Unplugged K - 8 Computer Science Enrichment Activities

Welcome.

After listening to your needs for instructional supports for the past couple of weeks, we've decided to provide CPS CS/technology teachers with weekly activities and lesson plans that focus on computational thinking skills for your K - 8 students.

We will be posting 1 lesson/plan activity per week, formatted so that you can drop the information as seamlessly as possible into the weekly remote learning templates that are on the Knowledge Center.

We know that many students do not have adequate technology in the home. We also know that many families have students from multiple grade bands. These activities are designed for **all** of our K - 8th grade students. Our hope is universal activities will take some strain off of parents (and you!). Students can work together at their own grade level to complete the projects, and we encourage older students to help their younger siblings.

Design features:

- Unplugged (Computer/technology may be used to distribute or collect completed work)
- English and Spanish translation
- K - 8th with appropriate modifications
- Meets the requirements of enrichment minutes for CS content area
- Standards and project goals included

Special thanks goes out to Joan Mendelson from Lorca elementary school for creating some of these unplugged activities and for the inspiration for the project!

As with all of our materials and projects, we welcome feedback and suggestions for how to improve on this work. Remember, iteration is our friend in Computer Science.

Stay safe and healthy,
The Office of Computer Science

Week 1 | *Kitchen Sort* | Link to files

Big Idea: Recognizing patterns and grouping objects are important skills for all age groups. They're also key parts of the Computer Science concept called abstraction. When using this activity with older students you can make connections to data science and data analysis. How we collect and sort data is extremely important in the story that our data will tell. Have fun!

K - 2 **Time:** 30 - 45 minutes • **MWF** | 10 minutes per day • **T/Th** | 15 minutes per day • **1-day** | 30 minute block **Modifications:** Students can draw (rather than write) items and categories	**Standards** **CSTA** **K-2** | *1A-DA-06* | Collect and represent data in various visual formats/Abstraction **Common Core Mathematics** **K |** *Goal 8* | Identify and describe common attributes, patterns, and relationships in objects. **1 - 2 |** *CCSS. Math. Practice.MP7* | Look for and make sure of structure.
3 - 5 **Time:** 60 - 75 minutes • **MWF** | 20 minutes per day • **T/Th** | 30 minutes per day • **1-day** | 60 minute block **Modifications:** Differentiate by changing the number of items per category and the number of categories required.	**Standards** **CSTA** *1B-DA-07* | Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea. Abstraction/Communication **Common Core Mathematics** *CCSS. Math. Practice.MP7* | Look for and make sure of structure.
6 - 8 **Time:** 90 minutes • **MWF** | 30 minutes per day. • **T/Th** | 45 minutes per day. • **1-day** | 90 minute block **Modifications:** Differentiate by changing the number of items per category and the number of categories required. Have students draw a graph to visualize something from the data.	**Standards** **CSTA** *2-DA-07* | Represent data using multiple encoding schemes/Abstraction **Common Core Mathematics** *CCSS. Math. Practice.MP7* | Look for and make sure of structure.

Week 2 | *Algorithms* | Link to Files

Big Idea: Breaking down tasks into discrete steps is an example of an important concept in Computer Science called **decomposition**. Decompomposing a task into smaller sets of instructions is a key step in writing an algorithm so that a computer can accomplish that task. Decomposing problems and writing algorithms are important skills for all age groups. When using this activity with older students you can ask them to have someone else "act-out" the algorithm and then write about how they needed to correct or iterate on their original algorithm. Have fun!

K - 2 **Time:** 30 - 45 minutes • **MWF |** 10 minutes per day • **T/Th |** 15 minutes per day • **1-day |** 30 minute block **Modifications:** Students can draw (rather than write) items and categories	**Standards:** **CSTA** *1A-AP-08* | Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. **Common Core Mathematics** **K |** *Goal 4* | Model with Mathematics. **1 - 2 |** *CCSS. Math. Practice.MP4* | Model with Mathematics.
3 - 5 **Time:** 60 - 75 minutes • **MWF** | 20 minutes per day • **T/Th** | 30 minutes per day • **1-day** | 60 minute block **Modifications:** Differentiate by changing the number of steps students need to complete the task.	**Standards:** **CSTA** *1B-AP-11* | Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. **Common Core Mathematics** *CCSS. Math. Practice.MP4* | Model with Mathematics.
6 - 8 **Time:** 90 minutes • **MWF** | 30 minutes per day. • **T/Th** | 45 minutes per day. • **1-day** | 90 minute block **Modifications:** Differentiate by changing the number of steps students need to complete the task and how many iterations of the algorithm you ask them to create.	**Standards:** **CSTA** *2-AP-13* | Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs. **Common Core Mathematics** *CCSS. Math. Practice.MP4* | Model with Mathematics.

