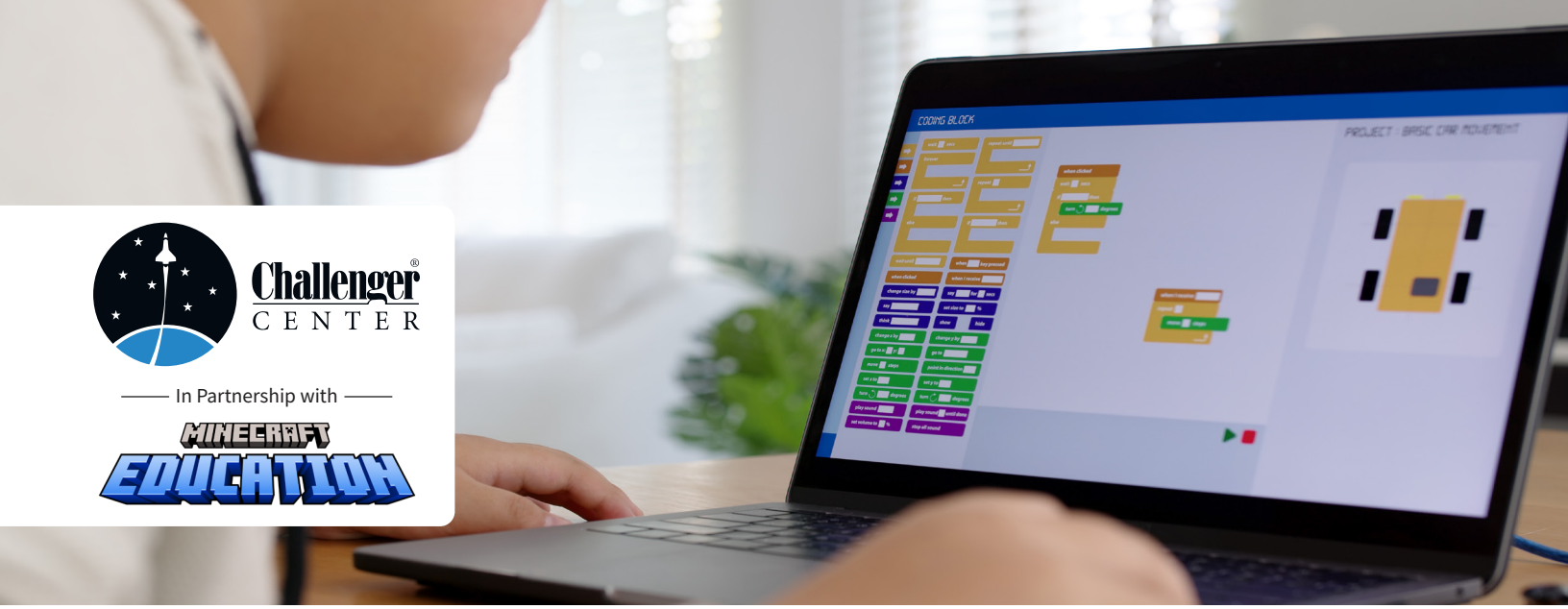

Challenger CENTER

In Partnership with

MINECRAFT EDUCATION

Coding Your Way to a Computer Science Career

LESSON OVERVIEW

Students will discover how women at NASA used their computer skills to make a big impact. Students will also get a chance to practice some basic computer programming by creating their own path towards a career in computer science.

LEARNING OBJECTIVES

Students will . . .

- become familiar with women who shaped history at NASA,
- become familiar with coding and what it is/does for NASA, and
- learn about career paths to work in computer science.

TEACHER NOTES AND PREP

Background

NASA has employed many women and people of color throughout its history. When men left to fight in World War II (1939), more women were hired, including—for the first time—African American women.

Women at NASA have worked in roles such as mathematician, astronaut, engineer, and supervisor.

In 1935, there was a government agency called the National Advisory Committee for Aeronautics (NACA) which hired the first female "human computers". Back then, there were no real computers, so people had to do complicated calculations by hand, like figuring out the paths of spacecraft. Many African American women worked in this computing unit. Over time, they also helped create code for the first machine computers, which could do those calculations much faster and with more accuracy.

