Unit 6: Array

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **Full Year**
Status: **Published**

UNIT RATIONALE

This unit focuses on data structures, which are used to represent collections of related data using a single variable rather than multiple variables. Using a data structure along with iterative statements with appropriate bounds will allow for similar treatment to be applied more easily to all values in the collection. Just as there are useful standard algorithms when dealing with primitive data, there are standard algorithms to use with data structures. In this unit, we apply standard algorithms to arrays; however, these same algorithms are used with ArrayLists and 2D arrays as well. Additional standard algorithms, such as standard searching and sorting algorithms, will be covered in the next unit.

ESSENTIAL QUESTIONS

How can programs leverage volcano data to make predictions about the date of the next eruption?

How can knowing standard algorithms be useful when solving new problems?

STANDARDS

NEW JERSEY STUDENT LEARNING STANDARDS: CONTENT AREA

New Jersey (NJSLS) - Grades 9-12 - Computer Science and Design Thinking (2020)

8.1.12.AP.1:

Design algorithms to solve computational problems using a combination of original and existing algorithms.

8.1.12.AP.2:

Create generalized computational solutions using collections instead of repeatedly using simple variables.

8.1.12.AP.3:

Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.

8.1.12.AP.4:

Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.

8.1.12.AP.5:

Decompose problems into smaller components through systematic analysis, using constructs such as

procedures, modules, and/or objects.

8.1.12.AP.6:

Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.

CS.9-12.8.1.12.AP.1	Design algorithms to solve computational problems using a combination of original and existing algorithms.
CS.9-12.8.1.12.AP.2	Create generalized computational solutions using collections instead of repeatedly using simple variables.
CS.9-12.8.1.12.AP.3	Select and combine control structures for a specific application based upon performance and readability, and identify trade-offs to justify the choice.
CS.9-12.8.1.12.AP.4	Design and iteratively develop computational artifacts for practical intent, personal expression, or to address a societal issue.
CS.9-12.8.1.12.AP.5	Decompose problems into smaller components through systematic analysis, using constructs such as procedures, modules, and/or objects.
CS.9-12.8.1.12.AP.6	Create artifacts by using procedures within a program, combinations of data and procedures, or independent but interrelated programs.

NEW JERSEY STUDENT LEARNING STANDARDS: CAREER READINESS, LIFE LITERACIES AND KEY SKILLS

TECH.9.4.12.CT.1	Identify problem-solving strategies used in the development of an innovative product or practice (e.g., 1.1.12acc.C1b, 2.2.12.PF.3).
TECH.9.4.12.CT.2	Explain the potential benefits of collaborating to enhance critical thinking and problem solving (e.g., 1.3E.12profCR3.a).

NEW JERSEY STUDENT LEARNING STANDARDS: COMPUTER SCIENCE AND DESIGN THINKING

See content area standards.

PRE-ASSESSMENTS

Discussion Questions:

- If we want to store a list how would we do that now?
- Why is the method you came up with problematic?

INSTRUCTIONAL PLAN

MODULE 6

LESSON 6.2

Lesson 6.2: Traversing Arrays

In this lesson, students will learn how to traverse arrays. Iteration statements can be used to access all the elements in an array. This is called traversing the array. This lesson corresponds with AP Computer Science A topic 6.2.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Traverse the elements in a 1D array
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. This quiz is a quick check for understanding. • Explore the Iterating Over an Array - For Loop example. • Explore the Iterating Over an Array - While Loop example. • Explore the Array Out of Bounds example. • Explore the Finding a Target Value example. • Complete the Print Array exercise. • Complete the Print Odd Array Indices exercise. • Complete the Matching Strings in a String Array exercise.

	• Complete the Fibonacci Sequence exercise.
Suggested Modifications	See Lesson 6.1 above.

LESSON 6.1

Lesson 6.1: Writing Classes

In this lesson, students will learn about and create arrays. The use of array objects allows multiple related items to be represented using a single variable. This lesson corresponds with AP Computer Science A topic 6.1.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Represent collections of related primitive or object reference data using one-dimensional (1D) array objects
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. • This quiz is a quick check for understanding. Explore the Making an Array example. • Explore the Making an Empty Array example. • Explore the Indexing Into an Array example. • Complete the Our First Array exercise. • Complete the Array Length exercise. • Complete the Last Element in Array exercise. • Complete the Find Average exercise.

	• Complete the Planning Programs with Diagrams handout.
Suggested Modifications	**English Language Learners** **Adjusted Speech**: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and speaking more slowly. **Visuals**: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand. **Front-Loading Vocabulary**: The teacher front loads vocabulary This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students. **Students with Individualized Education Plans/504s** **Chunking**: The teacher presents information in a way that make it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is a effective strategy to use with them. **Checking for Understanding**: It is important to constantly chec for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them. **Extra time**: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts. **Oral Reading**: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student. **Gifted & Talented Strategies** **Extensions/Enrichments**: Teachers will provide gifted and talented students with extension/enrichment projects. Students

will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference t acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to

	be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs **Hands On:** As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself. **Tests/Assessments:** Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test i the morning, another portion after lunch and the final part the next day. **Seating:** Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.

