EXTENSION ACTIVITIES

Build upon the computer science and coding concepts in this year's Hour of Code 2021 (TimeCraft) and explore how computer science is part of our every day lives, from music and art to engineering and architecture.

These integrated computer science extension activities are a fun way to connect computer science to core subject areas.

Hour of Code 2021
Extension Activity #1
Big Band Jazz

Big Band Jazz

LESSON DESCRIPTION: In this lesson, students will explore the life of Louis Armstrong and his lasting influence on jazz music.

TOTAL TIME REQUIRED: 60 minutes

STANDARDS:

SL.3.2 Determine the main ideas and supporting details of a text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

RI.3.1 Ask and answer questions to demonstrate understanding of a text, referring explicitly to the text as the basis for the answers.

MU:Re7.1.3a Demonstrate and describe how selected music connects to and is influenced by specific interests, experiences, or purposes.

TEACHER PREPARATION:

- Gather sticky notes and pencils for student use (or create a digital format for the Introduction Activity).
- Have a device with Internet access and a projector system with audio to showcase the "Heebie Jeebies" song.
- Select a suggested resource about Louis Armstrong (video clip, read aloud, or article) that is appropriate to your students' reading/comprehension levels.
- Prepare the handout for independent work (i.e., physical copies or digital copies).

Lesson Overview:

In this lesson, students will learn about who was Louis Armstrong and his profound impact on jazz music. Students will explore his music style and discover what made him famous in the jazz scene. Students will have the opportunity to hear/read about his biography and capture the main idea and key details surrounding his life and his legacy in jazz.

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Identify Louis Armstrong as a jazz musician and vocalist
- Explain his unique contributions to the genre of jazz music
- Provide the main idea and key details after hearing/reading a biographical text

Hour of Code Connection

Oh no! There is a problem…

The great jazz musician has lost his beloved trumpet and sought out a new calling, the kazoo! Can you assist the musician in recovering his beloved trumpet and set him back on course to being one of the most influential musicians in big band jazz?!

Lesson Activities:

Introduction

Gather students together as a group. Ask students to consider their favorite musician. Provide each student with a sticky note to write down their favorite musician and have them write a brief response as to why this is their favorite musician (or you can collect this information in a digital format). Provide the opportunity for a couple of students to share to share out their responses.

After students have been able to share out their responses, pose the following questions to students:

- What are some different types of music?
- How/when did these music types become popular?
- What musician(s) is best known in that specific genre?
- Do you think these music genres were always popular?

Direct Instruction

We are going to explore a specific genre of music—jazz. More specifically, we are going to look at a musical pioneer in the jazz scene, Louis Armstrong. Louis Armstrong was Louis Armstrong is one of the best-known jazz musicians of all time. He was an exceptional trumpet player and vocalist who greatly influenced the future jazz musicians and was also the first jazz musician to popularize an improvised solo in the jazz band setting. He starred in more than thirty movies, played in Broadway musicals, and toured the world. Many of his songs are featured in TV shows and movies even today. Let's consider the following questions:

- What do musicians do in jazz music?
- When was jazz music created?
- How did Louis Armstrong improvise with the trumpet and voice?
- Do you know any other great musicians?

Guided Instruction

Louis Armstrong is known for popularizing "scat"—scat is singing rhythmic "nonsense syllables". During the recording of the song, "Heebie Jeebies", Louis dropped his lyric sheet. He resorted to singing nonsense syllables (i.e., scat) because he didn't have the words in front of him. This type of singing became known as scat. Let's listen to the song Heebie Jeebies together. While we listen to the song, let's see if we can identify when Louis uses real words for lyrics and then we he switches over to scat (nonsense syllables).

Recording of "Heebie Jeebies" can be found here: Louis' Music Class | National Museum of American History

Independent Work

Select the text below that corresponds with your appropriate age group.

Ages 6-7	Ages 8-10	Ages 11-13	Ages 14-18
Louis Armstrong Facts	Louis Armstrong	CommonLit	Louis Armstrong	The Man & His Life

Debrief the information read about in the selected resource. Have students record the main idea and key details within the graphic organizer handout.

Computer Science in Music

Engage students in a discussion to consider the unique ways computer science has impacted music.

- When do you think music and computers can work together?
- How is music stored on a computer?
- What do you need to hear music on a computer?
- Who created the original audio wave synthesis algorithm for Java 1.1?

Handout: Louis Armstrong

Describe Louis' early life.	Explain his main accomplishment(s) and what he is best known for.
List three words to describe Louis.	Explain the impact Louis had on jazz music.

LOUIS ARMSTONG

EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #2
Pyramids of Giza

Pyramids of Giza

LESSON DESCRIPTION: IN THIS LESSON, STUDENTS WILL EXPLORE THE GEOMETRIC SHAPES USED IN THE CONSTRUCTION OF THE PYRAMIDS.

TOTAL TIME REQUIRED: 45-60 MINUTES

STANDARDS:

United States	Australia	United Kingdom – England
3rd Grade- Mathematics (CCSS) Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals).	**Year 3- Mathematics** Make models of three-dimensional objects and describe key features (ACMMG063)	**Year 3 Programme of Study (Math)** Geometry Draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them

TEACHER PREPARATION:

- Find an image of the Great Pyramids of Giza and have the ability to project the image for students to view.
- Gather sticky notes and pencils for student use (or create a digital format for the Introduction Activity).
- Have a device with Internet access and a projector system with audio to play the video clip.
- Prepare the handout for independent work (i.e., physical copies or digital copies).

LESSON OVERVIEW:

In this lesson, students will learn about one of the seven wonders of the ancient world—the Great Pyramids of Giza! Students will define and describe a pyramid. Within small groups, students will try to construct a pyramid from tangible materials to see how the shape of the object affects their ability to build a pyramid. After the building challenge, students will also compare the Great Pyramids of Giza to other pyramids from around the world.

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Describe the defining attributes of the Great Pyramids of Giza
- Explore different structural features of pyramids from around the world

HOUR OF CODE CONNECTION

Oh no! There is a problem…

The lead designer of the Great Pyramids at Giza is obsessed with the geometry of cubes, but they need to design a secure structure that will last thousands of years to come. Can you assist the designer in defining the perfect shape for their megastructure?

Lesson Activities:

Introduction

Project an image of the Great Pyramids of Giza. Ask each student to provide a word or phrase that describes a pyramid. Depending on the age of your students, you can complete this activity by having students orally state their response and you recording the response on chart paper or the whiteboard; having students write their response on a sticky note, or having students complete this in a digital platform, such as word cloud generator. After students have had a chance to respond, share out the responses and find commonalities amongst the responses.

Direct Instruction

"Based on the activity we just completed, we agreed on certain attributes that describe a pyramid. A pyramid is a three-dimensional shape. The most commonly known pyramid has a polygon for a base and flat triangular faces, which join at a common point called the apex. The Great Pyramids of Giza have this same shape. Let's watch this video clip to find out some more information about the pyramids and other ancient innovations in Egypt."

Guided Instruction

Put students in small groups. Provide students with a tangible material you have available, such as plastic forks, small paper cups, pipe cleaners, straws, popsicle sticks, etc. You want to give anything EXCEPT something that is a cube shape.

Instruct them to build a pyramid using only the materials provided. Explain to students that they will have five minutes to build their structure. Emphasize to students that the pyramid can be built only from the materials provided and it must be able to stand on its own. As students work, visit each group to see what types of problems they are encountering and what type types of strategies they are using to construct their pyramids.

After five minutes, pose the following questions to students:

- Were you able to successfully create a pyramid?
- What was difficult about this challenge?
- How did the shape of your object affect your ability to build a pyramid?
- How did you and your group work together on this task?
- What type of skills did you use in this challenge—creativity, collaboration, critical thinking, communication?

