

The Value of Computational Thinking Across Grade Levels 9-12 (VCTAL)



Computational Thinking

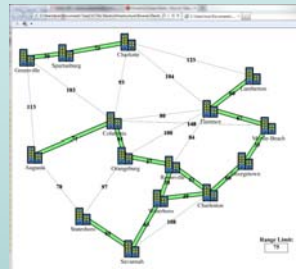
ISTE & CSTA say that **Computational Thinking** (CT) is a problem-solving process that includes:

- Formulating problems in a way that enables us to use a computer solve them
- Logically organizing and analyzing data
- Representing data through abstractions such as models and simulations
- Automating solutions through algorithmic thinking (a series of ordered steps)
- Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources
- Generalizing and transferring this problem solving process to a wide variety of problems

VCTAL Goals

- Help to define “Computational Thinking” and its place in high school curricula
- Develop, test, and implement an innovative mix of twelve instructional modules for grades 9-12
- Host summer Prototyping Workshops for students to assist authors in writing the modules and teachers in teaching them
- Evaluate the influence of VCTAL materials on diverse students’ awareness of computational thinking opportunities and interest in related technical fields
- Widely disseminate the materials we create for broad impact
- Help to broaden participation in CT and computing by providing examples from daily life that make them relevant and accessible

VCTAL is developing a set of instructional modules and mini-modules for use in high school classrooms to help cultivate a facility with computational thinking in students across different grade levels and subject areas



Module Fast Facts:

- Provide 4-6 days of classroom activities
- Student-centered, activity-driven, problem-based
- Active, not passive
- Drawn from everyday life
- Encourage hands-on experimentation with computers
- Include “stand-alone” parts so that teachers do not have to commit to the full module



Fundamental CT Question: How do I solve this problem *given that I can compute?*



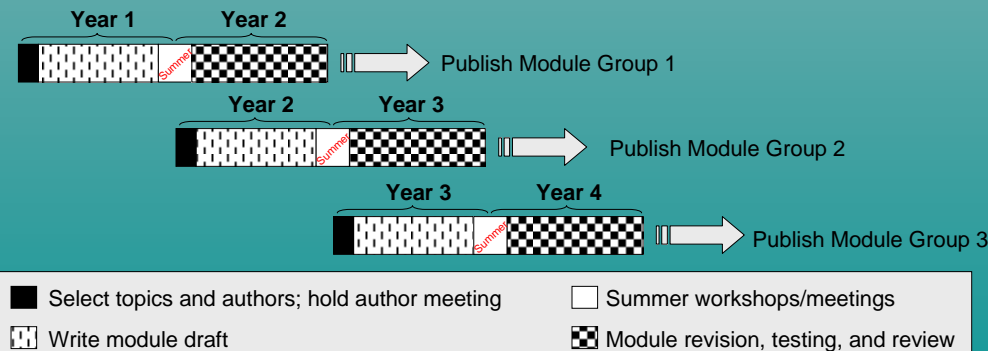
Module Testing and Evaluation:

- Pilot Testing with students at Student Prototyping Workshop
- Field Testing at partner high schools in AK, MS, MT, PA, SC
- Evaluation instruments to help assess student engagement, the CT/CS learning that occurs, CT skills transfer, etc.



Student comment following the Prototyping Workshop:
I would like to come back next year and possibly major in this in college.

VCTAL Timeline



Module Titles

- It’s an Electrifying Idea: Buying and Driving an Electric Car
- Heart Transplants and the NFL Draft
- Network Capacity Expansion and Utilization
- Privacy: Do you know what they know about you?
- Fair and Stable Matching
- Tomography and 3-D Reconstruction
- Polynomiography and Art
- Foolproof Codes and Ciphers
- Connect Four and Games That Can Be More Than Just Fun
- Tragedy of the Commons – Or Is It?

VCTAL Partners

- DIMACS, Rutgers University**
Overall project management
- Hobart and William Smith Colleges**
Student Prototyping Workshops
- Consortium for Mathematics and its Applications (COMAP)**
Module production
- Colorado State University**
Evaluation and research
- Partner High Schools and CSTA**
Module field testing

Contacts

Midge Cozzens (PI): midge6930@comcast.net
 Tamra Carpenter: tcarr@dimacs.rutgers.edu
 Paul Kehle: kehle@hws.edu
 Andrea Weinberg: andrea.weinberg@colostate.edu
 Rebecca Wright (co-PI): rebecca.wright@rutgers.edu