Maroti, Kristen Blair, Doris Chin, Rachel Wolf, Satabdi Basu, Shannon Campe, Brian Broll, Nicole Hutchins