Foundations of Computer Science

Competency

Educator communicates what computer science is and how it is a tool to engage with universal human problems.

Key Method

The educator designs lessons that introduce the foundational elements of computer science in the classroom.

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 help them 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.

Foundational Elements of Computer Science

- computational thinking
- abstraction
- logic
- algorithms
- data representations

Supporting Rationale and Research

Aaronson, Leslie, and Jake Baskin. “Guide to Inclusive Computer Science Education: How Educators Can Encourage and Engage All Students in Computer Science.” National Center for Women & Information Technology, 22 May 2019, http://www.ncwit.org/resources/guide-inclusive-computer-science-education-how-educators-can-encourage-and-engage-all.

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, 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

Code.org Glossary for K-5

CS Glossary from Code.org for 6-9

K-12 Computer Science Field Report and Market Map: Sept 2017

Report | Age of Agility

Standards for CS Teachers

The Future of Jobs Report 2018 | World Economic Forum

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 to pursue the Foundations of Computer Science 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 Foundations of Computer Science micro-credential.
4. Identify at least one asset and one barrier you anticipate when applying the foundations of computer science to your classroom practice.
5. 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 lesson plans and/or artifacts?

Passing: Response provides reasonable and 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 **two 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: Intro to Computer Science Unit of Study
Write and teach a unit of study with five lessons. Each lesson should include all of the following:

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

Artifact 2: Annotated Student Work Samples
From the unit of study that you taught in Artifact 1, upload five annotated examples of student work from the unit you planned and taught. Annotate student work with notes about how each piece of work demonstrates the students' understanding of the standards and learning outcomes.

Part 2. Rubric

	Proficient	**Basic**	**Developing**
Artifact 1: Intro to Computer Science Unit of Study	Unit of five lessons that incorporate *all* the following elements: CSTA Standards and/or State CS Standards addressed Learning outcomes Description of the lesson How Bloom's Higher-Order Thinking or Computational Thinking skills are included Differentiated instruction to engage and inspire underrepresented minorities and females Description of how CS topic will be integrated How the learning will be evaluated/ assessed	Unit of five lessons that incorporate *some of* the following elements: CSTA Standards and/or State CS Standards addressed Learning outcomes Description of the lesson How Bloom's Higher-Order Thinking or Computational Thinking skills are included Differentiated instruction to engage and inspire underrepresented minorities and females Description of how CS topic will be integrated How the learning will be evaluated/ assessed	Unit of five lessons that incorporate *fewer than three of* the following elements: CSTA Standards and/or State CS Standards addressed Learning outcomes Description of the lesson How Bloom's Higher-Order Thinking or Computational Thinking skills are included Differentiated instruction to engage and inspire underrepresented minorities and females Description of how CS topic will be integrated How the learning will be evaluated/ assessed
Artifact 2: Computer Science Foundational	Five annotated examples of student work from the unit are uploaded	Fewer than five student samples are uploaded and/or	Fewer than three student work samples are uploaded

Elements Artifact	and Annotations explain how each piece of work demonstrates students' understanding of the standards and learning outcomes	Annotations are not related to standards and/or learning outcomes	and/or Annotations are missing

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 and computer science?
2. How might you integrate computer science across the curriculum?
3. How can you connect your instruction to career readiness?
4. How did you inspire and engage girls and underrepresented groups in computer science? Share at least one example from your classroom.
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.