Lesson 5: Enhanced For Loops

45 minutes

Overview

When would I want to traverse an array with an enhanced for loop?

Students learn about enhanced `for` loops to traverse a 1D array. As students explore the functionality of enhanced `for` loops, they identify differences, advantages, and disadvantages of using an enhanced `for` loop to traverse an array. Students use an enhanced `for` loop to calculate the sum or average of the elements in a 1D array.

Standards

Full Course Alignment

CSA Conceptual Framework

▶ **CON-2** - Programmers incorporate iteration and selection into code as a way of providing instructions for the computer to process each of the many possible input values

▶ **VAR-2** - To manage large amounts of data or complex relationships in data, programmers write code that groups the data together into a single data structure wihtout creating individual variables for each value.

Agenda

Warm Up (10 minutes)
- **Data Science**

Activity (25 minutes)
- **Exploring Enhanced For Loops**
- **Using Enhanced For Loops**

Wrap Up (10 minutes)
- **Revisiting Data Science**
- **Assessment: Check for Understanding**
- **AP Classroom Topic Questions**

Objectives

Students will be able to:

- Differentiate between `while`, `for`, and enhanced `for` loops
- Implement an algorithm to calculate the sum or average of the values in a one-dimensional (1D) array
- Traverse a one-dimensional (1D) array using an enhanced `for` loop

Preparation

- Check the **Teacher's Lounge** for verified teachers on the CSA Forum to find additional strategies or resources shared by fellow teachers

Links

Heads Up! Please make a copy of any documents you plan to share with students.

For the students

- **Careers in Tech: My Name is Polina** - Video
- **Enhanced For Loops** - Video
- **U3L5 Extra Practice** - Handout

Vocabulary

- **enhanced for loop** - a loop for traversing an array from the first element to the last

Teaching Guide

Warm Up (10 minutes)

Data Science

Remarks

> Computer science involves more than just writing code. Computer science helps us answer questions and solve problems. Data scientists do this by collecting data and analyzing it using algorithms to obtain knowledge.

Display: Show the video – *Careers in Tech: My Name is Polina*.

Do This: Direct students to write down ideas and thoughts in response to the prompts on a sticky note or scrap piece of paper.

Teaching Tip

Students participate in a Give One, Get One activity during the wrap up to share their ideas with their peers.

Activity (25 minutes)

Exploring Enhanced For Loops (15 minutes)

Remarks

> We have used `while` loops and `for` loops to repeat blocks of code and traverse 1D arrays. Sometimes a problem will require us to use one type of loop. Other times, they both can be used in different ways to solve the same problem. There is a third type of loop that we can use to traverse a 1D array.

Do This: Review the lesson objectives.

Do This: Direct students to Level 1 on Code Studio to predict the program's outcome, then run the program to compare their predictions to the actual outcome.

1 **Predict: Enhanced for Loops**

Discuss: Click through the animated slide to display the prompts.

- *What do you notice about the code in this program?*
- *What do you wonder about the code in this program?*

Discussion Goal: Students notice the structure of the enhanced `for` loop and that it traverses the 1D array. Students may wonder why they would use this loop instead of a `while` or `for` loop.

Display: Show the video – *Enhanced For Loops*.

Do This: Define *enhanced* `for` *loop* and discuss the example.

Group: Place students in pairs.

Do This: Direct students to Level 2 on Code Studio to investigate the program with a partner. Students make the changes to the program as prompted.

2 Investigate: Enhanced for Loops

Do This: Explain the functionality of the enhanced `for` loop variable:

- It is assigned a copy of the element.
- Changing the value of the enhanced `for` loop variable does not modify the array.

Discuss: Click through the animated slide to display the prompts. Use the Hold That Thought strategy to discuss the prompts.

- *When is it best to use an enhanced* `for` *loop?*
- *When is it not best to use an enhanced* `for` *loop?*

Discussion Goal: Students note that an enhanced `for` loop is useful when the entire array needs to be accessed. Students also note that an enhanced `for` loop is not useful when only parts of the array need to be accessed or if they need to modify the elements stored in the array.

Teaching Tip

Ask additional probing questions to help students identify what they noticed in the program. For example:

- *What does an enhanced* `for` *loop do?*
- *What happened when you tried to modify the values stored in the array in the enhanced* `for` *loop?*
- *Can you start at a specific index instead of at the beginning of the array?*
- *Is the loop control variable in the enhanced* `for` *loop referencing the value in the array, or is it making a copy of the value from the array?*

Do This: Explain use cases and limitations for using enhanced `for` loops.

Using Enhanced For Loops (10 minutes)

Remarks

> Enhanced `for` loops are useful for when we need to traverse an entire array from first to last. We can also use enhanced `for` loops with standard algorithms, such as to the sum or average of all the values in a 1D array.

Discuss: Use the Hold That Thought strategy to discuss the prompt.

- *How could we use an enhanced* `for` *loop to find the sum of the values in a 1D array?*

Discussion Goal: Students identify the steps to solve the problem, including creating a variable to store the sum and traversing the array to add each value to the sum.

Teaching Tip

Encourage students to write pseudocode to plan a solution to the problem.

Do This: Click through the animated slide to discuss the pseudocode for finding the sum of the

values in a 1D array using an enhanced `for` loop.

Do This: Direct students to Level 3 on Code Studio to complete Levels 3, 4, and 5. Students complete a Check for Understanding, then continue to Level 4 to refactor the `for` loop to an enhanced `for` loop. On Level 5, students complete a choice level to use an enhanced `for` loop with a 1D array.

3-5 **Using Enhanced for Loops**

3 4 5

Wrap Up (10 minutes)

Revisiting Data Science

Remarks

> At the beginning of this lesson, we heard about how data scientists use programs to analyze data and find information. Let's revisit the ideas and thoughts you had and share these with your peers. It's time to...

Do This: Play the music clip to cue the Give One, Get One activity and direct students to participate in a Give One, Get One.

Discuss: Click through the animated slide to display the prompts.

- *What did you learn from each other?*
- *How do these ideas and thoughts contribute to your identity as a software engineer?*

Discussion Goal: Students share their thoughts and ideas about data science. Students identify aspects that relate or contribute to their identity as software engineers and may wonder about potential careers.

Display: Key Vocabulary

Assessment: Check for Understanding

Check For Understanding Question(s) and solutions can be found in each lesson on Code Studio. These questions can be used for an exit ticket.

6 **Check for Understanding**

AP Classroom Topic Questions

To assign questions from the AP Classroom Question Bank that align with this lesson, create a custom quiz in AP Classroom by searching the Question Bank for the Essential Knowledge statements listed at the top of this lesson plan. You can find instructions and video demonstrations to do this on **AP Central**.

The following Topic Questions in AP Classroom can be assigned as a formative assessment for this lesson:

- Topic Questions 6.3

Note: *Some Learning Objectives and Essential Knowledge statements in the suggested Topic Questions are covered in later units.*

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