Student Ages

8-13

Subjects

Computer Science
Equity and Inclusion
History and Culture

Skills

Collaboration
Communication
Creativity

Estimated Time

45 minutes

Educational Settings

Classroom
Informal *(museums, science centers, and camps)*

Thanks to the work of these early computer scientists, the United States was able to send its first astronaut into orbit and eventually reach the Moon.

NASA's first missions to the Moon occurred under the Apollo program. Despite there being many women and people of color involved in Apollo, the only astronauts to have ever walked on the Moon were white men. Today, as NASA returns to the Moon with the Artemis missions, a key goal is to land the first woman and the first person of color on the Moon.

In addition, there are already many women and people of color working on the Artemis program from Earth. They include a woman that helped lead the development of the Space Launch System rocket, a woman that drives the Space Launch System on a vehicle called a crawler, and a woman that made the call to launch Artemis I.

Preparation

In the activities that follow, students will learn about the careers of some important women that shaped NASA's early missions to the Moon, including:

- Vera Huckel
- Margaret Hamilton
- Mary W. Jackson
- Katherine Johnson

Students will also use basic computing logic to "code" a path to a STEM career. *Coding*, sometimes called *computer programming*, is how we communicate with computers (giving a computer direction to do a task). At NASA, coding is used to:

- build and test spacecraft;
- detect problems;
- monitor weather and space debris;
- navigate space;
- communicate with astronauts in space; and
- transmit, receive, and secure data.

Coding can look like steps or a set of directions that tells a computer what to do. Code is also what is used to make Minecraft!

STUDENT ACTIVITIES

Supplies

- Print and cut out the NASA Computer Scientist Profile Cards and Coding Career Cards
- Pencils
- Paper

Warm-Up and Introduction (10 minutes)

- Review the historical background provided in the Teacher Notes and Prep section, describing how women, and particularly Black women, contributed to NASA's first missions to the Moon under the Apollo program.
- Explain what is meant by the term "coding." See the Teacher Notes and Prep section for some information. In general, "coding" is writing a logical progression of steps that a computer uses to calculate a quantity or take an action.

- Discuss how computer science evolved from "human computers" (i.e., mathematicians who did complex calculations by hand) to electrical computers, in which the instructions for calculating the complex math problems were "coded" into a machine that then could perform the calculations faster and with more accuracy.
- Make the connection to the idea that "coding" is what is used to make Minecraft games. Minecraft Education's *Artemis: Return to the Moon* world has several coding challenges.
- Ask students if they have any experience with "coding." Some may have used block coding or other types of code to program robots in a robotics program. Some may have participated in coding activities such as *Hour of Code*.

Profile Review Activity (20 minutes)

Ask students to review the four profiles of NASA computer scientists. You could break the students into groups and assign 1-2 profiles per group.

Then, lead them through a discussion about the women and their career paths. Ask questions such as:

- What did the women have in common?
- What made the women unique?
- What was each woman's path to a computer science career? Note . . .
    - the common steps, including graduating from high school, going to college, applying for a job, and being promoted into higher level roles by working hard and producing good work.
    - that some women change careers along the way (e.g., Margaret Hamilton started as a high school teacher and became a computer scientist; Mary Jackson was an engineer and later moved into a human resources role).
    - that at least one woman went back to school to get more education after having worked for a while (Mary Jackson started as a mathematician but was encouraged by NASA to take courses to become an engineer).

Coding Your Way to a Computer Science Career Activity (30 minutes)

[EDUCATOR NOTE: This activity calls for students to walk around. This could be done in a classroom or a larger, more open space like a gymnasium. You will need a space large enough to enable students to spread seven 2"x8" cards out on the floor and for students to be able to move between the cards in multiple steps.]

