**Computer Science Content Matrix: Grades 9-12**

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| **Content Area(s)** | [**CS Standards**](https://www.michigan.gov/documents/mde/CompSci_Standards_Accessible_Final_Draft_642640_7.pdf)  (focus on 9-10 Computer  Science standards) | [**CT Skills**](https://csteachers.org/documents/en-us/4f93dab1-1086-40fa-8b7c-6f604b4909f4/1/#page=10)  (connections to Computational Thinking) | **Online or Unplugged** | **Resource Link** |
| **Science, Mathematics** | **3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.  **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests. | **Decomposition**  **Pattern Recognition**  **Abstraction**  **Algorithm Design** | Part 1 Unplugged; Part 2 Online | [Modeling Projectile Motion using Computational Thinking](https://www.google.com/url?q=https://docs.google.com/document/d/1RpylcO7MyhaxRtebYM6Y60134yLMFXYqP3oOKwU1rp8/edit&sa=D&source=editors&ust=1615488053313000&usg=AOvVaw2lfLJmt502lbgBbpOAttiE): In this demonstration the teacher shows how a program can be used to simulate projectile motion. Students will begin to see how **decomposition**, **pattern recognition** and **abstraction** can be used to understand natural phenomena. At the end of this demonstration students should have a better understanding of projectile motion and begin to see how scientists use computational thinking to model complex phenomena. |
| **ELA, Social Studies** | **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-IC-26** Demonstrate ways a given algorithm applies to problems across disciplines.  **3A-IC-27** Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. | **Automating solutions through algorithmic thinking.**  **Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources.** | Unplugged | [Alternatives to the Civil War](https://csteachers.org/documents/en-us/4f93dab1-1086-40fa-8b7c-6f604b4909f4/1/#page=44): The causes of the war are disputed and thoughts often follow geographic divisions. In this unit, students will study the issue “What caused the U.S. Civil War” by imagining different courses that the two sides might have taken had key events been different. The students will construct the basic outline of an adventure game to show how the war might have been avoided or accelerated had different decisions or actions occurred earlier. |
| **ELA, Humanities, Mathematics, Social Studies, Environmental Science** | **3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena.  **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-IC-26** Demonstrate ways a given algorithm applies to problems across disciplines.  **3A-IC-27** Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. | **Formulating problems in a way that enables us to use a computer and other tools to help solve them.**  **Representing data through abstractions such as models and simulations.**  **Logically organizing and analyzing data.**  **Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources.** | Unplugged and optional online | [Traffic Jam](https://csteachers.org/documents/en-us/4f93dab1-1086-40fa-8b7c-6f604b4909f4/1/#page=50): In this activity, students use the situation of a traffic jam to represent relationships between different real-world variables. While working in groups, students propose changes in variables that can help make a solution more efficient. |
| **American Literature, Earth Science, Environmental Science, Government, Human Geography, Mathematics, US History, World Geography, World History** | **Suggested CS Standards:**  **3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena.  **3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process. | **Suggested CT Skills:**  **Data Collection**  **Data Analysis**  **Data Representation**  **Abstraction**  **Simulation** | Online | [GeoInquiries Collections](https://www.esri.com/en-us/industries/education/schools/geoinquiries-collections):GeoInquiries™ are short, standards-based inquiry activities for teaching map-based content found in commonly used textbooks. Each activity is designed using a common inquiry model and can be presented quickly from a single computer and projector or modified for students’ hands-on engagement. Collections of 15-20 activities per topic enhance your curriculum throughout the year. |
| **Physics, Chemistry for Kinetic Molecular Theory**  **Math and Science for other PhET Simulations** | **3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena.  **Suggested CS Standards for PhET Simulations:**  **3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena.  **3A-AP-17** Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.  **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-IC-26** Demonstrate ways a given algorithm applies to problems across disciplines.  **3A-IC-27** Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. | **Simulation**  **Data Collection**  **Abstraction**  **Data Representation**  **Other PhET Simulations may include:**   * **Data Analysis** * **Problem Decomposition** | Online | [Kinetic Molecular Theory - Introduction (inquiry-based)](https://phet.colorado.edu/en/contributions/view/2816) - This is an inquiry introduction to Kinetic Molecular theory for a physics class, but could be used in chemistry.  This activity comes from the collection of [PhET Simulations](https://phet.colorado.edu/en/simulations/filter?levels=high-school&type=html&sort=alpha&view=grid): The PhET Interactive Simulations project at the University of Colorado Boulder creates free interactive math and science simulations. PhET sims are based on extensive education [research](https://phet.colorado.edu/en/research) and engage students through an intuitive, game-like environment where students learn through exploration and discovery. Find math and science lessons and activities that incorporate computer science skills.  Note: To access lessons, educators will need to register for a free account. |