After building with their assigned materials, then provide students with some kind of cube manipulative (wooden, foam, plastic, etc.). Have students try to rebuild a pyramid again using this shape (i.e., cubes). After students build their second pyramid, pose the following questions to students:

- Were you able to successfully create a model of a pyramid this time?
- What was creating this pyramid easier/more difficult than the first pyramid?
- Does your model look like the Great Pyramids?
- Is there anything you would change/add to your model to make it even better?

VIRTUAL/REMOTE LEARNING SUGGESTION

If you have students participating virtually, have students utilize this resource:
https://www.nms.ac.uk/includes/games/buildapyramid/index.html
In this virtual resource, students will be able to try out various conditions for building a pyramid.

Independent Work

Provide an opportunity for students to explore different kinds of pyramids. Although the Great Pyramids of Giza are the most well-known pyramids, they are not the only pyramids in the world. Have students research to find other examples of pyramids in the world. Students can record their findings on the handout provided.

Computer Science in Mathematics & Archaeology

Engage students in a discussion to consider the unique ways computer science has impacted mathematics and archaeology.

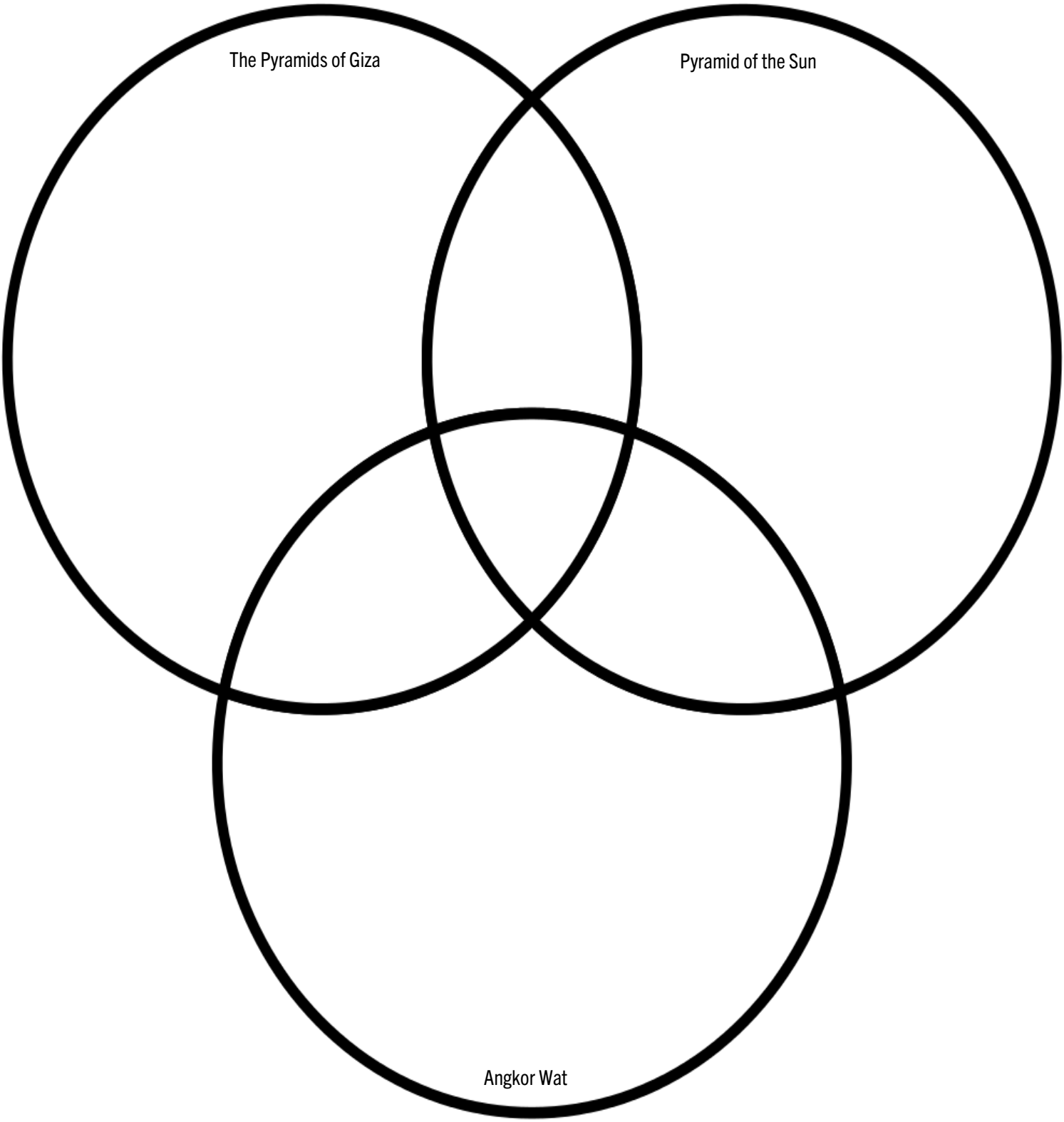
- What types of mathematical skills are used in architecture?
- How can architects use computers to help them design various structures?
- How do computers impact design principles?
- What are the benefits of using computers to design models?
- What are the limitations of computers designing models?

HANDOUT: THE GREAT PYRAMIDS OF GIZA

Research the following pyramids located around the world. Compare and contrast the pyramids—consider their physical shapes, materials they were constructed with, purpose of the structure, when they were built, etc.

The Great Pyramids of Giza Location: Egypt	
Pyramid of the Sun Location: Teotihuacan (modern day Mexico)	
Angkor Wat Location: Cambodia	

Use the 3-Circle Venn Diagram to compare the pyramids.



EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #3
Moon Mission

Moon Mission

LESSON DESCRIPTION: In this lesson, students will learn about Katherine Johnson and her remarkable accomplishments in the fields of mathematics, physics, aeronautical research, and computer science.

TOTAL TIME REQUIRED: 60 minutes

STANDARDS:

ADDITION + SUBTRACTION VERSION		
United States	**Australia**	**United Kingdom**
2nd Grade- Math (CCSS) 2.NBT.B.5 Fluently add and subtract within 100 using strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.	**Year 2- Math** Solve simple addition and subtraction problems using a range of efficient mental and written strategies (ACMNA030)	**Year 2 Programme of Study** Math Add and subtract numbers using concrete objects, pictorial representations, and mentally

MULTIPLICATION + DIVISION VERSION		
United States	**Australia**	**United Kingdom**
4th Grade- Math (CCSS) 4.NBT.B.5 Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. 4.NBT.B.6 Find whole-number quotients and remainders with up to four-digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	**Year 4- Math** Recall multiplication facts up to 10 × 10 and related division facts (ACMNA075)	**Year 4 Programme of Study** Math Multiply two-digit and three-digit numbers by a one-digit number using formal written layout

TEACHER PREPARATION:

- Gather sticky notes and pencils for student use (or create a digital format for the Introduction Activity).
- Have a device with Internet access and a projector system with audio to play the video clip.
- Prepare the handout for used both guided practice and independent work (i.e., physical copies or digital copies).

Lesson overview:

In this lesson, students will learn about one of the greatest mathematician and computer scientist—Katherine Johnson. Students will learn about how she became a critical asset to NASA, as she performed intricate calculations and trajectory analysis for space missions throughout her multiyear career at NASA. Students will have the opportunity to practice math calculations and create their own special messages for their peers to solve based on mathematics.

Learning objectives:

By the end of this lesson, the students will be able to:

- Describe the life of Katherine Johnson and her contributions
- Explain why Katherine Johnson was called a "human computer"

Hour of Code Connection

Oh no! There is a problem…

The Time Agent has struck again! The astronauts are about to land on the Moon, but the calculations are missing. The astronauts need your help—use the Minecraft Agent to deliver the calculations to help the astronauts successfully land on the Moon!

Lesson Activities:

Introduction

Post the following statement for students to view:

"***Math is all around us."***

Provide students with an opportunity to agree or disagree with this statement. Ask students to rationalize their response by providing evidence to support their thinking. Have students share out their responses.