Week 3 | *Variables* | Link to Files

Big Idea: Computers use variables to store information that programs and applications use in order to do what we want them to. Programs use variables to store information such as the size, color, and location of objects, as well as count iteration of loops in a program. Our computational thinking concept is abstraction: removing distracting details and using a symbol or label to represent an idea. In this activity we will use variables to store information for our mad libs. Have fun!

K - 2 **Time:** 30 - 45 minutes • **MWF |** 10 minutes per day • **T/Th |** 15 minutes per day • **1-day |** 30 minute block **Modifications:** Students can draw (rather than write) in the variables.	**Standards:** **CSTA** *1A-AP-09*	Model the way programs store and manipulate data by using numbers or other symbols to represent information. **Common Core English Language Arts** **K |** *Goal 4*	Craft and Structure. **1 - 2 |** *CCSS.ELA-LITERACY.CCRA.R.4*	Craft and Structure.
3 - 5 **Time:** 60 - 75 minutes • **MWF**	20 minutes per day • **T/Th**	30 minutes per day • **1-day**	60 minute block **Modifications:** Differentiate by changing the length of the stories that students create.	**Standards:** **CSTA** *1B-AP-09*	Create programs that use variables to store and modify data. **Common Core English Language Arts** *CCSS.ELA-LITERACY.CCRA.R.4*	Craft and Structure.
6 - 8 **Time:** 90 minutes • **MWF**	30 minutes per day. • **T/Th**	45 minutes per day. • **1-day**	90 minute block **Modifications:** Differentiate by changing length of the stories that students create and the parts of speech that they must use as the variable.	**Standards:** **CSTA** *2-AP-11*	Create clearly named variables that represent different data types and perform operations on their values. **Common Core English Language Arts** *CCSS.ELA-LITERACY.CCRA.R.4*	Craft and Structure.

Week 4 | *Binary Numbers* | Link to Files

Big Idea: Computers send, receive and store information using the Binary System. We understand this to be Base 2. The computational thinking concepts in this activity include identifying patterns and abstraction as use symbols to represent ideas. In this activity students will identify binary patterns and for older students use patterns to convert from binary to decimal. Have fun!

K - 2 **Time:** 30 - 45 minutes • **MWF |** 10 minutes per day • **T/Th |** 15 minutes per day • **1-day |** 30 minute block **Modifications:** Change the number of instances of On/Off students need to find and represent (light, color, mechanical, etc.) Modify the skip counting activity for increased rigor.	**Standards:** **CSTA** *1A-AP-09* | Model the way programs store and manipulate data by using numbers or other symbols to represent information. **Common Core Mathematics** **K |** *Goal 4* | Craft and Structure. **1 - 2 |** *Practices:* 4 - Model with Mathematics 7 - Look for and make use of structure.
3 - 5 **Time:** 60 - 75 minutes • **MWF** | 20 minutes per day • **T/Th** | 30 minutes per day • **1-day** | 60 minute block **Modifications:** Change the number of conversions that you would like students to make. Make the binary number larger or smaller by increasing or decreasing the place value.	**Standards:** **CSTA** *1B-AP-09* | Create programs that use variables to store and modify data. **Common Core Mathematics** *Practices* | 4 - Model with Mathematics, 7 - Look for and make use of structure.
6 - 8 **Time:** 90 minutes • **MWF** | 30 minutes per day. • **T/Th** | 45 minutes per day. • **1-day** | 90 minute block **Modifications:** Change the number of conversions that you would like students to make. Make the binary number larger or smaller by increasing or decreasing the place value.	**Standards:** **CSTA** *2-DA-07* | Represent data using multiple encoding schemes. **Common Core Mathematics** *Practices* | 4 - Model with Mathematics, 7 - Look for and make use of structure.

Week 5 | *Pixels* | Link to Files

Big Idea: Computer screens are divided into a grid pattern. Every cell on the grid is called a pixel (short for "pixel element"). In modern computers, pixels are so tiny your eyes can't see them individually, but every pixel can change color when the computer tells it to. Images are displayed on your screen when your computer tells a specific group of pixels to turn certain colors. This means that the colors in images on your screen are arranged on a coordinate plane, or graph. The computational thinking concepts in this activity include identifying patterns, decomposing the image into pixels, and abstraction as we build our image using different schema to color the pixels. In this activity students will identify squares on a grid as either black or white squares to recreate an image using numbers. Have fun!

