

Think Differently! Infusing Computer Science Concepts into the Business Classroom

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Agenda

What is Computer Science?

What are the South Carolina Computer Science Curriculum Strands?

What is Computational Thinking?

How do Computer Science Skills Relate to Your Core Content?

Look at and Discuss Computer Science Standards and how they can be Infused into your Course(s)



What is Computer Science?

ACTIVITY

- Close your eyes
- When you hear the phrase "computer science"
- What image comes to mind?
- What words come to mind?

Write or draw on the index card your thoughts about computer science



Definition of Computer Science

Computer science is "the study of computers and algorithmic processes, including their principles, their hardware and software designs, their applications, and their impact on society"

"Computer science is often confused with the everyday use of computers, such as learning how to use the Internet and create digital presentations. The focus is generally on "using computer technologies rather than understanding why they work and how to create those technologies."

"Knowing why and how computers work, provides the basis for a deep understanding of computer use and the relevant rights, responsibilities, and applications. This is computer science."



Definition of Computer Science

It's like the difference between watching a movie and producing and directing the movie.



Why Computer Science?

Code.org has developed facts sheets based on statistics in each state. Read the SC fact sheet. <u>https://code.org/advocacy/state-facts/SC.pdf</u>.

Read the vision for the CS framework <u>https://k12cs.org/a-vision-for-k-12-computer-science/</u>

Read the Google SC fact sheet <u>http://services.google.com/fh/files/misc/cs-edu-state-reports-2017.pdf</u>



Why Computer Science?

Activity: Sticky Notes

Write 3 things that surprise you about the current view of computer science

Write 2 things that you can do in your classroom to support the vision of the CS framework

Write 1 thing that you think you could do in your classroom to make students more aware of computer science as a career pathway



South Carolina Computer Science Standards

<u>K-8</u>

<u>9-12</u> Draft

South Carolina Computer Science Standards (K-8)	CS Framework K12CS (K-12)	CSTA Standards (K-12)
Digital Literacy		
Computing Systems	Computing Systems	Computing Practice and Programming
Networks and the	Networks and the	Computer and
Internet	Internet	Communication Devices
Data and Analysis	Data and Analysis	
Impact of Computing	Impacts of Computing	Community, Global, and Ethical Impacts
Algorithms and Programming (3 – 8)	Algorithms and Programming	Computational Thinking
		Collaboration



In the new 9-12 curriculum draft, Digital Literacy

has been taken

out, and woven into the other

strands as needed

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Computer Science Related to your Course(s)

What are some of the skill-sets that are common in all CATE courses?

- Ethics
- Careers
- Use of Technology
- Safety
- Professionalism and Employability Skills
- Professional Knowledge
- Communication
- Collaboration

As we look at lesson ideas shortly, think about how these skill-sets can be taught through computer science activities.

Computational Thinking

Computational thinking

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Computational Thinking

The thought processes involved in expressing solutions as computational steps, or algorithms that can be carried out by a computer.

(Cuny, Snyder, & Wing, 2010; Aho, 2011; Lee, 2016).

Computational Thinking

- Uses thinking patterns and processes to solve problems.
- Is a problem-solving process that involves designing solutions that capitalize on the power of computers.
- Refers to the attitudes and skills a person needs to persist in posing and solving problems.



Computational Thinking Applied to Computer Science

Computers require people to **express their thinking in a formal structure,** such as a programming language.

Creating a program allows people to **externalize their thoughts in a form that can be manipulated and scrutinized.**

Programming **allows students to think about their thinking;** by debugging a program, students debug their own thinking (Papert, 1980)

The assessment of computational thinking can be improved by having students **explain their decisions and development process** (Brennan & Resnick, 2012).