Then further the discussion by creating a list of examples of how math is utilized in our everyday lives. The list can be created as a whole-group (the teacher can write the ideas down for everyone) or the list can be created independently/small groups and then compiled into one list after analyzing the responses.

Direct Instruction

"Based on the activity we just completed, we can collectively agree that mathematics is a critical part of our everyday lives. Whether it relates to time, money, personal information, or measurement, math is all around us. There is an important connection between mathematics and computer science. In computer science, we also use numbers in various ways. Numbers in computer science are data types. When create algorithms and develop programs, we often use numbers as a part of our program development. We are going to explore some of those ideas today. I am going to introduce you to one of the greatest American mathematicians—her name is Katherine Johnson. They often refer to Katherine and her colleagues as the 'human computers'—more specifically 'computers who wore skirts'. Let's start with learning about exactly who was Katherine Johnson in this video clip and her remarkable contributions."

Guided Instruction

Katherine Johnson was a pioneer in the field of mathematicians, aeronautical research, physics, and of course, computer science—even though the field of computer science was still in its early stages. Her calculations were done manually, as the "human computer". Today, you are going to practice some of your own math calculations. Before you begin your own calculations, let's look at some problems together (pass out the handout).

TEACHER NOTE: Depending on the age/grade level of your students, you may need to change the type of math problems presented. You want the math problems to be developmentally-appropriate and relevant to your content standards/curriculum.

Independent Work

Have students create a secret message for their peers to solve on the provided handout. Each letter of the alphabet will represent a specific number. Each letter within the secret message will have a corresponding math problem—once correctly calculated, the student will have a number that will corresponds with the special alphabet.

Computer Science in Space Programs

Engage students in a discussion to consider the unique ways computer science has impacted mathematics and our advancement in space.

- How powerful was the computer on board the Apollo space mission?
- How have computers shaped the space programs?
- Do you think the space program would have been possible without computers?

Additional Resources

NASA Modern Figures Toolkit
Human Computers
My Hero – Katherine Johnson

HANDOUT: MOON MISSION

CRACKING THE CODE: ADDITION + SUBTRACTION

Create a secret message for a partner to solve.
1. Decide on your secret message (can be a word or phrase).
2. Create a math problem for each letter in your secret message.
For example, if your secret message was the word, "cat"—you would need three different math problems; one for each letter in the word cat (since the word "cat" has three different letters of the alphabet).
3. In provided alphabet charts below, write the number that corresponds with each letter.

NOTE: You cannot have the same number for multiple letters—if the letter H and the letter Z are both the number 4, your partner will not be able to successfully solve the secret message.

A	B	C	D	E	F	G	H	I	J	K	L	M
14	1	6	4	21	16	10	22	7	12	18	29	40

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
30	9	2	11	15	5	23	17	8	20	13	32	3

PRACTICE PROBLEM #1:

_____	_____	_____	_____	_____
10 + 4 = _____	1 + 9 = _____	13 + 8 = _____	23 + 7 = _____	3 + 20 = _____

PRACTICE PROBLEM #2:

_____	_____	_____	_____	_____
16 - 15 = ____	2 + 5 = _____	13 - 4 = _____	33 + 7 = _____	30 - 9 = _____

HANDOUT: MOON MISSION

CRACKING THE CODE: MULTIPLICATION + DIVISION

Create a secret message for a partner to solve.
1. Decide on your secret message (can be a word or phrase).
2. Create a math problem for each letter in your secret message.
For example, if your secret message was the word, "cat"—you would need three different math problems; one for each letter in the word cat (since the word "cat" has three different letters of the alphabet).
3. In provided alphabet charts below, write the number that corresponds with each letter.

NOTE: You cannot have the same number for multiple letters—if the letter H and the letter Z are both the number 4, your partner will not be able to successfully solve the secret message.

A	B	C	D	E	F	G	H	I	J	K	L	M
18	10	1	3	8	13	25	21	12	17	23	24	6

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	5	11	4	16	15	20	14	2	7	22	19	9

PRACTICE PROBLEM #1:

_____	_____	_____	_____	_____
3 x 6 = _____	5 x 5 = _____	2 x 4 = _____	4 x 0 = _____	20 x 1 = _____

PRACTICE PROBLEM #2:

_____	_____	_____	_____	_____
60 ÷ 6 = ____	48 ÷ 4 = _____	15 ÷ 3 = _____	42 ÷ 7 = _____	24 ÷ 3 = _____

Use the space below to create your secret message. Feel free to use another piece of paper if you need more space.

A	B	C	D	E	F	G	H	I	J	K	L	M

N	O	P	Q	R	S	T	U	V	W	X	Y	Z

HANDOUT: MOON MISSION – ANSWER KEY

CRACKING THE CODE: ADDITION + SUBTRACTION

Create a secret message for a partner to solve.
1. Decide on your secret message (can be a word or phrase).
2. Create a math problem for each letter in your secret message.
For example, if your secret message was the word, "cat"—you would need three different math problems; one for each letter in the word cat (since the word "cat" has three different letters of the alphabet).
3. In provided alphabet charts below, write the number that corresponds with each letter.

NOTE: You cannot have the same number for multiple letters—if the letter H and the letter Z are both the number 4, your partner will not be able to successfully solve the secret message.

A	B	C	D	E	F	G	H	I	J	K	L	M
14	1	6	4	21	16	10	22	7	12	18	29	40

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
30	9	2	11	15	5	23	17	8	20	13	32	3

PRACTICE PROBLEM #1:

A	G	E	N	T
10 + 4 = 14	1 + 9 = 10	13 + 8 = 21	23 + 7 = 30	3 + 20 = 23

PRACTICE PROBLEM #2:

B	I	O	M	E
16 - 15 = 1	2 + 5 = 7	13 - 4 = 11	33 + 7 = 40	30 - 9 = 21

HANDOUT: MOON MISSION—ANSWER KEY

CRACKING THE CODE: MULTIPLICATION + DIVISION

Create a secret message for a partner to solve.
1. Decide on your secret message (can be a word or phrase).
2. Create a math problem for each letter in your secret message.
For example, if your secret message was the word, "cat"—you would need three different math problems; one for each letter in the word cat (since the word "cat" has three different letters of the alphabet).
3. In provided alphabet charts below, write the number that corresponds with each letter.

NOTE: You cannot have the same number for multiple letters—if the letter H and the letter Z are both the number 4, your partner will not be able to successfully solve the secret message.

A	B	C	D	E	F	G	H	I	J	K	L	M
18	10	1	3	8	13	25	21	12	17	23	24	6

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
0	5	11	4	16	15	20	14	2	7	22	19	9

PRACTICE PROBLEM #1:

A	G	E	N	T
3 x 6 = 18	5 x 5 = 25	2 x 4 = 8	4 x 0 = 0	20 x 1 = 20

PRACTICE PROBLEM #2:

B	I	O	M	E
60 ÷ 6 = 10	48 ÷ 4 = 12	15 ÷ 3 = 5	42 ÷ 7 = 6	24 ÷ 3 = 8

EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #4
The Great Wall of China

The Great Wall of China

LESSON DESCRIPTION: IN THIS LESSON, STUDENTS WILL LEARN ABOUT THE HISTORY BEHIND THE GREAT WALL OF CHINA AND THE CONSTRUCTION MATERIALS USED TO BUILD THE GREAT WALL.

TOTAL TIME REQUIRED: 60 MINUTES

STANDARDS:

United States	Australia	United Kingdom
4th Grade- Science (NGSS) 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	**Year 4- Science** Natural and processed materials have a range of physical properties that can influence their use. (ACSSU074)	**Year 5 Programme of Study** Science Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets.

TEACHER PREPARATION:

- Gather sticky notes and pencils for student use (or create a digital format for the Introduction Activity).
- Have a device with Internet access and a projector system with audio to play the video clip.
- Prepare the handout for independent work (i.e., physical copies or digital copies).

LESSON OVERVIEW:

In this lesson, students will learn about one of the greatest structures ever built—the Great Wall of China. Students will learn the history as to why and how it was built throughout history. Students will then research the properties of the construction materials and decide which material would be the best (i.e., most durable) to withstand the testament of time and environmental factors.