K - 2 **Time:** 30 - 45 minutes • **MWF	** 10 minutes per day • **T/Th	** 15 minutes per day • **1-day	** 30 minute block **Modifications:** You can create larger grids for students that have difficulty with hand-eye coordination.	**Standards:** **CSTA** *1A-AP-09*	Model the way programs store and manipulate data by using numbers or other symbols to represent information. **Common Core Mathematics** **K	** *Goal 4*	Craft and Structure. **1 - 2	** *Practices:* 4 - Model with
3 - 5 **Time:** 60 - 75 minutes • **MWF**	20 minutes per day • **T/Th**	30 minutes per day • **1-day**	60 minute block **Modifications:** Differentiate by changing the size of the grid or see K - 2 and have students create images by writing 0s and 1s on grid. (Note: Hidden image on worksheet is Saturn)	**Standards:** **CSTA** *1B-AP-09*	Create programs that use variables to store and modify data. **Common Core Mathematics** *Practices*	4 - Model with Mathematics, 7 - Look for and make use of structure.
6 - 8 **Time:** 90 minutes • **MWF**	30 minutes per day. • **T/Th**	45 minutes per day. • **1-day**	90 minute block **Modifications:** Differentiate by changing the size of the grid. Older students can create grayscale images or color images. Have them create their own unique code for identifying the color of the pixels. (Note: Hidden image on worksheet is Saturn)	**Standards:** **CSTA** *2-DA-07*| Represent data using multiple encoding schemes. **Common Core Mathematics** *Practices* | 4 - Model with Mathematics, 7 - Look for and make use of structure.

Week 6 | *Schedule Table* **|** Link to Files

Big Idea: Breaking down tasks into discrete steps is an example of an important concept in Computer Science called **decomposition**. Decompomposing a task into smaller sets of instructions is a key step in writing an algorithm so that a computer can accomplish that task. Decomposing problems and writing algorithms are important skills for all age groups. In this activity students will create a weekly schedule using rules and algorithms. Have fun!

K - 2 **Time:** 30 - 45 minutes • **MWF |** 10 minutes per day • **T/Th |** 15 minutes per day • **1-day |** 30 minute block **Modifications:** Students can draw (rather than write) their daily schedule.	**Standards:** **CSTA** *1A-AP-08* | Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. **Common Core Mathematics** **K |** *Goal 4* | Model with Mathematics. **1 - 2 |** *CCSS. Math. Practice.MP4* | Model with Mathematics.
3 - 5 **Time:** 60 - 75 minutes • **MWF** | 20 minutes per day • **T/Th** | 30 minutes per day • **1-day** | 60 minute block **Modifications:** Differentiate by changing the complexity of the weekly schedule, rather than the entire week, they can create Monday - Friday.	**Standards:** **CSTA** *1B-AP-11* | Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. **Common Core Mathematics** *CCSS. Math. Practice.MP4* | Model with Mathematics.
6 - 8 **Time:** 90 minutes • **MWF** | 30 minutes per day. • **T/Th** | 45 minutes per day. • **1-day** | 90 minute block **Modifications:** Differentiate by changing the complexity of the weekly schedule, rather than the entire week, they can create Monday - Friday.	**Standards:** **CSTA** *2-AP-13* | Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs. **Common Core Mathematics** *CCSS. Math. Practice.MP4* | Model with Mathematics.

Note: Thank you to Yazmin Romo from Dore Elementary for inspiring this activity. She found that her students needed to develop a schedule to keep them on task. She helped them create tables to track their daily schedule and activities. A little executive functioning with the CS.

Week 7 | *Abstraction* | Link to Files

Big Idea: Removing distracting details, or pulling out the most important ideas to manage complexity in a program is called **abstraction**. Abstraction is an important skill to understand in many disciplines. Computer scientists look for ways to abstract tasks in their programs so that one piece of code can solve multiple problems. In this activity students will experiment with abstraction to make a complicated image into a few simple shapes that communicates the same idea as the picture.

