

Image source: https://www.chapman.edu/scst/graduate/phd-computational-science.aspx

Pedagogical Guidelines and a Learning Progression for CT Integration

Shuchi Grover, Ph.D. (@shuchig)

Senior Research Scientist, Looking Glass Ventures | Visiting Scholar, Stanford University

Acknowledgements



C2STEM: Synergistic Learning of Physics/Biology & CT through computational modeling in secondary school

Foundations for Advancing Computational Thinking: Balanced Designs for Deeper Learning in Intro Programming



(EDC) NSF Workshop on 'Computational Thinking From K-12 Disciplinary Perspectives NSF#1647018 VELA (Variables, Expressions, Loops. & Abstraction) Computational Concepts for Middle School Programming

Integrating CT into Science & Math activities for pre-K learners in formal & informal settings

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Pieces of the STEM+C Integration Curricular Puzzle







Exploit Synergies between STEM concepts/practices & CT/CS concepts/practices





PREPARING AMERICA'S STUDENTS FOR COLLEGE & CAREER



Sample Designed Activities	CT Skills	Mathematics Concepts / Practices	Science Topics/Concepts / Practices
City Walk (Physical & Digital activity suite)	Algorithms (Sequences & Loops) Encoding	Counting, Comparing, (more or less than, equal to) Spatial reasoning/ visual spatial counting	Modeling, Representations (3-D spatial and 2-D representations)
Carmella's Apple Store	Problem Decomposition, Testing and Debugging	Measurement (Length), Counting, Cardinality	Sink and float, Ramps & pathways, Practices: Observation, Developing & planning investigations; Cause & effect
Grocery Store	Abstraction, Pattern Recognition	Counting Spatial reasoning/visual spatial	Food & Nutrition Practices: Observing & describing, Classifying & sorting, Comparing & contrasting

2.

Engage with CT in STEM & coding concepts <u>outside</u> of coding

Source: Code.org



Story 1

"Excuse me ---- last week I bought one of these pens here for \$1.50. Are you really telling me they now cost \$3?"



Story 3

"Here is the temperature forecast for the next few hours today and for the rest of the week."



Source: http://csforall.sri.com (VELA Project)

Story 2

"We sell t-shirts in all sizes - extra-small (XS), small (S), medium (M), large (L), and extra-large (XL)"



Story 4

"I watched the basketball game last night. At halftime we were tied, but in the end they beat us, 34-30."



3.

Begin with noncoding activities (especially if learners are unfamiliar with coding)





Grover, S. (2018). Thinking about Computational Thinking and How Learning Sciences Can Shape Deeper Learning of Computer Science in Schools. () @shuchig Buchig B

A Breakdown/Progression for Computational Modeling in STEM



Grover, S. (2019, April 29). Computational Modeling: How Can We Manage Cognitive Load When Students Must Simultaneously Learn to Code AND Code to Learn in a STEM Classroom? (https://shuchigrover.com)

Øshuchig



shuchig@cs.stanford.edu

http://shuchigrover.com