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Describe the history of the Great Wall of China
- Explain the different characteristics of the construction materials used to build the Great Wall of China

HOUR OF CODE CONNECTION

Oh no! There is a problem…

The Great Wall of China isn't actually the Great Wall—it's the Small of China and we need your help! The workers were trying to build the Great Wall and they were using bamboo as scaffolding. Unfortunately, the panda bears are hungry and keep eating the bamboo scaffolding, which now means the workers cannot complete their work. Can you design a solution to prevent the pandas from eating the bamboo scaffolding?

Lesson Activities:

Introduction

Begin the lesson by asking students to participate in a "Thought Jot" activity.

- **Step 1: Introduction**

Ask students the difference between jotting something down and writing something down. Are they the same or are they different?

- **Step 2: Model a Sample Prompt (first)**

Say: "In 60 seconds, write down as many vegetables as you can think of on different sticky notes."
After students write down their vegetables, have the groups analyze all of the different sticky notes. Identify any listed foods that are not vegetables. Students should sort or group vegetables together in categories.
(Using sticky notes instead of creating a long list on paper is useful for students to create groups.)

- **Step 3: Read Prompt**

Read the following prompt: "In 60 seconds, list everything you know about the Great Wall of China".

- **Step 4: Jot Down Thoughts**

Have students write responses on sticky notes.

- **Step 5: Analyze the "Thoughts"**

In small groups, have students analyze the responses. Is there ways to categorize the information? Are there multiple sticky notes with the same response? Is there anything that you are unsure of or you do not know if the information is accurate?

- **Step 6: Share Out**

Each group has 30 seconds to share something with the whole class regarding what they noticed about their sticky notes. Groups could share what they noticed about their sticky notes, for example, any patterns or groupings, or a particularly interesting answer to the prompt.

Direct Instruction

"Based on the activity we just completed, we generated different thoughts around what we background information we have about the Great Wall of China. Today, we are going to learn some different facts about the Great Wall of China. The information we discuss today may confirm the thoughts you generated during the Thought Jot activity or you may find out some new information that you have never heard before. Let's start with learning about the History of the Great Wall of China in this video clip."

Guided Instruction

After watching the video clip, provide students with access to this map of the Great Wall of China.
Have students return to their sticky notes from the Thought Jot—was any of the information they had on their sticky notes confirmed by what they heard on video clip or saw on the map?
Otherwise, provide students with a different color sticky notes to capture and record any new information they learned about the Great Wall of China.

"Now, let's focus on the materials that the Great Wall of China was constructed from… As you heard on the video clip, the Great Wall of China was constructed over different periods in history and was made by different types of materials. The construction materials of the Great Wall were mainly earth (another word for soil), stone, brick, granite, marble, and wood. The materials used to build the wall was dependent on the local resources available within the region. When building the Great Wall on mountains, stones were used from the mountains; when building it across the plains, the materials used were earth, bricks, and lime. Even branches of willow trees were used with sand when the Great Wall was built across the deserts!"

Independent Work

In small groups, you will be responsible for investigating the properties of these construction materials. Prior to beginning your research, make a prediction as to which material you believe would be the best for construction. Place a star by your response in the graphic organizer before beginning your research.
After making your prediction, beginning working on your research with your group members.

EXTENSION: If possible, bring in one of each of the listed constructional materials. Have students directly observe the materials and notate their findings.

Computer Science in Science & Engineering

Engage students in a discussion to consider the unique ways computer science has impacted science and engineering.

- How do engineers use computers in their work?
- What are the benefits of using CAD (computer-aided design)?
- How is computational fluid dynamics (CFD) software used in testing?
- What's the difference between computer science and computer engineering?
- How can computers be utilized in the engineering process?

Additional Resources

National Geographic- The Great Wall of China
Kids Discover- Great Wall of China
Nearpod- The Great Wall of China Lessons
Bamboo Anatomy and Growth Habits

Handout: The Great Wall of China

Make a prediction as to which material you believe will be the most durable. Place a star by your prediction. Then research the following construction materials and make notes about the properties of the materials.

Earth (soil)	
Stone	
Brick	

Granite	
Marble	
Wood	

Challenge Question:
Which regions within China might these construction materials be found?

EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #5
The Mona Lisa

The Mona Lisa

LESSON DESCRIPTION: IN THIS LESSON, STUDENTS WILL LEARN ABOUT LEONARDO DA VINCI'S CONTRIBUTIONS TO THE ART WORLD AND LEARN ABOUT HIS MOST INFLUENTIAL WORK, "THE MONA LISA".

TOTAL TIME REQUIRED: 60 MINUTES

STANDARDS:

United States	Australia	United Kingdom
4th Grade- Visual Arts VA:Cr1.2.4a Collaboratively set goals and create artwork that is meaningful and has purpose to the makers.	**Year 4- Visual Arts** Explore ideas and artworks from different cultures and times, including artwork by Aboriginal and Torres Strait Islander artists, to use as inspiration for their own representations (ACAVAM110)	**Programme of Study- Art and Design** Key Stage 2 • About great artists, architects and designers in history • To improve their mastery of art and design techniques, including drawing, painting and sculpture with a range of materials

TEACHER PREPARATION:

- Gather sticky notes and pencils for student use (or create a digital format for the Guided Instruction Activity).
- Have a device with Internet access and a projector system with audio to play the video clip.
- Gather 12x18 white construction paper for students' artwork.

LESSON OVERVIEW:

In this lesson, students will learn about one of the greatest artists ever known—Leonardo da Vinci. Students will learn about Leonardo's early life, his apprenticeship, and his artwork. Students will specifically learn about his most famous art piece, "The Mona Lisa", which is most recognizable and valuable piece of art work in the world. Students will have the opportunity to create their own self-portraits alongside of something that would make them smile.

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Describe different areas in which Leonardo da Vinci was interested in
- Explain the premise of the "Mona Lisa" painting
- Create their own self-portrait

HOUR OF CODE CONNECTION

Oh no! There is a problem…

Mona Lisa is no longer smiling—in fact, she is very upset. The Time Culprit went back in time and trampled Mona Lisa's garden, causing her famous smile to be a frown. Can you help cheer up Mona Lisa by fixing her garden?

Lesson Activities:

Introduction

Gather students together as a group. Engage students in a discussion related to art:

- How can we define art? (*works made through use of the imagination and creative skills by artists*)
- What are some different types of visual art-making processes? (*painting, sculpture, printmaking, drawing, photography, film, computer-generated art, etc.)*
- What is the different between 2D artwork and 3D artwork? (*Three-dimensional art pieces have of height, width, and depth; they take up physical space and can be viewed from all sides and angles. On the other hand, two-dimensional works of art, which are created on flat surfaces, can only be observed in terms of height and width*.)
- What are some famous pieces of artwork that you know? (*Answers will vary*)
- Where can we find artwork to view? (*Art galleries, museums, public parks, schools, airports, etc.)*

Direct Instruction

"Based on the activity we just completed, we understand that there are many types of art and they can be found all throughout the world. Some of the most famous artwork in the world was created during what is known as the Renaissance period. The Renaissance was a period of European cultural, artistic, political, and economic 'rebirth' following the Middle Ages. Generally described as taking place from the 14th century to the 17th century, the Renaissance promoted the rediscovery of classical philosophy, literature and art. Leonardo da Vinci (1452-1519) was a critical figure in the late Renaissance. Not only is he regarded as one of the greatest artists who ever lived, but he made remarkable contributions to engineering, architecture, science, urban planning, cartography, philosophy, and anatomy during the Renaissance. Let's start with learning about exactly who was Leonardo da Vinci in this video clip and his remarkable contributions."