| **All Content Areas** | **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3B-AP-10** Use and adapt classic algorithms to solve computational problems. | **Algorithms & Procedures**  **Abstraction**  **Problem Decomposition** | Unplugged and optional online | [Bringing Algorithms to the Classroom](https://goopenmichigan.org/authoring/106-bringing-algorithms-into-the-classroom/view) This activity can be related to any content area. Teachers can use any relevant content that requires an algorithm (steps to complete a task)  Extension: This activity can easily incorporate the creation of a coding algorithm. |
| **ELA** | **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions. | **Abstraction**  **Algorithms & Procedures** | Unplugged (online with extension) | Code.org; [Abstraction with Mad Glibs](https://code.org/curriculum/course4/5/Teacher)  Extension - Educators are encouraged to extend this activity by having students create their own Mad Glibs game or app. Suggested tools: [Scratch](https://scratch.mit.edu/) or [App Lab](https://code.org/educate/applab) |
| **Physical science, Earth science, Life science, Health** | **3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena. | **Data Collection**  **Data Analysis**  **Data Representation**  **Simulation** | Unplugged and online | [Detecting Alpha, Beta, and Gamma Radiation](https://onedrive.live.com/redir?resid=D1EAAFC0BDFA320E%2110408&authkey=%21ADQX1r6V2sA3ybg&page=View&wd=target%28Overview.one%7C31abb3ac-a250-4611-b94d-a61021e12fa3%2FLab%20introduction%7C6206ad5b-dd5f-4d6e-952c-5254c8644300%2F%29) In this lesson, students measure the radiation in their environment and determine their own radiation exposure levels using a Vernier Go Direct® Radiation Monitor. Then, using a Power BI dashboard they learn about the astronauts’ radiation exposure on the space station and investigate the scale and extent of radiation in many different places. Next, they learn about alpha, beta, and gamma radiation and the current techniques used by NASA to protect astronauts on the space station. Then, they conduct investigations to measure the effectiveness of different radiation blocking materials. Finally, they  recommend the best material for protecting astronauts on future space missions. |
| **Art** | **3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions. | **Abstraction**  **Algorithm and Procedures** | Online | Generating Art with Code: [Teacher Guide](https://codehs.com/uploads/79b13314af2a9f532b1d8d43aa7fcd62) and [Student Activity](https://codehs.com/editor/playlist/video/969557/6639/4748?)  In this Hour of Code, students are introduced to the JavaScript block coding environment. They learn how to create a computer program that places images and text on a canvas to create their own meme. |
| **All Content Areas** | **3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.  (If extending this activity, it could involve more computer science standards, especially Algorithms & Programming and possibly Impacts of Computing) | **Algorithms and Procedures**  (if extending this activity, it could involve more computational thinking skills, such as Problem Decomposition, Data Collection, etc.) | Online | [App Lab](https://code.org/educate/applab): App Lab is a programming environment where you can make simple apps. Design an app, code in JavaScript with either blocks or text, then share your app in seconds. This activity can be extended to address other content area standards. There are resources to help show applications in other content areas, such as Starter Projects (flashcards, polls) that students can remix.  [App Lab Teacher Guide](https://curriculum.code.org/hoc/plugged/7/) |
| **All Content Areas** | **3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena. | **Data Analysis**  **Data Representation** | Online | [Google Trends](https://trends.google.com/trends/): Explore how Google data can be used to tell stories. This tool can be applied to many different content areas in regards to Data and Analysis. Below are some resources to assist with using Google Trends:  [Applications of Google Trends](https://www.fractuslearning.com/google-trends-explore-data-students/)  [Homepage and Top Trends explained](https://support.google.com/trends/answer/6248105?hl=en&ref_topic=6248052)  [FAQ about Google Trends data](https://support.google.com/trends/answer/4365533?hl=en) |
