SRI Education

Design and Cross-cutting Practices for CS/CT

- Analyze the effects of developments in computing
- Design and implement creative solutions and artifacts
- Apply abstractions and models
- Analyze computational work of self and others
- Communicate computational thought processes, procedures, and results to others
- Collaborate with peers on computing activities



Principled Assessment of Computational Thinking

2. For a class assignment, Gabriela and Lucia both created an algorithm that has a dog moving around on the screen.

Gabriela's algorithm

- Step 1: Ask for how many laps a dog should move/run.
- Step 2: Check the number entered. Step 2a: If the number entered is less than 2, then have a dog say "Please enter more."
- Step 2b: If the number entered is greater than 200, then have a dog say "Too many laps. Enter another number."
- Step 2c: If the number entered is greater than 2 AND less than 100, then have the dog move the number of laps around the screen.
- Step 2d: If the number entered is between 100 and 200, then have the dog move half the number of laps around the screen.

Lucia's algorithm

- Step 1: Ask for how many laps a dog should move/run.
- Step 2: Check the number entered.
- Step 2a: If the number entered is less than 2, then have a dog say "Please enter more."
- Step 2b: If the number entered is greater than 2, then have the dog move the number of laps around the screen

The PACT assessments for ECS test code comprehension

5. Below is some Scratch code and the initial stage y Hello! for 2 se dance to 100 til dance < 50 sk Howlong should I dance? and wai t dance 🔻 to 🛛 answer dance > 50 the say That's too long!! for 2 sec epeat dance) switch costume to ballerina-b wait secs switch costume to ballerina-c wait 2 secs switch costume to ballerina-d wait .2 secs New sprite: 💠 🖊 🗳 🔯 switch costume to ballerina-a

NEW TEST: Scenarios to Test Problem Solving Abilities

Your classmates have decided to use Arya's method and you now have to figure out who goes in which car. Below is a map showing where people live and people driving. The red circles show where people live and the stars show the people who are driving.



Darci would like to design a computer program to make sure everyone travels the least distance using Arya's method. (c) The program will use the map of the area. What other inputs does the program need in order to figure out the shortest distance the cars would



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Computer Science Concepts in the Next Generation Science Standards

Data Sources

- Next Generation Science Standards
- NRC Framework Document
- CSTA Standards
- CS Principles Big Ideas
- Exploring CS
- Expert Panelists





Future Work

Sample NGSS Engineering Performance Expectations **Compared with Computational Thinking Practices**

Performance **Expectations (NGSS)**

HS - ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants

Focal KSA

Analyze the Effects of Developments in Computing

Communicate Thought Processes and Results to Oth

Collaborate with Peers on Computi Activities

Design and Apply Abstractions and Models

HS-ETD1-2: Design a solution to a complex realworld problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Design and Implem Creative Solutions Artifacts

Analyze their Computational Wol and the Work of Others

Design and Apply Abstractions and Models

Computational **Thinking Practice**

s Pers	Students have to understand problems to which computing can be applied in order to define problems and solve them responsibly. Inspiration for solutions can come in part from understanding applications in other domains
ng	In order to verify the solutions meet important needs, communication and collaboration are critical
	Representations not only help communicate the criteria and constraints, but also to help a designer think through them
nent and ork	Design of computing artifacts involve problem solving steps: understanding, decomposing, and exploring the problem, creating the work products that show one or more deigned solutions and/or artifacts
	Design in computing can be more efficient through reuse: libraries of code are available to solve recurring problems. Doing this well relies on analyzing computational work.
	Breaking problems down requires working at multiple levels of detail, recognizing patterns, and working

on relating entities of processes.

Findings

Exploring Computer Science

ECC	
EUS	

Unit 1: Human Computer Interaction	Students an object
Unit 2: Problem Solving	Students the tradeo algorithm problem
Unit 3: Web Design	Students abstraction content of and deve
Unit 4: Introduction to Programming	Students debuggin in terms of problem of

We can Re-interpret the Framework's Science & **Engineering Practices as CT Practices**

Engineering Practices	CS/CT Practices	Notes
 Asking questions (for science) and defining problems (for engineering) 	Analyzing the Effects of Developments in Computing Connecting Computation with Other Disciplines	 have to understand problems to which computing can be applied in order to define problems and solve them responsibly. have to be able to see how problems in other domains can be solved computationally.
4. Analyzing and interpreting data	Analyzing their Computational Work & the Work of Others	Reusing code involves such exploration. "Data" can include data produced by computation. Computing emphasizes testing, debugging, and critical thinking about the limits of computing
6. Constructing explanations (for science) and designing solutions (for engineering)	Designing and Implementing Creative Solutions and Artifacts Analyzing their Computational Work & the Work of Others	Reusing code involves such exploration. "Data" can include data produced by computation. Computing emphasizes testing, debugging, and critical thinking about the limits of computing

Marie Bienkowski Daisy Rutstein Eric Snow

Sample Abilities Mapped to Practices

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are able to explain why is or is not a computer

are able to compare eoffs between different ns for solving the same

are able to apply on to separate style from during web page design elopment

are able to evaluate ng and testing methods of how they relate to the or program

Computational **Thinking Practice**

Analyze the effects of developments in computing.

Design and implement creative solutions and artifacts.

Apply abstractions and models.

Apply abstractions and models.