Guided Instruction

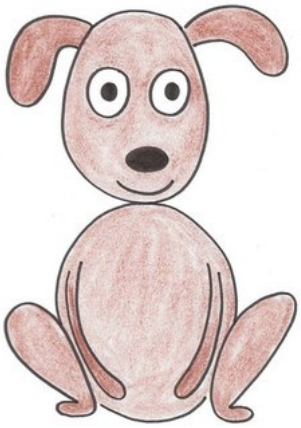
Leonardo da Vinci was a brilliant and talented artist amongst other things. As mentioned in the video clip, his most famous works of art included the "Mona Lisa". The "Mona Lisa" is the most recognized and most valuable painting in the world. It is also the most visited piece of artwork in the world—the "Mona Lisa" painting is housed at the Louvre, which is located in France. The style of this artwork is called a portrait. A portrait is artwork depicting a person, whether painted, drawn, sculpted, or photographed. It typically only showcases the individual's face and their expression. In this case, "Mona Lisa" is portrait created of the model, Lisa del Giocondo, the wife of wealthy Florentine silk merchant Francesco del Giocondo. The painting is thought to have been commissioned for their new home. Even though it may appear subtle, Lisa del Giocondo is smiling in the portrait. Show students an image of the Mona Lisa painting.
On a sticky note (or any digital medium), write down the reason you believe the Mona Lisa is smiling.
After each student have the opportunity to write down their response, have each student share out their response.

Independent Work

Students are going to have the opportunity to create a piece of artwork. The artwork will have 2 components. The paper will be split into two halves—the half on the left is going to be a self-portrait. The students should draw a self-portrait to represent themselves. After drawing/outlining, they should color their drawing. Just like the Mona Lisa, there should be a background behind their self-portrait. The Mona Lisa has a background depicting valleys, mountains, hills, a river and a bridge.

On the right hand side of the paper, the students are going to create a representation of what makes them smile—they can choose whatever best represents the person/activity/object/etc. that would make them happy and create a smile.

Example

Computer Science in Art

Engage students in a discussion to consider the unique ways computer science has impacted visual arts.

- How do artists use algorithms in their artwork?
- How do computer scientists work with images?
- How have computers afforded people the possibility of experiencing art?
- What is immersive art? How do artists use technology to achieve an immersive art experience?

Additional Resources

The Mona Lisa for Kids
How to Draw a Self-Portrait: For Kids!
Leonardo da Vinci: Creative Genius
da Vinci—Learning Activities (Museum of Science, Boston)

EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #6
First Flights

First Flights

LESSON DESCRIPTION: In this lesson, students will learn about The Wright Brothers' contributions to the world of aircraft and learn about engineering design principles that enabled the first flight to occur on Kitty Hawk in 1903.
TOTAL TIME REQUIRED: 60 minutes
STANDARDS:

United States	Australia	United Kingdom
Science (NGSS) **K-2-ETS1-2.** Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem. **3-5-ETS1-2.** Generate and compare multiple solutions to a problem based on how well they meet the criteria and constraints of the design problem. to a problem based on how well each is likely to meet the criteria and constraints of the problem. **MS-ETS1-2.** Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	**Science** **Year 1** Participate in guided investigations to explore and answer questions (ACSIS025) Represent and communicate observations and ideas in a variety of ways (ACSIS029) **Year 2** Participate in guided investigations to explore and answer questions (ACSIS038) Represent and communicate observations and ideas in a variety of ways (ACSIS042) **Year 3** With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS054) Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS055) **Year 4** With guidance, plan and conduct scientific investigations to find answers to questions, considering the safe use of appropriate materials and equipment (ACSIS065) Consider the elements of fair tests and use formal measurements and digital technologies as appropriate, to make and record observations accurately (ACSIS066) **Year 5**	**Key stage 1 Programme of study** **Years 1 and 2** Working Scientifically • Asking simple questions and recognising that they can be answered in different ways • Performing simple tests • Gathering and recording data to help in answering questions **Years 3 and 4** Working Scientifically • Setting up simple practical enquiries, comparative and fair tests • Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units • Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions **Years 5 and 6** Working Scientifically • Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary • Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate

	Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS086) Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS087) **Year 6** Identify, plan and apply the elements of scientific investigations to answer questions and solve problems using equipment and materials safely and identifying potential risks (ACSIS103) Decide variables to be changed and measured in fair tests, and observe measure and record data with accuracy using digital technologies as appropriate (ACSIS104)	• Using test results to make predictions to set up further comparative and fair tests

TEACHER PREPARATION:

- Select a developmentally-appropriate text about The Wright Brothers for students.
- Have a device with Internet access and a projector system with audio to play the video clip.
- Prepare the images for student use.
- Have devices with Internet access for students to participate in the Interactive Wright Brothers Workshop activity.
- Gather materials for students to use for their paper aircraft creations (i.e., construction paper, tape, scissors, straws, paper clips).
- Prepare the handout for student use (i.e., physical copies or digital copies).

LESSON OVERVIEW:

In this lesson, students will learn about some of the greatest inventors ever known—The Wright Brothers. Students will learn about The Wright Brothers fascination with human flight and the designs that inspired their designs for the first flying machine. Students will participate in an interactive, digital workshop to explore some crucial engineering principles for aeronautical design. Then students will have the opportunity to create their paper aircraft designs to see how these design engineering principles work in real life.

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Explain the Wright Brothers' contributions to aircraft design and flight
- Identify basic engineering design principles needed for aircraft design
- Create their own paper aircraft prototypes

HOUR OF CODE CONNECTION

Oh no! There is a problem…

The inventors were never able to achieve lift off so aeronautics was changed forever—since now they use balloons instead! Can you rewrite history by going back in time to help the inventors complete their first flight?

Lesson Activities:

Introduction

Gather students together as a group. Begin the session by reading (or having students read) a text about The Wright Brothers. You may choose an selection that is appropriate for your students' ages/grade levels.

SUGGESTIONS

Learning to Fly: The Wright Brothers Adventure (NASA) (this resources has several articles—select 1-2 texts)
"Wright Brothers" Article (National Geographic Kids)
The Wright Brothers for Kids (Mary Kay Carson)
The Story of the Wright Brothers: A Biography Book for New Readers (Annette Whipple)
To Fly: The Story of the Wright Brothers (Wendie C. Old)

Direct Instruction

"Based on the text we just read, we know the Wright Brothers made significant contributions to our ability to fly and aircraft design. The Wright Brothers invented the airplane and proved it could fly on December 17, 1903. They also pioneered the modern practice of aeronautical engineering. All successful airplanes since 1903 have incorporated the basic design elements of the Wright Flyer. Watch this video clip and learn about their remarkable contributions in human flight with their 'the flying machine'."

Guided Instruction

"Today we are going to look at the original Wright Flyer, created in 1903. Provide students with a copy of the image (accessed from the National Archives). We are going to investigate the parts of the 1903 Wright Flyer and how the parts worked together to make the airplane fly."
Navigate to this site: https://airandspace.si.edu/exhibitions/wright-brothers/online/workshop/
Students will work in the interactive workshop to discover basic engineering principles and investigate the concept behind the "flying machine".

Independent Work

Students are going to have the opportunity to investigate some different kinds of "flying machines" through the creative design process. This video tutorial will provide some design examples for students. After making the paper aircraft designs, students will to try and collect data on their paper air flight. Consider some of the following questions:

- Describe the paper design—what characteristics/attributes does this design have?
- Which design flies the farthest distance? How do you know?
- Did you try your design multiple times to ensure the reliability of the data?
- How are you ensuring a fair trial? (i.e., using the same design for all trials; throwing the paper design from the same spot; limiting external factors {example: wind gusts can occur outside which can skew the data}; using the same kind of paper for all designs; etc.)
- How are you collecting your data from the trials? What is the easiest way to record and then help others to visualize the data?

Computer Science in Science

Engage students in a discussion to consider the unique ways computer science has impacted science.

- How do different types of scientists use computers?
- What scientific inquiry skills are used when working on computers?
- How can computers help during science experiments?
- What computer tools would be helpful for making observations, collecting data, and recording results?