| **All Content Areas** | **3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena.  (if working collaboratively, 3A-IC-27 Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields) | **Data Analysis**  **Data Representation** | Online | [Canva](https://www.google.com/aclk?sa=l&ai=DChcSEwivl7roxq3wAhVWHq0GHRNmAnwYABAAGgJwdg&sig=AOD64_03REdOfYDaWLNie1EP-901t2PuiQ&q&adurl&ved=2ahUKEwjUgLToxq3wAhW4JzQIHdy-AfwQ0Qx6BAgDEAE): Canva is a graphic design platform, used to create social media graphics, presentations, posters, documents and other visual content. Canva is a good tool for creating infographics (a visual image such as a chart or diagram used to represent information or data. Infographics can be a useful assessment option for any content area.  [How do I support students to use Canva for Infographic Creation?](https://www.teachology.ca/knowledgebase/how-do-i-support-students-to-use-canva-for-infographic-creation/) |
| **All Content Areas** | **3A-DA-11** Create interactive data visualizations using software tools to help others better understand real-world phenomena.  **3A-AP-17** Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.  (if working collaboratively, 3A-IC-27 Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields) | **Decomposition**  **Data Representation** | Online | [Coggle](https://coggle.it/?lang=en-US): Coggle allows students to mind map. A mind map is a visual tool to help break down complex topics into smaller, more understandable chunks. They are great for sharing information, understanding complex topics, and lots more! This is another great assessment tool for any content area.  [What is Mind Mapping?](https://coggle.it/what-is-mindmapping)  [Using Coggle in a Classroom Setting](https://coggle.it/diagram/XfahsHDSoLdyg2lO/t/using-coggle-in-a-classroom-setting) |
| **ELA**  **All Content Areas for many of the CS First Activities** | **Suggested CS Standards:**  **3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.  **3A-AP-22** Design and develop computational artifacts working in team roles using collaborative tools.  **3A-IC-25** Test and refine computational artifacts to reduce bias and equity deficits | **Suggested CT Skills:**  **Data Representation**  **Abstraction**  **Problem Decomposition**  **Algorithms & Procedures** | Online | [Figurative Language](https://goopenmichigan.org/courses/cs-first-figurative-language): Students explore Figurative Language with an emphasis on metaphors, similes, personification, hyperbole, and idioms. This activity can be modified to complement ELA lessons regarding figurative language (see Materials -> Lesson Plan). This lesson is linked in [goopenmichigan.org](https://goopenmichigan.org/), but can also be found in the collection below.  [CS First Collection](https://csfirst.withgoogle.com/s/en/home): Students learn through video-based lessons, with different themes like sports, art, and game design. These activities can be modified for HS courses and all content areas. |
| **ELA (suggested** [**http://www.corestandards.org/ELA-Literacy/RL/9-10/6/**](http://www.corestandards.org/ELA-Literacy/RL/9-10/6/)**)** | **Suggested CS Standards**  **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.  **3A-IC-27** Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. | **Algorithms & Procedures**  **Problem Decomposition** | Online | [Google CS First: Narration:](https://docs.google.com/document/d/1pMRpW-pzr22SIL9JKRINQCiPWiVJMJlDCtR2sEFE47M/edit)  Students take an existing story and explore the first and third person point of view. |
| **Art** | **Suggested CS Standards**  **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions. | **Algorithms & Procedures** | Plugged/ Online | [Google CS First; ART](https://csfirst.withgoogle.com/c/cs-first/en/art/overview.html): Students create animations, interactive artwork, photograph filters, and other exciting, artistic projects using code.  [Lesson Plans](https://docs.google.com/document/d/1zkUnFUlPanbWUNsqaMkNlHpKkwM4jo7yPuWYXWK7U-k/edit)  Alternate Art option is the [**Artist section**](https://studio.code.org/s/artist) **of** [**Code.org**](https://code.org/) which is for beginners.More advanced students can explore different kinds of code art before deciding how to proceed. Here is an article to explain how one art teacher utilizes this resource: [Students Can Create a Work of Code Art](https://www.iste.org/explore/computer-science/students-can-create-work-code-art?utm_campaign=EdTekHub%20Lead%20Generation&utm_medium=email&_hsmi=125839136&_hsenc=p2ANqtz--nGbZYaDOu1ajxKisdjI-GnUIMU3-Pm9_BAUXUf1qOTDyGRayr0G0-dd3OaQt8e6dzAvgM68mWpSqGe29NBNMOwTn8Xg&utm_content=125839136&utm_source=hs_email).  Another Art Option is [Code.org - Code with Anna and Elsa](https://studio.code.org/s/frozen/lessons/1/levels/1) and this can also relate to mathematics (angles, rotations). |
| **Math and Other Content Areas** | **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests. | **Algorithms & Procedures** | Unplugged | [Searching Algorithms](https://classic.csunplugged.org/searching-algorithms/): Searching for a keyword or value is the basis of many computing applications, whether on an internet search engine or looking up a bank account balance.  This activity explores the main algorithms that are used as the basis for searching on computers, using different variations on the game of battleships.  Computers are often required to find information in large collections of data. They need to develop quick and efficient ways of doing this. This activity demonstrates three different search methods: linear searching, binary searching and hashing.  This activity can be a “starter” for addressing various problem-solving strategies in mathematics and other content areas.  [CS Unplugged Classic](https://classic.csunplugged.org/): Searching Algorithms is part of a larger collection of unplugged activities that address various computer science and computational thinking skills. |
