Data and Analysis

Competency

Educator designs integrated learning experiences for students to use multiple data sets to generate, store, transform, and/or analyze data.

Key Method

The educator designs units with a culminating activity or assessment to determine students' understanding of essential vocabulary and key concepts in data and analysis.

Method Components

What is Computer Science?

Computer science moves beyond using technology tools toward an understanding of how they work and ultimately designing new solutions to enduring human problems. Despite common misperceptions, computer science is not simply programming. Like any scientific discipline, computer science consists of a body of knowledge that informs how people understand and perceive the world around them, as well as practices for exploration, creation, and experimentation. Programming, defined as giving computers instructions to follow, is a practice used in computer science. The field itself is much broader, much as biology is not simply conducting lab experiments.

Why Should Students Learn Computer Science?

- Over 70% of jobs in STEM are actually computing jobs, and most of the others use computer science as a core part of the job.
- Many future jobs and opportunities will require knowledge and skills in the area of computer science. Therefore, students need multiple opportunities to use computer science to explore and understand the world.

- Even a student who does not end up programming in their job will still need to understand the central principles of how data, networking, the Internet, and cybersecurity impact the lives of people in their families and communities.
- Students need to know that when they use a free social media platform, their data can be shared with anyone.
- All of the strands of computer science have drastic impacts on how we live our lives,
- Understanding the basic principles of computer science influences how students will interact with the world around them.

What is Data and Analysis?

Data analysis is the practice of working with data to glean useful information, which can then be used to make informed decisions.

The amount of digital data generated in the world is rapidly expanding, so the need to process data effectively is increasingly important. Data is collected and stored so that it can be analyzed to better understand the world and make more accurate predictions.

Big Ideas: Why Do Students Need Data and Analysis?

- Learning to analyze trends across data sets
- Using computing devices to generate data faster and perform more efficient calculations
- Data aggregations
- Life skill: students need to understand their data is collected and combined in ways most people are not aware of.

Essential Vocabulary by Grade Level

K-1	2-5	6-8	9-12
Data Table Graph	Prediction Data Model Artifact	Data Cleaning Simulation Parameter Input Output Computational-model Command Variable Firewall	Hardware Software (System & Application) Network (IoT) Hierarchy Network Packet Protocol Reliability Scalability IP Address

			Local Area Network (LAN) Router Server Switch Wide Area Network (WAN) Data Exploit Malware Virus Vulnerability Anti-X Software Cybersecurity Cyber Attack Data Vulnerability

Supporting Rationale and Research

Burgstahler, Sheryl. "Differentiating for Diversity: Using Universal Design for Learning in Elementary Computer Science Education." Universal Design: Implications for Computing Education, ACM Transactions on Computing Education, Oct. 2011, https://staff.washington.edu/sherylb/ud_computing.html

Honey, Margaret, et al. "STEM Integration in K–12 Education: Status, Prospects, and an Agenda for Research." The National Academies Press, National Academy of Engineering and National Research Council of The National Academies, 7 Feb. 2014, http://www.nap.edu/catalog/18612/stem-integration-in-k-12-education-status-prospects-and-an

Lewis, Colleen, and Niral Shah. "How Equity and Inequity Can Emerge in Pair Programming." Association for Computing Machinery, ICER '15 Proceedings of the Eleventh Annual International Conference on International Computing Education Research, July 2015, http://blogs.hmc.edu/lewis/wp-content/uploads/sites/2/2013/07/LewisShah2015_EquitySpeed.pdf

Lewis, Colleen M. "Good (and Bad) Reasons to Teach All Students Computer Science." SpringerLink, Springer, Cham, 1 Jan. 2017,

https://docs.google.com/document/d/1R57koI5El5B6jZQyZkmG4NY9MM4wwfJ13V13Yx4gWzw/edit#heading=h.gjdgxs

Resources

Bridging the Encouragement Gap in Computing | National Center for Women & Information Technology

Guide to Inclusive Computer Science Education: How educators can encourage and engage all students in computer science | National Center for Women & Information Technology

How Equity and Inequity Can Emerge in Pair Programming

Standards | Computer Science Teachers Association

STEM Integration in K-12 Education: Status, Prospects, and an Agenda for Research | The National Academies Press

Lessons

Big Data and Privacy

Binary Numbers

Digital Information

Submission Guidelines & Evaluation Criteria

To earn the micro-credential, you must receive a passing score in Parts 1 and 3 and receive a proficient for all components in Part 2.

Part 1. Overview Questions (Provides Context)

(250–500 words)

Please answer the following contextual questions to help our assessor understand your current situation. Please do not include any information that will make you identifiable to your reviewers.

1. Help us understand the context of computer science in your school and classroom. Is there a state or local mandate to include computer science instruction?

