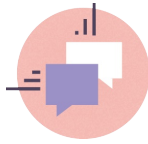# Sequencing Pixels
Unplugged

OVERVIEW

In this lesson, students play with the order of commands in unplugged Pixel Bot exercises. The lesson explores a foundational concept in computer science—sequence.

OBJECTIVES

- Know that computers run code in a sequence.
- Read, write, and execute code in a sequence.

AGENDA

Length: 45 minutes

- Whet students' appetites for coding. Hold a discussion about how code shapes our world. Consider autonomous cars, music, online communities. Watch "A Day in the Life of a Software Engineer" (http://tinyurl.com/q966xd5). (10 minutes)

- Guide students to see the importance of sequence. Use Lesson 1 | Warm-up Worksheet. Students first develop ideas about how the arrow and paint elements work in Pixel Bot. Once settled on the meaning of each element, students read the two programs in the worksheet. The programs have slightly different sequences. Students predict what Pixel Bot will paint for each program and compare the results. The class reflects on the idea of sequence. (15 minutes)

- Demonstrate how a computer executes a program. Draw a Pixel Bot program and grid on the whiteboard (3 or 4 lines of code, 3 x 3 grid). Work with students to read,

step through, and number the program. While reading the program, trace and paint with the Magnetic Pixel Bot. Repeat a few times with new programs. (10 minutes)

- Students practice reading and executing code. Use Worksheet 1 | Page 1 & Page 2. Students read and step through code while tracing and painting with the pixel bot. (10 minutes)

CONTENT KNOWLEDGE

- Sequence - The idea that statements must be performed in the order they are written.

MATERIALS

1. Lesson 1 | Warm-up Worksheet
2. Worksheet 1 | Page 1 & Page 2
3. Small pixel bot cutout for each student
4. Magnetic pixel bot
5. Scratch paper grids
6. Pencils
7. Whiteboard
8. Queued up video: http://tinyurl.com/q966xd5

WELCOME TO CODING

Length: 10 minutes

Teacher Actions	Student Actions
1 Lead a discussion: What does it mean to be a coder? Where do we use code? Chart responses on the whiteboard.	**1** Coders: Work on computers Hack things Create video games Make websites Work with data Code runs in: Phones Computers Traffic lights Spaceships Game consoles Movies and tv shows
2 Offer other examples: Autonomous cars Streetlights Music Flight simulators And on and on...	
3 Watch video: A day in the life of a software engineer: http://tinyurl.com/q966xd5	

PREDICT PIXEL BOT ICONS

Length: 15 minutes

Teacher Actions	Student Actions
1 Distribute Lesson 1 | Warm-up Worksheet.	

2 Introduce reading code with care:
 	
`Imagine being a computer when you read code.`
 	
`As computers, we read carefully. We pay attention to every detail. Every line of code.`	

3 Have students interpret the coding elements in the warm-up:
 	
`What do you think these elements do?`
	3 Possible Responses:
	
	`The bot rotates in place.`
	`The bot jumps.`
	`The bot moves until it hits the edge.`
	`The bot shoots lightning.`
	
	Correct Responses:
	
	`The bot moves one square at a t`

```
ime.
The bot moves up, right, left,
and down.
The bot paints.
```

4 Individual Work: Have students fill out the worksheet.

4 Trace the movement of the Bot. Paint with the Bot.

5 While students code, draw the worksheet's programs and grids on the whiteboard.

6 Reflect on sequence:

```
How did you arrive at your answer?
```

```
What is the difference between the two programs?
```

```
How does the order of the icons matter?
```

6 I arrived at my answer by:

```
Reading one element at a time.
Moving the bot after each element.
Following the correct sequence.
```

The two programs:

```
Have elements in different orders.
```

Order matters because:

```
The bot paints a different square.
```

7 Solve the two warm-up problems together on the whiteboard.

7 Call out lines of code and bot actions.

8 Work as a class to define each element.	**8** Work as a class to figure out what each element makes the bot do.

DEMONSTRATE HOW TO READ AND STEP THROUGH PROGRAMS

Length: 10 minutes

Teacher Actions	Student Actions
1 Draw a blank 3x3 grid on the whiteboard.	
2 Write a short (3 or 4 line) program on the whiteboard.	
3 Explain sequence: When a computer executes code, it steps through the code in the correct order. This is called sequencing.	
4 Read the first line of code together: What is the first line of code? Number the first line of code.	**4** Students call out the first line of code.

5	Move the Pixel Bot after reading each line. Trace its path or shade in a square.	**5**	Students call out where Pixel Bot should move.
6	Continue reading and stepping one line at a time.	**6**	Students continue helping to read the code.
7	Read and step through three new examples with the class. Design problems on the fly, making them interesting and complex enough.		
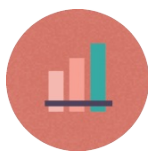
READ PIXEL BOT ICONS

Length: 5 minutes

Teacher Actions	Student Actions
1 Distribute Worksheet 1: Page 1 & Page 2.	
2 Leave the worked example from the previous activity on the whiteboard.	
3 Individual Work: Ask students to individually fill out the worksheet.	**3** Students read the code, trace the pathway of the pixel bot, and paint the correct blocks on the worksheet.