| **Math, Science, and Health** | **3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process.  **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-IC-24** Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.  **3A-IC-27** Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. | **Data Analysis**  **Abstraction**  **Simulation** | Online | [Spread of Disease](http://www.shodor.org/interactivate/activities/SpreadofDisease/): an activity that engages students with the refinement of a computational model displaying the spread of disease to see which factors affect the spread more.  [Slow the Spread](https://docs.google.com/document/d/1POGDqq98TkWYTrXkRgoRNoPtn7Mv2PKa8BKg4UljUEA/edit): PBL starter in which students explore the spread of disease and create an app prototype to slow the spread of COVID-19 |
| **Fine Arts** | **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.  **3A-AP-17** Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.  **3A-IC-24** Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices. | **Algorithms & Procedures** | Online | [Coding in Music](https://codehs.com/editor/hoc/video/963996/6636/4747?) (activity) - Students explore how coding is used in music creation by building their own dynamic eight-count beats and patterns with JavaScript blocks! (Hour of Code Activity)  [Coding in Music](https://codehs.com/uploads/558659af4e9dbd0193030a66bac27881) (Teacher Notes) |
| **ELA, Mathematics** | **3A-AP-13** Create prototypes that use algorithms to solve computational problems by leveraging prior student knowledge and personal interests.  **3A-AP-16** Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue by using events to initiate instructions.  **3A-AP-17** Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects. | **Algorithms & Procedures** | Online | [Nasa Moon 2 Mars](https://www.tynker.com/hour-of-code/nasa-moon-2-mars) - explore NASA’s exciting new efforts to reach the Moon and then Mars. Students can design their own animated mission patch, imagine their life as an Artemis astronaut on the Lunar Gateway, take control of robotic rovers, and even create their own lunar habitat.This is designed to be a one hour activity  [Nasa Moon 2 Mars](https://www.tynker.com/hour-of-code/nasa-lunar-gateway-javascript-guide.pdf) (Teacher Guide) |
| **Science** | **3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process. | **Data Collection**  **Data Analysis** | Online | [Rabbits and Wolves](http://www.shodor.org/interactivate/activities/RabbitsAndWolves/) This activity allows the user to simulate how nature keeps its balance. This applet shows how wolves and rabbits would behave in their natural setting. |
| **Math and other Content Areas** | **Suggested CS Standards**  **3A-AP-21** Evaluate and refine computational artifacts to make them more usable and accessible.  **3A-IC-25** Test and refine computational artifacts to reduce bias and equity deficits**.**  **3A-IC-27** Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields. | **Algorithms & Procedures**  **Problem Decomposition** | Online | [Debug It!](https://docs.google.com/presentation/d/e/2PACX-1vQwM-cIkpKQlTxuZPUdd5o8CRDixmOU_FkcCwC0yBOWnrR4EMhKW50KIDWgS3dD6NumqdJKbd-UlU-y/pub?start=false&loop=false&delayms=3000&slide=id.g5c60e90489_0_0) This lesson uses Scratch to work with debugging. Have students work in groups to debug 2-3 of the situations. Next, provide students with 2-3 content appropriate examples to debug (i.e. 3 math problems that have errors). Finally, ask students to compare and contrast debugging in computer science and in the other content area.  NOTE: Here is a [link](https://docs.google.com/presentation/d/1R880lBzkm-HJC4wfQEaJcq8-lIS0qWO1LfD2xZXSkXA/copy) to make an editable copy of Debug It! |
| **Science and Other Content Areas** | **3A-DA-12** Create computational models that represent the relationships among different elements of data collected from a phenomenon or process. | **Simulation** | Online or Unplugged | [Simulating Experiments](https://curriculum.code.org/csf-19/coursef/10/) In this lesson, students simulate an experiment, collect data, identify trend patterns, and predict and test a hypothesis.  Here is the link to the [simulation](https://studio.code.org/s/coursef-2019/stage/10/puzzle/1).  With the discussion, this activity easily connects with a scientific or other content area simulation (This simulation used in this lesson is purposefully broad and kind of silly. Through this discussion, students should start to connect the predictions and variable changes with actual scientific hypotheses. From there you can encourage students to think about computational modeling or more authentic scenarios or experiments.)  NOTE: This activity can be done unplugged as a whole class.  Here is a link to OER (Open Educational Resources) Simulations and Virtual Labs that could be used to connect to science and other content areas: <https://libguides.mines.edu/oer/simulationslabs> |