2. Why did you select the Data Analysis micro-credential, and what is your current level of comfort with incorporating computer science content and instruction into your core curriculum?
3. Describe the student population you serve (such as demographics, grade level, location, etc.) and how these students will benefit from your professional development in the Data Analysis micro-credential.
4. In the field of computer science, women and minorities are underrepresented. How will you intentionally differentiate instruction to engage and inspire underrepresented groups through the design of your unit?

Passing: Response provides accurate information that justifies the reason for choosing this micro-credential to address specific needs of both the teacher and the student. Educator includes a learning goal that describes what they hope to gain from earning this micro-credential. Specific details about how you will engage and inspire underrepresented minorities and girls are included.

Part 2. Work Examples/Artifacts/Evidence

To earn this micro-credential, please submit the following **three artifacts** as evidence of your learning. *Please do not include any information that will make you or your students identifiable to your reviewers*.

Artifact 1: Data Analysis Unit
Create two data analysis lessons that include all of the following components:

- CSTA Standards and/or State CS Standards addressed
- Learning outcomes
- Description of the lesson
- Data analysis key vocabulary
- How Bloom's Higher-Order Thinking or Computational Thinking skills are included
- How you will intentionally engage and inspire underrepresented minorities and females
- Description of how CS topic (data analysis) will be integrated
- How the learning will be evaluated/assessed

Artifact 2: Culminating Student Activity
Create a culminating activity to determine students' understanding of new computing systems knowledge. Your activity needs to include:

- A student evaluation tool/rubric
- Computer science goals
- Content goals
- A description of the lesson (150–250 words)

Artifact 3: Student work samples Upload two examples of student work from the activity above. You may choose from the following types of files to upload: • Image • Audio and/or video (30 sec–1 min clip) • Document

Part 2. Rubric

	Proficient	**Basic**	**Developing**
Artifact 1: Computing Systems Unit	Unit of two or more lessons that incorporate *all of* the following elements: CSTA Standards and/or State CS Standards addressed Learning outcomes Description of the lesson Computing systems key vocabulary How Bloom's Higher-Order Thinking or Computational Thinking skills are included Intentionally differentiated instruction to engage and inspire underrepresente	Lessons that incorporate *most of* the following elements: CSTA Standards and/or State CS Standards addressed Learning outcomes Description of the lesson Computing systems key vocabulary How Bloom's Higher-Order Thinking or Computational Thinking skills are included Intentionally differentiated instruction to engage and inspire underrepresented minorities and females	Lessons that incorporate *a few of* the following elements: CSTA Standards and/or State CS Standards addressed Learning outcomes Description of the lesson Computing systems key vocabulary How Bloom's Higher-Order Thinking or Computational Thinking skills are included Intentionally differentiated instruction to engage and inspire underrepresented minorities and females

	d minorities and females Description of how CS topic will be integrated How the learning will be evaluated/ assessed	Description of how CS topic will be integrated How the learning will be evaluated/ assessed	Description of how CS topic will be integrated How the learning will be evaluated/ assessed
Artifact 2: Culminating Student Activity	Activity includes all of the following: -A student evaluation tool/rubric -Computer science goals -Content goals -A description of the lesson (150–250 words)	Activity includes some of the following: -A student evaluation tool/rubric -Computer science goals -Content goals -A description of the lesson (150–250 words)	Activity is missing most of the following: -A student evaluation tool/rubric -Computer science goals -Content goals -A description of the lesson (150–250 words)
Artifact 3: Student Work Samples	Two examples of student work are uploaded Student work is from the culminating activity The student work shows understanding and application of the learning goals	Two examples of student work are uploaded Student work is not from the culminating activity but may be from another data analysis lesson The student work shows understanding and application of one of the learning goals	One example of student work is uploaded Student work is not from a lesson on data analysis The student work does not show understanding or application of the learning goals

Part 3. Reflection

250–500 words Use the word count as a guide to write a personal reflection about your work on this micro-credential. For tips on writing a good reflection review the following resource: [How Do I Write a Good Personal Reflection?]() *Please do not include any information that will make you identifiable to your reviewers.* 1. How did this micro-credential process influence how you make connections to the real world through teaching data analysis, and what did you find rewarding or enjoyable? 2. What was your process for intentionally choosing resources for this unit? 3. What other standards might you have integrated with computing systems across the curriculum, and how can you connect your instruction to career readiness in the future? 4. How did you address the needs of girls and underrepresented groups in your classroom, and how did they respond to your choices in the lesson? 5. In what ways did students engage with collaboration, communication, critical thinking, creativity, and citizenship through computer science instruction? 6. What challenges, if any, did you encounter during this micro-credential process, and how did you overcome them? **Passing:** Reflection provides evidence that this activity has had a positive impact on both educator practice and student success. Specific examples are cited directly from personal or work-related experiences to support claims. Also included are specific actionable steps that demonstrate how new learning will be integrated into future practice.