Additional Resources

NPS: The Wright Brothers- Curriculum Materials
First in Flight: The Wright Brothers
Smithsonian Learning Lab- The Wright Brothers

Handout: Paper Aircraft Designs

Paper Aircraft Investigation

	Distance Travelled				
	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Vortex Thrower					
Hoop Glider					
Helicopter					
Sky King					

Which paper aircraft design travelled the farthest? _____

What variable(s) did you keep consistent to ensure a fair trial?

_____

_____

_____

_____

If you could make one modification to a paper aircraft design, what would you change and why?

_____

_____

EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #7
First Computer Scientist

First Computer Scientist

LESSON DESCRIPTION: IN THIS LESSON, STUDENTS WILL LEARN ABOUT ADA LOVELACE AND HER PROFOUND INFLUENCE AS THE WORLD'S FIRST COMPUTER PROGRAMMER.

TOTAL TIME REQUIRED: 60 MINUTES

STANDARDS:

United States	Australia	United Kingdom
Computer Science (CSTA) **1A-AP-08** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. **1B-AP-08** Compare and refine multiple algorithms for the same task and determine which is the most appropriate. **2-AP-10** Use flowcharts and/or pseudocode to address complex problems as algorithms.	**Digital Technologies** **Foundation to Year 2** Follow, describe and represent a sequence of steps and decisions (algorithms) needed to solve simple problems (ACTDIP004) **Year 3 and 4** Define simple problems, and describe and follow a sequence of steps and decisions (algorithms) needed to solve them (ACTDIP010) **Year 5 and 6** Design, modify and follow simple algorithms involving sequences of steps, branching, and iteration (repetition) (ACTDIP019) **Year 7 and 8** Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input and to identify errors (ACTDIP029)	**Programme of study - Computing** **Key Stage 1** Understand what algorithms are, how they are implemented as programs on digital devices, and that programs execute by following precise and unambiguous instructions **Key Stage 2** Use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs **Key Stage 3** Understand several key algorithms that reflect computational thinking; use logical reasoning to compare the utility of alternative algorithms for the same problem

TEACHER PREPARATION:

- Prepare the handout for student use (i.e., physical copies or digital copies).
- Have a device with Internet access and a projector system with audio to play the video clip.
- Gather materials for students to use to create their algorithms (i.e., paper, pencils, tangible materials, etc.)

LESSON OVERVIEW:

In this lesson, students will learn about the world's first computer programmer—Ada Lovelace. Students will learn about Ada's profound impact on computer programming and her influence on modern day computers. Students will learn about creating algorithms, as a specific step-by-step set of instructions to solve a problem or complete a task. Then students will have the opportunity to practice creating their own algorithms in an unplugged environment (i.e., using paper and pencil).

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Explain Ada Lovelace's contributions to computer programming and modern day computing languages
- Describe and identify an algorithm
- Create their own algorithm (offline)

Hour of Code Connection

Oh no! There is a problem…

The punch card has all holes filled so the first coded algorithm cannot be invented! Can you restore the punch card by using your Agent to break the "X" blocks on the punch card to restore it back to its original form?!

Lesson Activities:

Introduction

Provide students with the provided template "I Used to Think, But Now I Think". In the left hand side of the paper, ask students to draw/label/write what they know about a computer programming. They can include any information they deem important to answer the specific question about "what is a computer programming". Give students about 5-10 minutes to articulate their thoughts. After students have completed the first half of the template, allow students to share out their responses. Try to find commonalities amongst the responses and if needed, generate a list of additional questions that may arise during the discussion.

Have students set aside the template, but keep it close by as they will return to the template at the conclusion of the lesson activities.

Direct Instruction

"Based on the activity we just completed, we have some background information about what is a computer programming. However, today, we are going to focus on the origin story of computer programming. There are two very important people we need to become familiar with—Ada Lovelace and Charles Babbage.

Watch this video clip and learn about their remarkable contributions in computer programming and Ada's impact on the modern day computer."

Guided Instruction

"Ada Lovelace is considered the world's first computer programmer. She was a bright mind and ahead of the times. As we saw within this video clip, Ada was responsible for creating the first algorithm for Babbage's analytical machine.

- But exactly what is an algorithm?
- How are algorithms used in computer science?
- Are algorithms applicable in other areas of study (i.e., other subjects like science, reading, history, etc.)?

We are going to work together to explore exactly what algorithms are and how they are used.

An **algorithm** is defined as, "*a set of steps that are followed in order to solve a problem or to complete a process/task*". Algorithms can be specifically created with or without a computer. Sometimes individuals will complete an algorithm offline as a part of the planning processing of program development. Individuals will write pseudocode (*plain language description of the steps in an algorithm*) or even create a flowchart (*a diagram that depicts a process, system or computer algorithm*) to document their work".

Let's explore a simple task together first. Let's consider the step-by-step process to make a bowl of cereal. (Show this example of an algorithm to students—read out loud and ask students to consider if this is an accurate process)

Example:

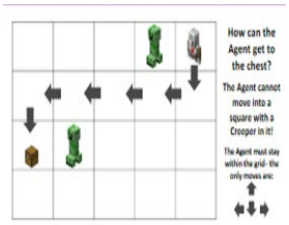
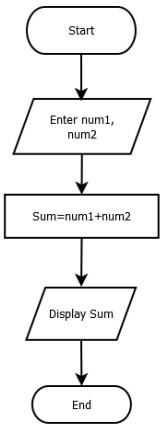
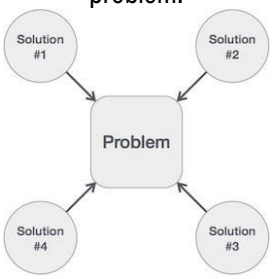
1. Collect items- bowl, cereal, milk, spoon
2. Pour cereal into the bowl
3. Pour milk over the cereal in the bowl
4. Place spoon into bowl
5. Eat cereal

Although this set of directions may seem complete, we need to think about the specifics. A computer will only do exactly what we "tell" it to do in our program. So sometimes we need to consider the small details of our commands. Here are some questions to consider:

- How much cereal do we place into the bowl?
- How much milk do we pour into the bowl?
- When do we stop eating?

Independent Work

Students are going to have the opportunity to create their own algorithm. Here are some suggestions for the various age levels:

Ages 6-7	Ages 8-10	Ages 11-13	Ages 14-18
Have students use tangible materials to help a character to "move". 	Design an algorithm of your morning routine.  Image: Tynker	Design an algorithm to add two numbers together and display the result. 	Create multiple algorithms to solve the same problem. 

After students have completed their algorithms, provide an opportunity for students to share out their responses.

At the conclusion of the lesson, have students return to their template (that they began in the introduction activity). In the 2nd half of the paper (on the right hand side), have students write down any information they learned about computer programming. They can also use this time to fact-check anything they listed on the left-hand side of their template as well.

Computer Science Skills

Engage students in a discussion to consider the unique ways computer science skills are used in the workplace.

- How has computers changed the workplace over time?
- How has technology changed the types of jobs available?
- What are the most important computer science skills in the workplace? (Education, Marketing, Healthcare, etc.)
- What are the fastest growing jobs in the field of computer science?
- What are the most in-demand jobs in the field of computer science?

Additional Resources

Finding Ada—Resources for Schools
BrainPop: Ada Lovelace
STEM Sisters- Ada Lovelace

Handout: What is Computer Programming?

I Used to Think…	
But Now I Think…	

EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #8
Human's Best Friend

Human's Best Friend

LESSON DESCRIPTION: IN THIS LESSON, STUDENTS WILL LEARN THE HISTORY BEHIND THE DOMESTICATION OF ANIMALS OVER TIME AND HOW DOMESTICATION HAS ALLOWED US TO OWN AND CARE FOR PETS.