Computational Thinking

New Words!



say it with me: De-com-pose Break a problem down into smaller pieces

Pattern Matching

say it with me Pat-ern Mat-ching Finding similarities between things



Say it with me: Ab-strac-shun

Pulling out specific differences to make one solution work for multiple problems



Say it with me: Al-go-ri-thm

A list of steps that you can follow to finish a task

How are you already doing this in your courses?





https://www.amazon.c om/gp/product/15063 41284/ref=oh_aui_det ailpage_o01_s00?ie= UTF8&psc=1

Computational Thinking- Activity

Decomposition- Taking a large problem and breaking it down into smaller, more

manageable parts

Problem: How do I solve this

Sudoku puzzle?

At your table break down the steps to be able to solve the puzzle. Write them out.

	3	4	
4			2
1			3
	2	1	



Computational Thinking- Activity

Pattern Recognition: Finding similarities between sets of information which may help inform how you solve different problems in the future

Are there patterns in the steps you identified? How does that pattern help you solve the puzzle?





Computational Thinking- Activity

Abstraction: Focusing on the important details in order to find a solution that works in multiple situations.

If we changed the numbers, what details would you need to know in order to still solve the problem?

	3	4	
4			2
1			3
	2	1	



Computational Thinking- Activity

Algorithms: Developing step by step

instructions or the rules to follow when

solving a problem

Are your directions clear? Send them to another table for your colleagues to test.

What steps are unclear?

	4	3	
2			4
3			1
	1	2	



Computing Systems Activities



How can you use this idea in your classroom?

What common CATE skill-sets can be applied to this activity?

Computing Systems

HS1.CS.1.1 Analyze the **impact that computing devices have in real-world settings** (e.g., **traffic lights**, **medical devices**, facial recognition).

Healthcare:

https://www.addondata.com/2018/02/5-key-benefits-computer-wheels-cow-healthcare-hospitals/ https://www.ncbi.nlm.nih.gov/pmc/articles/PMC344572/ Traffic Control/ Law Enforcement: https://qz.com/385629/the-intelligent-technology-behind-traffic-lights/ The Role of Technology in Marketing: https://www.forbes.com/sites/johnkoetsier/2017/12/15/top-10-most-transformative-technologies-for-marketing-in-2018-350-cmo s-ceos-experts-speak/#7202a1d0564d

- Prepare a report or PSA about the importance of this technology
- Write an article for a newspaper or blog day in the life without this piece of technology
- Compare and contrast the same real world settings in different countries (ie: traffic flow, healthcare)



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Computing Systems

HS3.CS.1.1 Recommend modifications for existing computing devices to improve functionality for end users

Take this idea one step further and determine:

WHO are the end users?

WHAT functions does the current technology allow us to do or HOW does this technology affect our job performance?

WHAT are the functions we would like be able to do with this technology or WHY do we want to improve functionality?

WHAT modifications would help the end users have a better experience?

Make recommendations for modifications that are an improvement over the current system

- Shark Tank that explains why this new version is better than the older one
- Debate- current system vs. making modifications (cost, training, etc.)
- Project management- how would you train users on this new device?



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Computing Systems

HS3.CS.2.1 Solve common computer malfunctions or describe the problem accurately so that others can solve it.

- Create a problem in your content area, and walk student through how you would solve it. Analyze if they were able to accurately describe or solve the problem
 - The CEO is embezzling money
 - Your company delivered the wrong item to a customer
 - Your employee has not shown up for work in 3 days
- Then: Create opportunities for students to be exposed to common computer problems (Involve your tech team if needed). Have them determine what the problem is and write out the steps to describe or solve it.
 - The projector or computer won't turn on
 - Flash player is not working so your video can't be displayed
 - Your computer is not connected to the internet
- Have students use a piece of technology equipment in their field and make note of problems or troubleshooting needs



Networks and the Internet Activities



How can you use this idea in your classroom?

What common CATE skill-sets can be applied to this activity?

Networks and the Internet

HS2.NI.2.1 **Evaluate how sensitive data can be affected by malware and other attacks** (e.g., denial-of-service attacks, ransomware, viruses, worms, spyware, phishing) (CSTA, 2017).

