IGNITE MY FUTURE

CURRICULUM CONNECTOR | MATHEMATICS

Computational thinking goes beyond computers

Computational thinking teaches students to apply strategies that computers use to solve real-world problems. The seven computational thinking strategies equip students with valuable problem-solving skills such as analyzing data in order to make inferences and breaking a problem down into manageable pieces. As a math educator, you know that these skills overlap with CCSS math practices. These engaging and fun standards-aligned resources give you the tools to integrate computational thinking into your math classroom.

Computational thinking strategies:

Collecting data—in order to solve a problem, you need to find the right information

Martian Impact Craters, from the Smithsonian

Collecting quantitative data about a phenomenon allows for mathematical problem solving. The Smithsonian National Air and Space Museum hosts a project called "Modification of Martian Impact Craters" that studies how craters on Mars change over time. Using measurements and angle data, students can use geometry and algebraic methods to determine volume of erosion and infill of craters over time. Other applications include lessons about diameter and radius of a circle, as well as dimensions and angles.

Connect to: Algebra, geometry, ratios

Analyze data—interpret data to find relationships, identify trends and predict outcomes

Create a Graph, by The National Center for Educational Statistics

Producing charts helps students visualize and communicate mathematical concepts and evaluate their calculations. National Center for Educational Statistics hosts a web page that allows users to create a variety of graph types by inputting data. The interface is user friendly and includes many visuals to help navigate the controls for making a graph or chart. Examples on the side tab and a "Create A Graph Tutorial" help users get started. Other resources also assist students in producing charts and evaluating the graphed results:

- Graphing Projects at Scratch (MIT)
- Math Simulations at PhET (University of Colorado Boulder)

Connect to: Statistics and probability, functions, dependent and independent variables

Decompose—solve a complicated problem by breaking it into smaller pieces

Math Riddles by Steve Miller (Williams College)

Breaking down information within the text of a mathematics word problem is key to finding a solution. Students decompose math riddles into smaller tasks on the way to solving the larger problem. These riddles can be sorted by difficulty level and by topic, including Algebra, Geometry, Probability, and Number Theory. Additional links provides suggestions for starter riddles, how to use riddles in school, a blog discussion, and accolades for those that have solved riddles.

Connect to: The number system, expressions and equations

Find more easy-to-implement resources to integrate computational thinking practices into your classroom by visiting **ignitemyfutureinschool.org**

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Find Patterns—identify themes and connections in order to simplify problems

Fractals Projects (New Mexico Tech University)

Identifying patterns often leads to explaining them using mathematical rules. This is true of phenomena from gravity to fractals. The Fractals Projects by the New Mexico Tech University for Science, Engineering and Research lists numerous types of fractals, with links to visuals, how each is created, data recording, and equations behind each fractal. Students connect patterns in the natural and designed world to mathematics as they apply rules and create fractals. Additional links on the right side of the page include background information, pedagogy, sample lessons, and further study.

Connect to: Geometry, exponents

Abstract—remove details to see the big picture

STEM On Demand (Johns Hopkins University)

Using an abstract concept to solve a new problem is the domain of invention. The website of the Applied Physics Lab at Johns Hopkins University contains a page dedicated to Science, Technology, Engineering, and Math (STEM), and connections to real world solutions. Students see how abstract ideas in mathematics are applied to real-world problems. The site makes connections between geometry and prosthetics, calculations of angular momentum and figure skaters or satellites, and speed and distance with sonar. Student see how math concepts are driving innovation through new applications and technological advancements. Additional links to activities, games and videos support content knowledge learned in the classroom.

Connect to: Geometry, irrational numbers, radical numbers

Build models—test, experiment and simulate to fix errors

PhET Interactive Simulations (University of Colorado Boulder)

Visualizations and simulations of mathematical models allow student to experiment, find and fix errors, and simulate real-life events using mathematics. The PhET Interactive Simulations website offers interactive models for math concepts and applications such as estimation, equations and their graphs, area, fractions and proportions, least-squares regression, and much more. Students can manipulate parts of the models and observe resulting quantitative and qualitative data that help to demonstrate principles of the modeled concept. Engage students in data-driven modeling by using simulations that support concept knowledge exploration and understanding.

Connect to: Modeling, functions, graphs, statistics and probability

Develop algorithms—step-by-step instructions on how to perform a task

The Sound of Sorting—Sorting Algorithms (Scratch by MIT)

Mathematical tasks such as sorting by some value are often made more efficient using an algorithm. In the Sound of Sorting—Sorting Algorithms, a program made in Scratch by MIT, a visual and audio representation demonstrates computer processes for sorting information. Multiple algorithms are shown. Students can infer the rules and sequence of steps being used for each algorithm, then click on "See Inside" to see the block coding behind the representation. Students can develop their own algorithm for sorting sounds and represent it visually and with sound, or can apply algorithmic thinking more broadly to develop a program in Scratch for math curricula currently under study, such as operations with fractions or percent, or solving for variables in functions or equations.

Connect to: Algorithms, expressions and equations, functions