LESSON 6.3

Lesson 6.3: Enhanced for Loop for Arrays

In this lesson, students will take a look at enhanced loops. An enhanced for loop is an alternate method to traverse an array instead of using for or while loops. This lesson corresponds with AP Computer Science A topic 6.3.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Traverse the elements in a 1D array object using an enhanced for loop
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding

	Completion of below activities AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. This quiz is a quick check for understanding. • Explore the Enhanced For Loop example. • Explore the Classroom Array example. • Explore the Updating Values in a Loop example. • Complete the Print Odds exercise. • Complete the Largest Value exercise. • Complete the Classroom Array exercise. • Complete the Array Average exercise.
Suggested Modifications	See Lesson 6.1 above.

LESSON 6.4

Lesson 6.4: Developing Algorithms Using Arrays

In this lesson, students will learn how arrays are used to develop algorithms. They will examine common techniques used in array analysis. This lesson corresponds with AP Computer Science A topic 6.4.

Student Learning Intentions (SLI) WALT: (We are learning to…)	• Recognize and identify common algorithms that utilize array traversals
Student Learning Strategies	Code tracing Create a plan Error analysis Identify a subtask Look for a pattern Pair programming Predict and compare Simplify the problem Think aloud
Success Criteria	Check for understanding Completion of below activities

	AP Topic Questions
Formative Assessment (drives instructional decisions)	Teacher Observation Check for Understanding AP Topic Questions
Activities and Resources	• Watch the lesson video and take the corresponding quiz. Thi quiz is a quick check for understanding. • Explore the Finding the Minimum Value example. • Explore the Reordering an Array example. • Explore the Finding Duplicates example. • Complete the Find the Median exercise. • Complete the Find the Last Multiple of 3 exercise. • Complete the Most Improved exercise. • Complete the Car Showroom challenge.
Suggested Modifications	See Lesson 6.1 above.

REFLECTIONS

INTERDISCIPLINARY CONNECTIONS: NEW JERSEY STUDENT LEARNING STANDARDS FOR ELA, SOCIAL STUDIES, SCIENCE AND/OR MATHEMATICS

CCSS - English-Language Arts

Key Ideas and Details:

CCSS.ELA-LITERACY.RL.11-12.1 Cite strong and thorough textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text, including determining where the text leaves matters uncertain.

Integration of Knowledge and Ideas:

CCSS.ELA-LITERACY.W.11-12.1 Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

Production and Distribution of Writing:

CCSS.ELA-LITERACY.W.11-12.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge:

CCSS.ELA-LITERACY.W.11-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

Range of Writing:

CCSS.ELA-LITERACY.W.11-12.10 Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences

CCSS - Mathematics

Reason quantitatively and use units to solve problems:

CCSS.MATH.CONTENT.HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.

Create equations that describe numbers or relationships:

CCSS.MATH.CONTENT.HSA-CED.A.1 Create equations and inequalities in one variable and use them to solve problems.

Analyze functions using different representations:

CCSS.MATH.CONTENT.HSF-IF.C.7 Graph functions expressed symbolically and show key features of the graph.

Apply geometric concepts in modeling situations:

CCSS.MATH.CONTENT.HSG-MG.A.1 Use geometric shapes, their measures, and their properties to describe objects

Calculate expected values and use them to solve problems:

CCSS.MATH.CONTENT.HSS-MD.A.1 Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space;

CCSS.MATH.CONTENT.HSS-MD.A.2 Calculate the expected value of a random variable;

English Language Arts

- Journal writing
- Close reading of industry-related content
- Create a brochure for a specific industry
- Keep a running word wall of industry vocabulary

Social Studies

- Research the history of a given industry/profession
- Research prominent historical individuals in a given industry/profession
- Use historical references to solve problems

World Language

- Translate industry-content
- Create a translated index of industry vocabulary
- Generate a translated list of words and phrases related to information technology

Math

- Compare and contrast use of equations and variables in algebra and programming.
- Program graphics and use the properties of geometric shapes
- Compare the computer graphic coordinate system with the Cartesian coordinate plane in math
- Compare probability and the use of random numbers in computer programming.
- Track and track various data, such as industry's impact on the GDP, career opportunities or among of individuals currently occupying careers

Fine & Performing Arts

- Create a poster recruiting young people to focus their studies on a career in Information Technology

Science

- Research the environmental impact of a given career or industry
- Research latest developments in Information technology

- Investigate applicable-careers in STEM fields