Activity Ideas:

The FTC is a great resource for information on how malware and other attacks happen and to find advice on how to mitigate these issues. <u>https://www.ftc.gov/</u>

- Visit the FTC website and look at the most recent news articles or blog posts to see how companies are fighting back against malware
- Look at the Tips and Advice menu to find valuable information about how you can protect yourself.
- Look at the Video and Media site to understand how you can be exploited. https://www.consumer.ftc.gov/media
- Determine in your field, how you can help protect yourselves and others from attacks



How can you use this idea in your classroom?

What common CATE skill-sets can be applied to this activity?

Networks and the Internet

HS3.NI.2.1 **Research security measures** (i.e., hardware, software and practices that control access to data and systems) **to combat a variety of cybersecurity vulnerabilities** (CSTA, 2017).

Cyber Definitions

- https://ccdcoe.org/cyber-definitions.html
- https://www.pbs.org/newshour/nation/hacktivists-launch-cyberattacks-local-state-governments

List of threats and vulnerabilities from Kaspersky

- https://threats.kaspersky.com/en/threat/
- https://threats.kaspersky.com/en/vulnerability/

Let's look at some types of attacks

- https://heimdalsecurity.com/blog/cyber-attack/
- https://www.getcybersafe.gc.ca/cnt/rsks/cmmn-thrts-en.aspx



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2018 Cyber attack timeline

- https://www.hackmageddon.com/2018-master-table/
- https://www.hackmageddon.com/category/security/cyber-attacks-statistics/

Attack Maps

- https://threatmap.checkpoint.com/ThreatPortal/livemap.html
- https://www.fireeye.com/cyber-map/threat-map.html



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Networks and the Internet

HS3.NI.2.1 **Research security measures** (i.e., hardware, software and practices that control access to data and systems) **to combat a variety of cybersecurity vulnerabilities** (CSTA, 2017).

Activity Ideas:

Thinking about your content area, what are some vulnerabilities you might face in your future employment? How can you protect yourself and others from these vulnerabilities?

- Create a Poster that can be hung in each office to help users learn how to protect themselves.
- Create a PSA warning of cybersecurity vulnerabilities
- Create a brochure that explains to customers how your products, services, or practices are protecting their interests and information

You can order FREE materials from the FTC to share with students and their families. They do have Spanish versions of many materials as well. <u>https://www.bulkorder.ftc.gov/</u>



Data and Analysis Activities



How can you use this idea in your classroom?

What common CATE skill-sets can be applied to this activity?

Data and Analysis

HS1.DA.1.1 Describe the various data collection methods, data analysis tools, and data representation tools.

Activity Ideas:

What are some simple ways that we collect data through observation?

- Describe Everyday Objects- Students are given an everyday object that is hidden to their partner. They have to describe various attributes of the object to see if their partner can determine what the object is. Can those objects then be sorted or categorized by different attributes?
- Create Spreadsheets that contain data related to your course of study
 - Collect and organize data into rows and columns (data collection)
 - Analyze data (conditional formatting, sum, average, etc) (data analysis)
 - Create charts or pivot tables from the data (data representation) <u>https://www.gcflearnfree.org/excel2016/</u>



How can you use this idea in your classroom?

What common CATE skill-sets can be applied to this activity?

Data and Analysis

HS2.DA.2.1 Compare and contrast data sets that could be used to explore a real-world phenomenon or support a claim.

Activity Ideas:

• Choose ideas that match your curriculum and look for data sets that help support and idea or further explore an important topic that is necessary for students to understand.

The Census Bureau is one place to look large sets of data https://www.census.gov/data.html https://www.census.gov/library/publications/2017/demo/p60-260.html World Bank Data https://data.worldbank.org/ Our World in Data https://ourworldindata.org/ CIA World Factbook https://www.cia.gov/library/publications/the-world-factbook/



Algorithms and Programming Activities



How can you use this idea in your classroom?

What common CATE skill-sets can be applied to this activity?

