

STEP-BY-STEP: INTRODUCTION TO CODING

OBJECTIVE: Students will gain an understanding of what algorithms are, and how they are translated into coding to drive the actions of computers and computer-controlled objects.

TIME: 30 minutes (60 minutes with lesson extension)

MATERIALS: Pencils or pens, "Step-by-Step" student worksheet

LESSON PLAN

1. Pre-Activity Discussion: What Is Coding?

Ask students to describe some of the actions that we use computers to do. (*For example, send emails, play video games, perform calculations, etc.*) Ask students how they think the computer performs these complicated tasks. (*Students may say that there are computer programs that give computers instructions about what actions to take.*) Explain to students that computer programmers rely on **algorithms** to direct the actions of a computer or a computer-controlled device like a robot. An algorithm is a set of steps that can be followed from start to finish to complete a task. In an algorithm, a complicated action is broken into many small steps. Explain that computer programmers write algorithms for each task a computer needs to do. Then they translate the algorithms into a language that a computer can read and follow. This language is called computer **code**.

2. Conduct the Activity: Hand out the "Step-by-Step" student worksheet. In the exercise, students will follow an algorithm to draw an image and then write a code for the algorithm. When everyone has finished, discuss what they learned. Why was it important that each step was very simple? How might you make the code shorter? (*For example, a code may include instructions to repeat a small segment of the steps.*) Explain that computer programmers use loops to shorten the codes that they write. A loop is a group of actions that is repeated a given number of times. For example, take the following code:

↓ • ↓ • ↓ • ↓ • ↓ • ↓ • ↓ • ↓ • ↓ • ↓ •

This code can be shortened to **Repeat 12 times: ↓ •**

STANDARDS FOCUS:

Science (NGSS)

Science and Engineering Practices: Asking Questions and Defining Problems, Developing and Using Models, Using Mathematics and Computational Thinking

ETS1.A: Defining and Delimiting an Engineering Problem

Language Arts (CCSS)

R7: Integrate content presented in diverse formats

RSci2: Follow precisely a multistep procedure when performing technical tasks

Art (National Core Arts Standards)

VA—Cr1: Generate and conceptualize artistic ideas and work

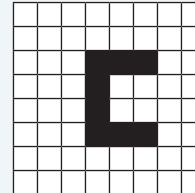
Math (CCSS)

MP5: Use appropriate tools strategically

MP7: Look for and make use of structure

ANSWERS TO STUDENT WORKSHEET

PART 1



PART 2

Code:

→ → → ↓ ↓ • ↓ • ↓ • ↓ • → • → • ↑ ↑ ↑ • ← •

EXTENSION

Coding Challenge: Challenge students to write code that can be used to create a more complicated image. Have them start by drawing a multicolored image on a piece of graph paper. Then ask them to write a code, using symbols that can be used to copy the image. Challenge them to include loops in their code. Have students test their code by giving it to a classmate. Were they able to successfully draw the image? Discuss the challenges students faced when writing their code.

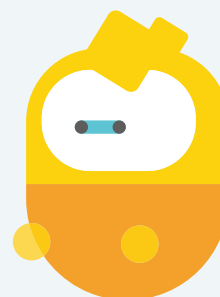
DIVE DEEPER WITH KOOV

KOOV provides endless opportunities to explore how coding can drive the actions of a robot. The My First Coding Learning Course gives students an in-depth introduction to basic coding on the computer. To use KOOV to extend this lesson, open the KOOV interface and go to the Learning Course. Choose My First Robot Coding. Complete Stage 1: "Let's Start Coding with KOOV." As you complete the stage, discuss how the code breaks larger actions down into small steps. Experiment with changing the order of steps.

STEP-BY-STEP

Computers can perform very complicated tasks. Inside the computer, each complex action is broken down into smaller parts. These small steps are put together in a sequence, called an **algorithm (al-guh-ri-them)**. The computer follows the steps in the algorithm from beginning to end to complete a task.

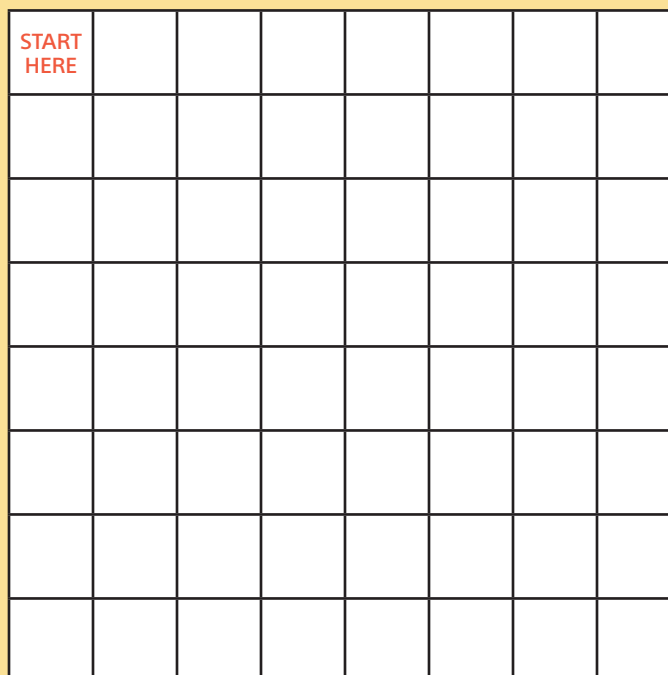
In this activity, you'll draw an image on a grid by following the steps in an algorithm.



PART 1: Follow an Algorithm

DIRECTIONS: Start in the square in the left-hand corner of the grid below. Then follow the algorithm below.

Move one square right.
Move one square right.
Move one square right.
Move one square down.
Move one square down.
Color in square.
Move one square down.
Color in square.
Move one square down.
Color in square.
Move one square down.
Color in square.
Move one square right.
Color in square.
Move one square right.
Color in square.
Move one square up.
Move one square up.
Move one square up.
Color in square.
Move one square left.
Color in square.



What did you draw? _____

PART 2: Convert to Code

You probably noticed that it required a lot of text to guide you to draw a simple image. In computer programs, algorithms are written in a special language that can be read by the computer. This language is called computer code. Can you convert the algorithm above into a different form?

DIRECTIONS: Use the symbols below to change the algorithm you followed into a type of code.

← **Move one square left** → **Move one square right** ↓ **Move one square down**
 ↑ **Move one square up** • **Color in square**

CODE: _____

CHALLENGE YOURSELF: Draw a more complicated image on a piece of graph paper. Then write your own code that can be used to copy the image. Test your code by giving it to a friend. Did they draw the same image?