K - 2 **Time:** 30 - 45 minutes • **MWF |** 10 minutes per day • **T/Th |** 15 minutes per day • **1-day |** 30 minute block **Modifications:** Differentiate by having students can create abstractions that don't rely on shapes. Or, give students a new set of shapes to create a picture.	**Standards:** **CSTA** *1A-AP-09* | Model the way programs store and manipulate data by using numbers or other symbols to represent information. **Common Core English Language Arts** **K |** *Goal 4* | Key ideas and details. **1 - 2 |** *CCSS.ELA-LITERACY.RL.1.1* | Key ideas and details.
3 - 5 **Time:** 60 - 75 minutes • **MWF** | 20 minutes per day • **T/Th** | 30 minutes per day • **1-day** | 60 minute block **Modifications:** Differentiate by changing the number of shapes a student needs to use. Give the students other animal abstract challenges.	**Standards:** **CSTA** *2-AP-14* | Create procedures with parameters to organize code and make it easier to reuse.. **Common Core English Language Arts** *CCSS.ELA-LITERACY.RL.4.2* | Key ideas and details, summarize.
6 - 8 **Time:** 90 minutes • **MWF** | 30 minutes per day. • **T/Th** | 45 minutes per day. • **1-day** | 90 minute block **Modifications:** Differentiate by changing the number of shapes a student needs to use. Give the students other animal abstract challenges.	**Standards:** **CSTA** *2-AP-14*| Create procedures with parameters to organize code and make it easier to reuse. **Common Core English Language Arts** *CCSS.ELA-LITERACY.RL.6.2* | Key ideas and structure, summarization.

Week 8 | *Decomposition* | Link to Files

Big Idea: Breaking a problem down into smaller parts so that you can solve one part at a time is called **decomposition**. By decomposing a problem into smaller parts, and writing code to solve each smaller part individually, our programs become easier to write and debug: we get to check for errors in manageable chunks, instead of having to debug a long program all at once. Debugging is also a great skill to use in your everyday life! Breaking down big problems into smaller ones is helpful when we come up against a problem that's too big to solve in its entirety. In this activity students will decompose a problem in order to come up with an answer.

K - 2 **Time:** 30 - 45 minutes • **MWF |** 10 minutes per day • **T/Th |** 15 minutes per day • **1-day |** 30 minute block **Modifications:** Differentiate by having students determine if they can create a different number of sandwiches.	**Standards:** **CSTA** *1A-AP-08*	Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. **Common Core Mathematics** **K |** *Goal 4*	Model with Mathematics. **1 - 2 |** *CCSS. Math. Practice.MP4*	Model with Mathematics.
3 - 5 **Time:** 60 - 75 minutes • **MWF**	20 minutes per day • **T/Th**	30 minutes per day • **1-day**	60 minute block **Modifications:** Differentiate by having students determine if they can create a different number of sandwiches. Change the amount of ingredients available.	**Standards:** **CSTA** *1B-AP-11*	Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. **Common Core Mathematics** *CCSS. Math. Practice.MP4*	Model with Mathematics.
6 - 8 **Time:** 90 minutes • **MWF**	30 minutes per day. • **T/Th**	45 minutes per day. • **1-day**	90 minute block **Modifications:** Differentiate by having students change the various variables of time, amount of ingredients, etc.	**Standards:** **CSTA** *2-AP-13*	Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs. **Common Core Mathematics** *CCSS. Math. Practice.MP4*	Model with Mathematics.

Week 9 | *Digital Citizenship* **|** Link to Files

Big Idea: We are all living through unprecedented times. Over the last few months, you have provided your students with a safe place to learn and process a new reality. Over the summer our students will not have the safe classroom space that you established. These activities are designed to help your students develop tools to take care of themselves online, and cope with the content they encounter in the news and on social media.

K - 4 **Time:** 30 - 45 minutes • **MWF |** 10 minutes per day • **T/Th |** 15 minutes per day • **1-day |** 30 minute block **Modifications:** You know your students and what they need in the way of Social Emotional Learning.	**Standards:** **CSTA** *1A-1C-17*	Work respectfully and responsibly with others online. **Social Emotional Learning** Goal 1 *Develop self-awareness and self-management skills to achieve school and life success.* Goal 2 *Use social-awareness and interpersonal skills to establish and maintain positive relationships.* Goal 3 *Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.*

6 - 8 **Time:** 90 minutes • **MWF** | 30 minutes per day. • **T/Th** | 45 minutes per day. • **1-day** | 90 minute block **Modifications:** Differentiate by changing the number of items that students compare or the number of sources that they use.	**Standards** **CSTA** *2-DA-08* | Collect data using computational tools and transform the data to make it more useful and reliable. 2-1C-21 | Discuss issues of bias and accessibility in the design of existing technologies. **Social Emotional Learning** Goal 1 *Develop self-awareness and self-management skills to achieve school and life success.* Goal 2 *Use social-awareness and interpersonal skills to establish and maintain positive relationships.* Goal 3 *Demonstrate decision-making skills and responsible behaviors in personal, school, and community contexts.*