Algorithms and Programming

HS1.AP.1.1 Create flowcharts and/or pseudocode to express a problem or idea as an algorithm. Pseudocode Example (free trial)- <u>https://study.com/academy/lesson/pseudocode-definition-examples-quiz.html</u>

- Create a flowchart that symbolizes the tasks in order that you need to complete for a job • or project. https://technovationchallenge.org/curriculum/code-6/
- Create a mad libs game that relates to your content area and use pseudocode to show how • you would fill in the blanks. <u>https://www.youtube.com/watch?v=IIpArSmezAA</u>



How can you use this idea in your classroom?

What common CATE skill-sets can be applied to this activity?

Algorithms and Programming

HS1.AP.1.1 Create flowcharts and/or pseudocode to express a problem or idea as an algorithm.

Activity Ideas:

 Create an art project or create a layout using pseudocode to explain the color, size, and placement of objects <u>http://pseudo-code.org/</u>



1	//background set the background to light blue
0 4 ID 6	//sun draw circle coordinates 0 0
7 8 9	color gold border weight 0.1 draw triangle
11 12 13	coordinates 10, 120, 40, 114, 30, 160 color gold border weight 0.1
14 15 16	draw triangle coordinates 90, 80, 70, 100, 100, 120 color gold border weight 0,1
17 18 19 20 21	draw triangle coordinates 110, 25, 100, 60, 150, 50 color gold border weight 0.1
22 23 24 25 26	//grass draw rectangle coordinates 0 445 width 800
27 28 29 30	height 5 color <u>gaddlebrown</u> border weight 0.1 draw rectangle coordinates 0 440
32	width 800



Impacts of Computing Activities



How can you use this idea in your classroom?

What common CATE skill-sets can be applied to this activity?

Impacts of Computing

HS1.IC.1.1 Research computing solutions to problems in different countries, considering the personal, ethical, social, economic, and cultural impact (e.g., the use of drones to deliver blood and medical supplies in countries in Africa, the use of Uber in India to address traffic congestion).

Activity Ideas:

• Research computing problems as they relate to your field of study

The use of drones around the world to solve problems. Medical- Drone delivery in Africa- <u>http://money.cnn.com/2017/08/24/technology/east-africa-drones/index.html</u> Drones in Tanzania-

http://www.flyzipline.com/uploads/Tanzania%20Announcement%20Press%20Release%20vFinal.pdf Drones to survey riverbanks-

http://www.akbizmag.com/Alaska-Business-Monthly/January-2018/Welcome-to-the-Drone-Age/ Drones in the construction industry- https://www.dartdrones.com/blog/flying-construction-drones/



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Impacts of Computing

HS3.IC.1.2 **Research how computing is used in non-traditional computer science careers** (e.g., sensors on soldiers' or firefighters' uniforms, robots to detect and diffuse explosive devices).

- Determine what technological equipment will be available in careers in the future <u>https://interestingengineering.com/technological-advances-take-firefighting-next-level</u>
- Create a poster, website, brochure, etc. that illustrates one of these pieces of equipment
- If you are a supervisor, determine how implementing these items would affect your budget
- Determine how you would market this item to a small town or small business
- Create a presentation to share with the Board of Directors explaining the need for this product



Impacts of Computing

HS2.IC.2.2 Define and visually display students' digital footprint.

Activity Ideas:

• Have students create a paper footprint or use a word cloud generator to display their digital footprint based on your parameters. Relate their footprint to making positive statements about their future career goals.

Example: <u>https://docs.google.com/document/d/1DnEkkzj14hCh5ShNpoh6r6EoRBRKktucZ570_kWLQas/edit</u>

Turn and Talk: Which computational thinking strand(s) does this meet?

How can you use this idea in your classroom?

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How can you use this idea in your classroom?

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Impacts of Computing

HS1.IC.2.1 Select the most appropriate means of communication for given situations (e.g., personal versus professional communication, communication with teachers and employers)

- Give students scenarios that they need to respond to in writing to help them learn the most appropriate means of communication when:
 - Applying for a job
 - Following up after a job interview
 - Discussing a problem with a boss
 - Communicating with a colleague about a project who works in another state (videoconferencing?)



Contact Information

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