Middle School CS in Science

PROJECT GUTS
Growing Up Thinking Scientifically

Overview

Code.org is partnering with the award-winning Project GUTS to deliver a middle school science program consisting of four curricular units and professional development for the introduction of computer science concepts into science classrooms. The goal of the program is to situate computer science practices and concepts within the context of life, physical, and earth sciences and prepare students to pursue formal, year-long courses in computer science during high school. Code.org's middle school science program uses computer science as a tool to deeply explore STEM concepts while addressing course standards. All lesson resources are aligned to the Next Generation Science Standards (NGSS), designed to integrate into existing units, and leverage years of research funded through the National Science Foundation (NSF). The professional development program consists of about 15 hours of online experiences and 35 hours of in-person workshops.

Science Content and Curriculum

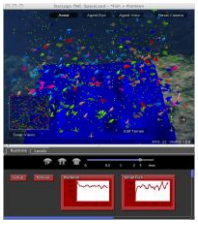
Code.org's middle school science program connects computer science to science through computer modeling and simulation. The modules address performance expectations in both the NGSS and Computer Science Teachers Association K-12 Computer Science Standards.

Module 1: Introduction to Computer Modeling and Simulation


This module introduces basic concepts in modeling complex systems through hands-on activities and participatory simulations. A scaffolded series of highly-engaging design and build activities guide students through developing their first computer model in StarLogo Nova, a modeling and simulation environment developed at the Massachusetts Institute of Technology.

Module 2: Greenhouse gases and climate

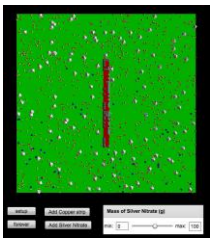
This Earth Science module explores climate change: what it means, what the difference is between climate and weather, and evidence of climate change. The global climate system is presented as a complex system with feedback loops and interconnected processes.



Module 3: Ecosystems as complex systems

This Life Science module begins with an exploration of a simple predator-prey model to consider who eats whom—and what happens when one population grows faster than another. Students develop their own model of a local ecosystem and learn about ecosystem dynamics, producers and consumers, and interdependent relationships within an ecosystem.

Module 4: Chemical Reactions



This Physical Science module explores chemical reactions: the conditions under which they occur, the evidence that a chemical reaction has taken place, limiting reactants versus reactants in excess, and when chemical reactions stop. The base model for this unit simulates the chemical reaction between silver nitrate and copper.

Implementing the Code.org Science modules

Module 1, “Introduction to Computer Modeling and Simulation”, can be combined with either Module 2, 3 or 4 to create a ten-day lesson in Earth, Life or Physical Science. Extensions to modules enable them to be used in 6th, 7th, or 8th grade.

Throughout the process of computer modeling and simulation, students will follow a “Use-Modify-Create” progression in which they first gain experience with the concepts by using an existing model, then expand on and modify that model, and finally create a model of their own that builds off the knowledge and experience gained in the use and modify phases. This iterative approach to exploring the models facilitates topic mastery while easing students into the technical and programming components of the lessons.

Professional Development Program

Code.org’s year-long, three phase professional development program prepares middle school science teachers to implement the four modules.

Phase 1: Pre-Workshop online preparation. (Spring)
Introductory videos and guided tutorials through which teachers build background knowledge in Computer Modeling and Simulation and progress through a guided tour of StarLogo Nova’s interface and capabilities.

Phase 2: Summer intensive professional development workshop. (Summer)
In-person workshops through which teachers experience modules as learners in a group setting, learn and practice pedagogy for teaching computer modeling and simulation, and create a professional learning community.

Phase 3: Mini-workshops and online support. (Academic year)
One-day in person mini-workshops held in districts at which teachers prepare for the implementation of the modules, practice leading the activities, and review best practices for integrating modeling and simulation into STEM classes.