Integrating Computational Thinking

What is Computational Thinking?

Historical/Theoretical Context

- To define computational thinking (CT), which must be conceived as a process of mind, we would have to frame it historically, functionally, and in practice. Historically, **computing** is a rational process whereby an agent, initially human and later mechanical, regards the relationships between two quantities and formulates a resulting definition or relationship.

- Alan Touring (1936) "we can identify computable quantities and utilize mathematical operations to solve them" (Touring Machines)

- Computers where designed to emulate the way we think but to do it much more efficiently (Osman Yasar 2017)

- Seymore Papert (1980) said "Computers will also change the way we think"; essentially they will be tools used in our evolution

- The term 'Computational Thinking' would be formalized and popularized by Jeannette Wing (2006) "The thought process by which problems and their solutions can be represented in a form that can be carried out by an information-processing agent" (2010)

Practical Context

- Generally accepted characteristics of CT for instructional purposes (ISTE, NSF, etc)
  - Decomposition
  - Data Collection
  - Pattern Recognition
  - Abstraction
  - Algorithmic Thinking
  - Debugging

Why Should We Teach CT?

The All-Important 'Why'

- It is an intentional tool for the evolution of humans
  - Similar to delayed gratification
  - A technical approach is designed to get certain results; it's designed to bring about victory

- More efficient in personal and societal problem solving

- Relevant skill in jobs of tomorrow and today

- Ubiquitous Computational Solutions

Where Can We Teach CT?

Georgia Department of Education

STEM

- Math
  - The study of mathematics and algorithms is essentially a formal abstraction of real-world concepts down to inert numbers that are then related to other numbers to discern solutions to problems.

- Science
  - It is through these processes (data collection and analysis) and the reasoning that follows that humans are able to investigate cultures, physical principles of the universe, and biological processes.

- Engineering
  - CT is a practical approach to solving problems and is instrumental in the development of tangible solutions, be they abstract as in the case of computer software or concrete as in the case of robotics, the internet of things and the embedded computing systems that have begun to pervade our society.

Beyond STEM

- Art

- Social Studies

- Health

- ELA

MARS

Bryan Cox

Computer Science Program Specialist - GaDOE

bcox@doe.k12.ga.us

(404) 798-5251