TOTAL TIME REQUIRED: 60 MINUTES

STANDARDS:

United States	Australia	United Kingdom
English Language Arts (CCSS) **W.3.7** Conduct short research projects that build knowledge about a topic. **W.4.7** Conduct short research projects that build knowledge through investigation of different aspects of a topic. **W.5.7** Conduct short research projects that use several sources to build knowledge through investigation of different aspects of a topic. **W.6.7** Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.	**Literacy** **Year 3** Plan and deliver short presentations, providing some key details in logical sequence (ACELY1677) **Year 4** Plan, rehearse and deliver presentations incorporating learned content and taking into account the particular purposes and audiences (ACELY1689) **Year 5** Plan, rehearse and deliver presentations for defined audiences and purposes incorporating accurate and sequenced content and multimodal elements (ACELY1700) **Year 6** Plan, rehearse and deliver presentations, selecting and sequencing appropriate content and multimodal elements for defined audiences and purposes, making appropriate choices for modality and emphasis (ACELY1710)	**Programme of study – English** **Year 3 and 4** **Reading-Comprehension** Retrieve and record information from non-fiction **Year 5 and 6** **Reading-Comprehension** Retrieve, record and present information from non-fiction

TEACHER PREPARATION:

- Prepare the handout for student use (i.e., physical copies or digital copies).
- Have a device with Internet access and a projector system with audio to play the video clip.
- Have available devices with Internet access for student research

LESSON OVERVIEW:

In this lesson, students will learn about the history of domestication. Students will learn how humans' interactions with wild animals caused domestication over time. They will also learn about the responsibilities that come with being a pet owner and analyze time and money costs associated with being a pet-owner. Students will conduct a short research project to make an informed decision about what it would entail to own the pet of their choice.

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Explain what "domestication" means
- Describe the time and money considerations when it comes to pet ownership

Hour of Code Connection

Oh no! There is a problem…

Humans' best friend is no longer the dog, but a domesticated version of a bear! Can you make sure the wolves befriend humans by leading them back to their camps? Use your Agent to lead the wolves back to the campsite by leaving a trail of food from the woods to the campsite.

Lesson Activities:

Introduction

Gather students together as a group. Engage students in a discussion related to animals:

- Who can name an animal for me? (*Answers will vary—but any real animal can be accepted*)
- What are some animal categories (or ways to classify/sort animals)? (*fish, birds, mammals, amphibians, reptiles, and insects. Students could also respond with physical characteristics.)*
- Where can we find these animals on the Earth? (*Animals can be found on all 7 continents. However, different animals live in different environments and can only survive in certain conditions.)*
- What kind of animals have been considered pets? (*Some examples: fish, , dogs, cats, rabbits, lizards, etc.*)
- Why do only certain animals make appropriate pets? (*Wild animals have lived for thousands of years without the direct influence of humans. They are adapted for survival in complex, wild environments. They are not well adapted to living with humans or in a house. Certain animals (like dogs, cats, certain kinds of fish, hamsters, rabbits, etc. have been 'domesticated' over time and make suitable pets.)*

Direct Instruction

"Based on our conversation, it is important to understand the special needs of animals. We are going to discuss the concept of domestication. Domestication is a change that happens in wild animals, when they are kept by humans for a long time. The Latin term literally means "to make it suitable for home". If humans take wild animals and keep and breed them, over time the animals may change. This is why certain kinds of dogs, cats, rats, lizards, fish, frogs, and other animals have been able to become household pets. An important part of this conversation is also understanding that we, as humans, have a shared responsibility on Earth. We must ensure that we are leaving wild animals undisturbed whenever possible and not destroying their environments and habitats.

Pets were not always a concept. A long time ago, all dogs were wild. However, over time, dogs became one of the most domesticated animals in existence. Let's watch this video clip to understand the history of domesticating dogs."

Guided Instruction

"Owning a pet is not a decision to be made lightly. If we choose to own a pet, it is also an important responsibility. As a pet owner, we are responsible for its nutrition, healthcare, socialization, exercise, training, and arranging alternative care if we are going to be away on a vacation. There are several time considerations and fiscal implications that must be considered before becoming a pet owner. Today, you are going to investigate exactly what kind of time, energy, and money would be invested into a pet of your choice through a short research project."

Independent Work

Have students research and complete their pet research project. Students should use the template provided to organize their thoughts. Remind students to remember to give credit and site their sources, when appropriate. If students are using images, videos, or other created content, remember to respect copyrighted materials! After answering the research questions, allow students to create and share a presentation of their pet selection.

Computer Science in Research

Engage students in a discussion to consider the unique ways computer science has affected our ability to effectively research.

- What is the role of computers in research?
- How has computers impact our ability to access information?
- How do you conduct database research?
- What does a computer research scientist do?

Additional Resources

Ducksters: Dogs (early elementary students)
Wolf-Dog Hybrids (upper elementary students)
How Wolves Really Became Dogs (secondary students)

Handout: Domesticated Pets Research Questions

1. Choosing a Pet - Compare and contrast the impact various pets might have on the household - Examine stereotypes about certain breeds or species - Find evidence to support the assertion that a certain type of pet is the one you should choose	
2. Pet Care Research the following time and costs associated with: - Grooming - Pet nutrition and feeding - Providing a proper environment - Right amount and kind of exercise - Typical veterinary care	
3. Animal Training What kind of training will your pet require? If your pet requires training, what kind of training and what are the time and money costs associated with training?	
4. Civic Considerations Owning a pet may involve obeying leashing and tagging laws and making sure a barking dog doesn't disturb others. Research your local laws to see what may apply to you.	

EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #9
Paleontology Puzzle

Paleontology Puzzle

LESSON DESCRIPTION: IN THIS LESSON, STUDENTS WILL LEARN ABOUT THE JOB OF A PALEONTOLOGISTS AND HOW THEY STUDY FOSSILS TO UNDERSTAND MORE ABOUT THE DINOSAURS (AND OTHER LIVING ORGANISMS) OF THE PAST.

TOTAL TIME REQUIRED: 60 MINUTES

STANDARDS:

United States	Australia	United Kingdom
Science (NGSS) **3-LS4-1.** Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.	**Science** **Year 4** Earth's surface changes over time as a result of natural processes and human activity (ACSSU075)	**Programme of study - Science** **Year 3** **Rocks** Describe in simple terms how fossils are formed when things that have lived are trapped within rock

TEACHER PREPARATION:

- Prepare the handout for student use (i.e., physical copies or digital copies).
- Have a device with Internet access and a projector system with audio to play the video clip.
- Gather popsicle sticks and markers for student use.

LESSON OVERVIEW:

In this lesson, students will learn about the scientists who study fossils—paleontologists. Students will learn about what paleontologists do as part of their job and how studying fossils gives us an idea of life in the past. Students will create their own "fossil" puzzles for their peers to discover and participate in a virtual workshop as they learn about the fossils of a dinosaur.

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Explain what paleontologists do
- Describe the importance of fossils and how they help us understand living organisms of the past
- Create their own fossil puzzles

HOUR OF CODE CONNECTION

Oh no! There is a problem…

Dinosaurs are looking very different! The time culprit went back in time and stole some fossils from underground causing the paleontologists to put the dinosaur fossils back together incorrectly. Can you use the Agent to help replace the stolen fossils so the paleontologists can put the dinosaurs back together correctly?

Lesson Activities:

Introduction

Provide the Frayer model handout to each students. Ask the students to fill in the graphic organizer and what they know about fossils.

Direct Instruction

"Based on the activity we just completed, we are going to continue to conversation about fossils. There are two important types of fossils we are going to learn about—fossils can fall into two different categories: body fossils and trace fossils. Body fossils were once part of an animal—things like a skull, tooth, and foot. Trace fossils are evidence of something the dinosaur left behind—things like footprints, eggs, and skin impression. (You can show these visual images like ones shown here).

An important part of this conversation is understanding that this is someone's full-time job. There are special scientists called archaeologists—archaeologists are scientists who study of people and artifacts from ancient times. More specifically, there are scientists who are called paleontologists. Paleontologist are scientists who study fossils to understand life throughout geologic time. Let's watch this video clip and learn exactly what paleontologists do and see various types of fossils."