- Break the students into small groups (e.g., 2-4 students).
- There are four sets of Career Path Cards included in this lesson. Each student group should receive just one set.
- Lay the cards out on the floor randomly in the space designated for each group. For example, if you have four groups of four students, divide the room into quadrants, laying out a set of cards in each quadrant.
- Tell the students, "You are now going to become coders!" Remind them that coding involves a logical progression of steps, and so their coding teams will be writing a logical progression of steps for this activity.
- Ask the students to collaborate to identify a logical order for the cards (i.e., what is Step 1 in the journey to their assigned career, what is Step 2, what is Step 3, etc.). They may write numbers on the cards so they remember the order they agreed upon.
- Ask the students to "code" the path (number of steps and direction) to get to each card; then, write down the path.
    - For example, to reach Card 2 from Card 1, the students will start standing near Card 1 and may then need to take 3 steps forward, then 2 steps left, to arrive at Card 2. The code would be "Start at Card 1. Take 3 steps forward. Take 2 steps left. Arrive at Card 2."
    - This layout will vary for each group, as each group's cards are laid in different places.

- Once students are confident in their "code," the group should select one student to read the code the team wrote and one student to follow the code. Starting at Card 1, the "coder" will read out his/her "code" (e.g., "Take three steps forward; then, two steps left") and see if the student following those directions lands on each card in sequence.
    - If the student is successful, he or she will find themselves in a computer science career!
    - If the student is not successful, the team will have to reconsider whether their "code" is correct and try again. Just like a real computer scientist, they might have to adjust their code several times before it works. This may be a good time for the team to rotate with a different student reading the code and a different student following the code.

[EDUCATOR NOTE: For students with limited mobility, the "coder" role is ideal as they will read steps for other students to follow.]

Post Activity Discussion Questions and Activities (10 minutes)

Ask the class open-ended questions to extend their critical thinking:

- What challenges did you face in the coding activity? How did you overcome them?
- What things in your life do you think are driven by computer code? Possible answers include: apps on their computers and tablets; connections to wi-fi; phone calls; health devices at the doctor's office, such as machines used to monitor blood pressure or check heart rate; cameras; and watches.
- What kinds of things do you think computer scientists do at NASA today? Possible answers include: building and testing spacecraft, detecting problems with spacecraft, navigating in space, monitoring weather and space debris, communicating with astronauts in space, and transmitting data.
- Did learning about the women at NASA change your perspective on jobs in computer science? If so, why?
- What studies do you think will help you get a job in computer science? There are many degree and certificate programs in specific programming languages, technical support, software testing, network engineering, and other computer science related topics.
- Share NASA's *Women of Artemis* video: https://youtu.be/N0acoq5Uzfs

GUIDING IDEAS AND QUESTIONS

- What is coding?
- How have women and people of color contributed to NASA's Moon exploration in the past?
- How are women and people of color contributing to NASA's Artemis program to go back to the Moon?
- What is the path to a career in computer science?

PERFORMANCE EXPECTATIONS

Students will:

- learn the history of important women who used computer science skills to help reach the Moon in the early 1960s and 1970s,
- work collaboratively in groups,
- apply basic computer programming skills without using a computer, and
- understand the path that can lead to a career in computer science.

NGSS SCIENCE AND ENGINEERING PRACTICES

For educators based in the United States, the Next Generation Science Standards (NGSS) Science and Engineering Practices in this lesson are:

- obtaining, evaluating, and communicating information; and
- constructing explanations and designing solutions.

EXTERNAL REFERENCES

History.com | Human Computers: The Women of NASA
https://www.history.com/news/human-computers-women-at-nasa

NASA | About the Artemis Program
https://www.nasa.gov/specials/artemis/

NASA | Women of Artemis (*For Extension Activity)*
https://youtu.be/N0acoq5Uzfs

NASA Careers | *For Extension Activity*
https://www.nasa.gov/careers

National Women's History Museum | The Women of NASA
https://www.womenshistory.org/exhibits/women-nasa

Science History Museum | Ladies Who Launch
https://www.sciencehistory.org/distillations/ladies-who-launch

SUPPORTING FILES

- Vocabulary List
- NASA Computer Scientist Profile Cards
- Coding Career Cards

EXTENSIONS

CAREER EXPLORATION EXTENSION

Have students visit the NASA Career Page, search for one job in computer science, and summarize the key skills and education required for the job.

LANGUAGE ARTS / WRITING EXTENSION

Using a simple resume template (such as the free templates in Microsoft Word), have students develop their first resume where they highlight their education, out-of-school activities, and key skills.

RESEARCH EXTENSION

There are many women and people of color involved with the Artemis missions. Have students identify individuals, research the roles they hold, report back to class with a written paper, an oral presentation, or a poster.