Guided Instruction

"Paleontologists often spend a long time hunting for fossils before they find any. They often spend a lot of time looking for a good site. Once they have found a site, they begin looking for fossils. Once a fossil is found, the hardest part of the process starts. Paleontologists have to excavate and remove the fossils from the ground. This often is very difficult and takes a lot of hard physical work to do. After careful excavation, paleontologists then have a tedious job of bringing them back to their to study!"

You are going to complete a hands-on activity today to mimic the job of a paleontologist.

Provide students with popsicle sticks (i.e., tongue depressors) and colored markers. Then follow the next set of steps:

- Lay 10 popsicle sticks side by side flat on a table. Write your initials (so you can identify yours!) and number the sticks 1-10. Tape them together on the top and bottom then flip them over.
- Draw a picture of one of the extinct animals from Florissant Fossil Beds National Monument on the popsicle sticks.
- Take the tape off the popsicle sticks and mix them up. Take the sticks and hide them for a peer to find.
- Now, make sure each person has a set of sticks they are going to find. They should know the initials of the person's sticks they are looking for. Find the popsicle sticks! Use the paper and pencil to take notes about where you find the sticks and the position they are in. Are they lying flat or on their side? Are they standing up? Are they close together or spread out? Are any on top of each other? In the field paleontologists take detailed notes, photographs, and measurements while they excavate fossils. This way they can learn as much as possible about the fossil and past environment.
- Once you find the sticks put them back together like a puzzle. Did you find all of the pieces of your fossil? Unfortunately, complete fossils of an organism are extremely rare. There are usually missing pieces from the fossils. When this happens, paleontologists have to use their imagination and deductive reasoning to make educated guesses and fill in the missing pieces.

Independent Work

Have students work on the virtual fossil workshop in Jonah's Lab:
https://www.amnh.org/explore/ology/paleontology/living-large2

Computer Science in Paleontology

Engage students in a discussion to consider the unique ways computer science has impacted paleontology.

- How do paleontologists use computers in their work?
- How is artificial intelligence being used in paleontology?
- How are computer-aided design, rapid prototyping, and biomechanics used in paleontology?
- What is the future of paleontology with the utilization of computers and other types of technology?

Additional Resources

AAAS ScienceLinks: Fossils and Dinosaurs
PBS Learning Media: Fun with Fossils
Virtual Tour of Melbourne Museum: Dinosaur Walk
Mystery Science—Fossil Evidence Classification

Handout: Frayer Model Template

Working Definition	Facts/Characteristics
Fossils	
Examples	Non-Examples

EDUCATOR GUIDE

Hour of Code 2021
Extension Activity #10
Elements of Discovery

Elements of Discovery

LESSON DESCRIPTION: IN THIS LESSON, STUDENTS WILL LEARN THE IMPORTANCE OF DIVERSITY IN SCIENCE AND HOW MARIE CURIE HELPED TO DEFY THE STEREOTYPES FOR WOMEN SCIENTISTS.

TOTAL TIME REQUIRED: 60 MINUTES

STANDARDS:

United States	Australia	United Kingdom
Media Arts (National) MA:Cn10.1.3 b. Identify and show how media artworks form meanings, situations, and/or culture, such as popular media MA:Cn10.1.4 a. Examine and use personal and external resources, such as interests, research, and cultural understanding, to create media artworks.	**Media Arts** **Year 3 and 4** Investigate and devise representations of people in their community, including themselves, through settings, ideas and story structure in images, sounds and text (ACAMAM058) **Year 5 and 6** Explore representations, characterisations and points of view of people in their community, including themselves, using settings, ideas, story principles and genre conventions in images, sounds and text (ACAMAM062)	**Programme of study – Citizenship** **Key Stage 1** b. to listen to other people, and play and work cooperatively; c. to identify and respect the differences and similarities between people; **Key Stage 2** b. to think about the lives of people living in other places and times, and people with different values and customs; f. that differences and similarities between people arise from a number of factors, including cultural, ethnic, racial and religious diversity, gender and disability;

TEACHER PREPARATION:

- Gather small pieces of white paper or index cards for student use.
- Have a device with Internet access and a projector system with audio to play the video clip.
- Have available devices with Internet access for student research

LESSON OVERVIEW:

In this lesson, students will learn about the profound impact Marie Curie had on the science world. She broke stereotypes and showcased that women scientists were just as capable as anyone else. Through hard work and dedication, Marie Curie made innovative discoveries in science and earned her place in history as one of the most influential scientists.

LEARNING OBJECTIVES:

By the end of this lesson, the students will be able to:

- Explain Marie Curie's contributions to the field of science
- Describe how diversity within the science community is important as perceptions are often created at an early age

Hour of Code Connection

Oh no! There is a problem…

While the scientist was experimenting in the lab, she decided to stop for a lunch break while the test was running. During her lunch break, the time culprit snuck into the lab and hid some of the elements. Can you find the elements before the scientist gets back from lunch?!

Lesson Activities:

Introduction

Gather students together as a group. Engage students in a discussion related to science:

- What is science? (*Science is the study of the world around us*)
- What are some different things studied within science? (*animals (biology), astronomy (star and planets), the Earth (geology), the oceans (marine biology or oceanography), etc.)*
- How do scientists find out specific information in science? (*Scientists use their inquiry skills and scientific practices—they are constantly observing, describing, experimenting, collecting data, analyzing data, asking questions, documenting their findings, communicating their ideas, etc.).*
- How do scientists communicate their ideas? (*The sharing of scientific knowledge is one of the most important parts of a scientists' job. There are a variety of ways that scientists communicate their results of scientific research and these include scientific journal publications, conference presentations, conference posters, education lectures, etc.).*

Direct Instruction

Provide each student with a small piece of paper or an index card. Ask students to draw/sketch a picture of a scientist that they are aware of and write something to explain what are they known for.

After students have completed this brief activity, have students share out their responses. After sharing out the responses, ask students to analyze the responses.

- Were the duplicates listed? Why do you think there were duplicates?
- How many male scientists were in the responses?
- How many female scientists were in the responses?
- Was there a scientist represented in the field of (insert name of field- such as marine biology, astrophysics, chemistry, engineering, medicine, botany, etc.)?

Guided Instruction

"Today, we are going to take a look at another pioneer in science—Marie Curie. Marie was born Maria Sklodowska in Poland on November 7, 1867. She developed a talent and passion for science early in her life. At that time in Warsaw, the university did not accept female students. Marie moved to Paris, France so she could pursue her dream of studying science at university. Let's watch this video clip to see how her passion for science and lifelong learning lead to amazing and innovative contributions in the science."

After watching the video clip, ask students the following questions:

- What kind of struggles did Marie experience during her time at university? (courses were in French, didn't have much money, forgot to eat at times)
- What science disciplines did Marie Curie study and earn a degrees in? (physics and chemistry)
- Had a woman ever received a PhD in science at this point in history? (no)
- What elements did Marie Curie and his husband, Pierre, discover? (polonium and radium)
- What were some of Marie's significant contributions? (answers will vary)

Independent Work

Have students research and read through this site: https://www.iamascientist.info/collection

Ask students to return to their original response of "what is a scientist"—after hearing about Marie's remarkable accomplishments in science and seeing all of these diverse scientists with the "I Am a Scientist" collection, does your definition or perspective of who is a scientist change? Have students respond to these prompts:

- Why do you think it is important for everyone to understand the diversity in scientists?
- Why is diversity important—even beyond the world of science and scientists?
- How can we support diversity and open-mindedness in our own lives?

Provide students with the opportunity to create a multimodal art piece that represents diversity and multiculturalism in science.

Computer Science in Chemistry

Engage students in a discussion to consider the unique ways computer science has impacted chemistry.

- What types of technology does a chemist use in their work?
- What is chemical modelling?
- How might quantum computing might bring significant advances in chemistry in the coming years?

Additional Resources

Marie Curie Unit Study
School History: Marie Curie
Who is Marie Curie?